State of the Canadian Space Sector

Report 2024

Canadian Space Agency
Agence spatiale canadienne

Canada

State of the Canadian Space Sector Report 2024

Cover image

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About this Report

OBJECTIVE

The State of the Canadian Space Sector Report provides factual information about the Canadian space sector. The report, which is now in its 27th edition, is based on a questionnaire sent to companies, not-for-profit organizations, research centres and universities with space-related activities in Canada.

To align with international practices, the publication is identified by the year in which the survey took place (2024) but reports on data covering the year 2023.

The organization-specific information used to compile this report remains strictly confidential and will not be released in any manner other than aggregate form. Consequently, in certain circumstances, a detailed explanation or in-depth reporting of the results cannot be provided in order to protect the confidentiality of the respondents.

Of note, the numbers presented throughout the report may not add up precisely to the totals provided due to rounding. Additionally, the findings presented throughout this report are provided at current prices (i.e. unadjusted for inflation), unless otherwise stated.

ABOUT THE AUTHORS

Policy Branch

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FOR MORE INFORMATION

For more information about the Canadian space sector, or for an electronic copy of this report, please go to www.asc-csa.gc.ca/eng/publications.

ACKNOWLEDGMENTS

The CSA wishes to acknowledge all those in the Canadian space sector who responded to the questionnaire. Without them, this report would not have been possible.

President's Message and Executive Summary

Lisa Campbell,
President of the Canadian Space Agency

Credit: CSA.

I am pleased to present the *State of the Canadian Space Sector Report 2024*. This annual report plays a longstanding and crucial role in deepening our insights into the economic activity generated by the space sector in Canada. The analysis in this year's report was derived from space organizations dispersed across Canada. It includes businesses of all sizes, not-for-profit organizations, Canadian government departments, research centres, as well as universities. Each of these organizations is integral to the Canadian space economy, with large organizations generating the highest revenues (64%), SMEs capturing a significant portion of the export market (39%), and universities and research centres supporting a substantial workforce of almost 2,800 employees.

This report strives to unpack the invisible benefits of space and demonstrate tangible impacts derived from across the country. The Canadian space sector is mature, forward-looking, and diverse in capability. These qualities make the sector well positioned to shape the future and capitalize on domestic and international opportunities. In fact, many areas of the Canadian space economy are showing strong performance, and we have even uncovered a number of new record-breaking highs. Highlights include:

- **Contribution to GDP continues to grow**. The space sector is estimated to have contributed $3.4B to Canada's GDP in 2023. This marks a new all-time high, reflecting an upward real growth trend of +8.4% from 2019 to 2023.
- **Revenues remain stable**. Overall revenues grew 0.8% from last year, reaching $5.1B in 2023. Exports were the primary area of growth, increasing 9% from 2022 to reach $2.2B in 2023. Domestic revenues declined to $2.9B (-5%). The divergence in growth between exports and domestic revenues reflects the difficulties present in satellite communication (a declining broadcasting sector), despite growth in the Earth observation, space exploration, and navigation sectors of the space economy. The demand for broadcasting services is expected to continue to decline as customers change their behaviours towards other products, including Internet-based services. This shift also creates future opportunities for the space sector through satellite-based solutions given the strong demand for reliable Internet.
- **The workforce is expanding and in demand**. The Canadian space workforce grew by 5.9% in 2023 to 13,888 space-related jobs – marking a new all-time high. Workforce multiplier impacts indicate that activities in the space sector supported an additional 12,592 jobs in the wider Canadian economy. Canada's space workforce is highly specialized given that 70% are science, technology, engineering and mathematics (STEM) employees and 73% are highly qualified personnel (HQP). Organizations have increasingly highlighted competition and labour shortages for experts in software and business development, applications of artificial intelligence, and mechanical engineering systems.

- **Investment in innovation is booming and producing results**. Research and Development (R&D) expenditures increased again in 2023, reaching another new all-time high of $650M (+10%). As in previous years, the increased R&D activity is primarily led by the private sector, creating opportunities for new development and growth in both the upstream and the downstream market in Canada. There was also a significant increase in activity related to inventions and patents. The number of inventions climbed by +33% while registered patents rose dramatically by +114% compared to last year.
- **CSA funding programs are helping companies leap forward**. The Government of Canada has been making strategic investments and providing substantial support to the sector in all space domains. This support has helped generate new products and services that have enabled Canadian organizations to thrive in the sector. An ongoing analysis of return on investment (ROI) for CSA space development programs revealed that for every dollar invested, three dollars and sixty cents are returned through follow-on revenues five years after a project has completed.

As evidenced through this report, the space sector plays an important role in driving economic growth, fuelling innovation, and supporting industries that keep our economy strong. In a sense, the space sector quietly acts as a backbone for our modern society and provides crucial services that we rely on every day. The demand for these products and services continues to be strong as space-based solutions are needed in our fast-paced world.

I would like to convey my gratitude to all those who contributed to the 2024 survey. This publication would not be possible without the generous collaboration of members of the Canadian space industry and academia.

1 The Canadian Space Sector Landscape

HIGHLIGHTS

- Canada's top 30 space organizations (by revenues) accounted for 94% of total revenues and 64% of the total workforce, slightly higher than previous years.
- The sector, based on responses, includes 77% companies (9% large, 68% SME), 19% universities and research centres, and 4% Government of Canada.
- Large companies make the biggest economic impact in the sector, accounting for the majority of revenues, workforce, BERD, and exports.
- Despite their smaller workforce, SMEs capture a significant portion of exports – a primary growth area for the space economy.
- University and research centres have lower revenues by nature but have the most educated workforce, consisting primarily of HQP and STEM employees.

The survey included responses from 215 organizations involved in space activities from across Canada. The composition of organizations includes large companies (9%), small and medium-sized enterprises (SMEs) (68%), and universities and research centres (19%). For the first time, the survey also includes input from government departments (4% of organizations), represented in the area of workforce. The unique characteristics of these organizations contribute to a diverse Canadian space ecosystem, as demonstrated below:

	Total Revenues	Total Workforce	Total BERD	Total Exports
Large Companies	$3.3B (64%)	6,212 (45%)	$451M (69%)	$1.3B (61%)
SMEs	$1.7B (33%)	3,443 (25%)	$199M (31%)	$842M (39%)
Universities & Research Centres	$141M (3%)	2,792 (20%)	N/A	$7M (<1%)

*The remaining percentage of workforce can be attributed to the Government of Canada. For the definition of BERD refer to Annex C.

LARGE COMPANIES

There were 19 large companies that responded to the survey (defined as employing >500 workers). Although they represented only 9% of organizations, they generated the majority of revenues, workforce, BERD, and exports in the sector. The number of large organizations in the space sector nearly doubled between 2022 and 2023 due to reclassifications of organizations as a result of growth, company acquisitions, and new entrants. Of note, many of the new large entrants have a broader business focus with a limited role in the space sector.

SMALL AND MEDIUM-SIZED ENTERPRISES (SMEs)

There were 146 SMEs that responded to the survey (defined as employing 1 to 499 workers). Although SMEs generate less of an economic impact when compared to large companies, they account for most companies in the sector and contribute significantly to exports, which is a primary area of growth in the space sector.

UNIVERSITIES AND RESEARCH CENTRES

There were 42 universities and research centres across the country that responded to the survey. Contributions to overall revenues remain small, but this is expected given the research orientation of these organizations. Universities and research centres have the most educated workforce, with HQP representing 88% and STEM employees representing 97% of employees.

CANADA'S LEADING SPACE ORGANIZATIONS

Results for Canada's top 30 space organizations (i.e. based on revenues) were similar to previous years, comprised of 26 companies and 4 universities. The majority of these organizations are SMEs, displaying the diversity of organizations contributing to the Canadian space sector.

Top 30:

Workforce	Inventions and Patents	Revenues	BERD	Exports
64%	50% and 78%	94%	76%	94%

2024-01-17. With the Aqualunar Challenge, we are looking to develop new technologies to purify Moon water for human deep-space missions which could also help advance water purification processes here on Earth.

Credit: CSA.

2 Economic Impact – Gross Domestic Product

HIGHLIGHTS

- The space sector contributed $3.4B towards Canada's GDP in in 2023, up +4.1% in real growth from last year.
- From 2019 to 2023, the space sector contribution to real GDP grew by +8.4%, with a CAGR of +2.0%.

The methodology for GDP impact has been updated this year, given several methodology improvements and adjustments to multipliers from Statistics Canada. This work accounts for inflation where applicable and has been backdated to ensure comparability. Further details can be found in Annex B.

The space sector contributed $3.4B to Canada's GDP in 2023. This reflects a +4.1% growth in real GDP from last year. This represents the unduplicated value of goods and services produced in Canada by the space sector, and by other industries as a result of the Canadian space sector's supply chain purchases and of associated employees' consumer spending. Total GDP contribution was broken down into the following:

- $1.80B in space sector impacts;
- $0.81B in supply industry impacts; and
- $0.81B in impacts related to consumer spending by associated employees.

The space sector therefore creates benefits in the larger economy with a multiplier of 1.90. In other words, every dollar that the space sector contributed to GDP resulted in an additional $0.90 in GDP contributions for the broader economy.

Despite the challenges from the pandemic and inflation, the real GDP impact of the Canadian space sector increased by 8.4% ($215M), translating into a Compound Annual Growth Rate (CAGR) of 2.0% from 2019 to 2023.

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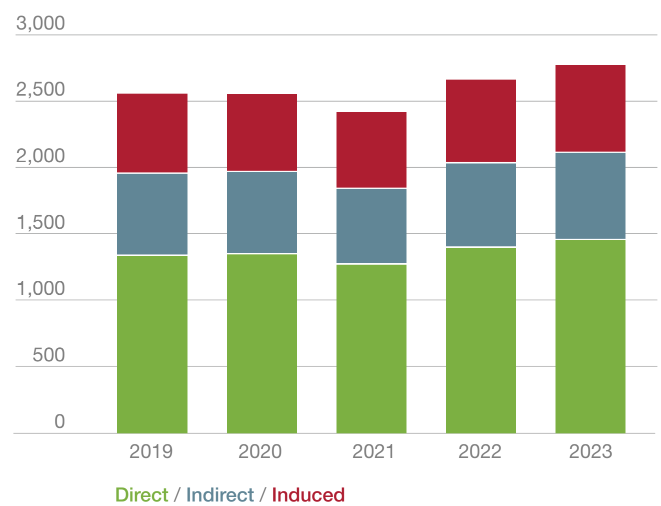
Total GDP Impact Trend: 2019–2023 (2017 Chained $M)



3 Revenues Impact

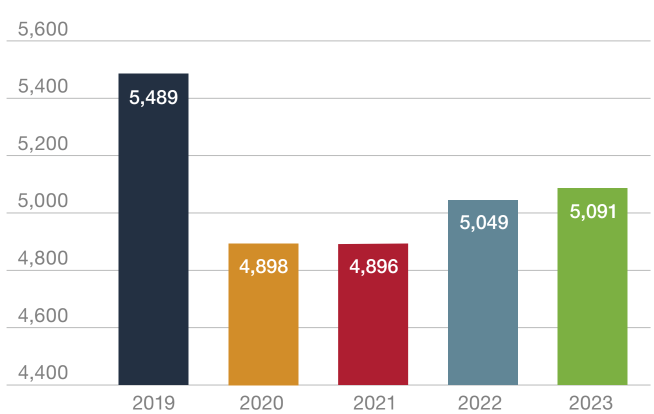
HIGHLIGHTS

- Total revenues in the Canadian space sector increased 0.8% to $5.1B. The stability is partially associated with a divergence in the space economy, with a decline in satellite communication (broadcasting), despite growth in Earth observation, space exploration, and navigation sectors.
- Domestic revenues declined to $2.9B (-5%) – influenced by broadcasting declines, but export revenues grew to $2.2B (+9%). Exports in North America (primarily to the US) led the recovery.
- The upstream segment generated roughly $1.3B in revenues (25%), while the downstream segment generated $3.8B in revenues (75%).

TOTAL REVENUES

In 2023, total revenues in the Canadian space sector reached $5.1B, a +0.8% ($42M) increase from last year. The CAGR of the space sector was -1.86% between 2019 and 2023.[1] Despite the negative CAGR, revenues in the Canadian space sector appear to be trending upward.

Total Space Sector Revenues: 2019–2023 (in $M)



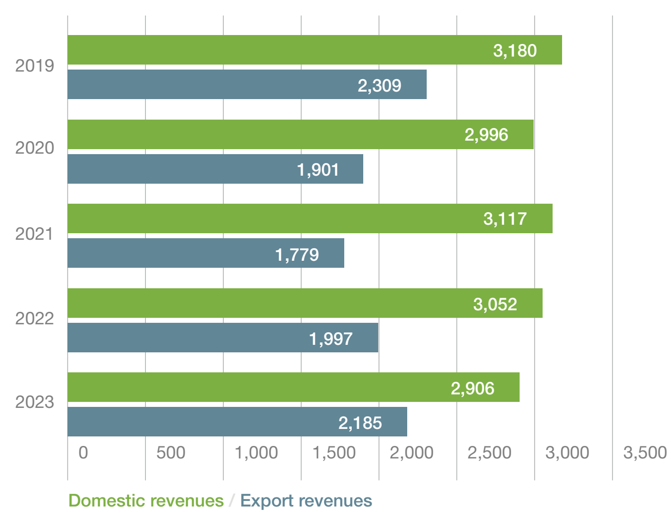
MARKET SHARE BY CUSTOMER LOCATION

Domestic vs. Export Revenues

In 2023, Canadian space revenues totalled $5.1B, of which 57% ($2.9B) were from domestic sources and 43% ($2.2B) were from exports. Domestic revenues decreased by 4.8%, or $145M; exports increased significantly, rising 9.4%, or $188M.

Between 2019 and 2023, the CAGR was -1.9% for the entire space sector, -2.2% for domestic revenues, and -1.4% for exports.

Domestic vs. Export Revenues: 2019–2023 (in $M)



1 Calculated using compound annual growth rate (CAGR).

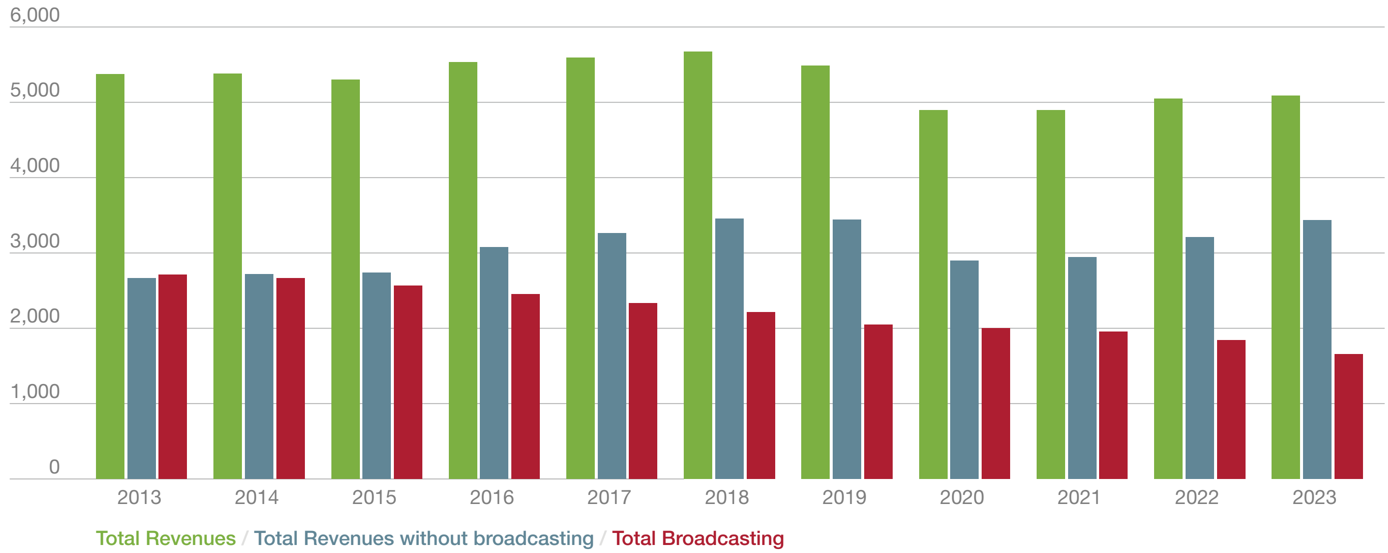
Domestic vs. Broadcasting Revenues

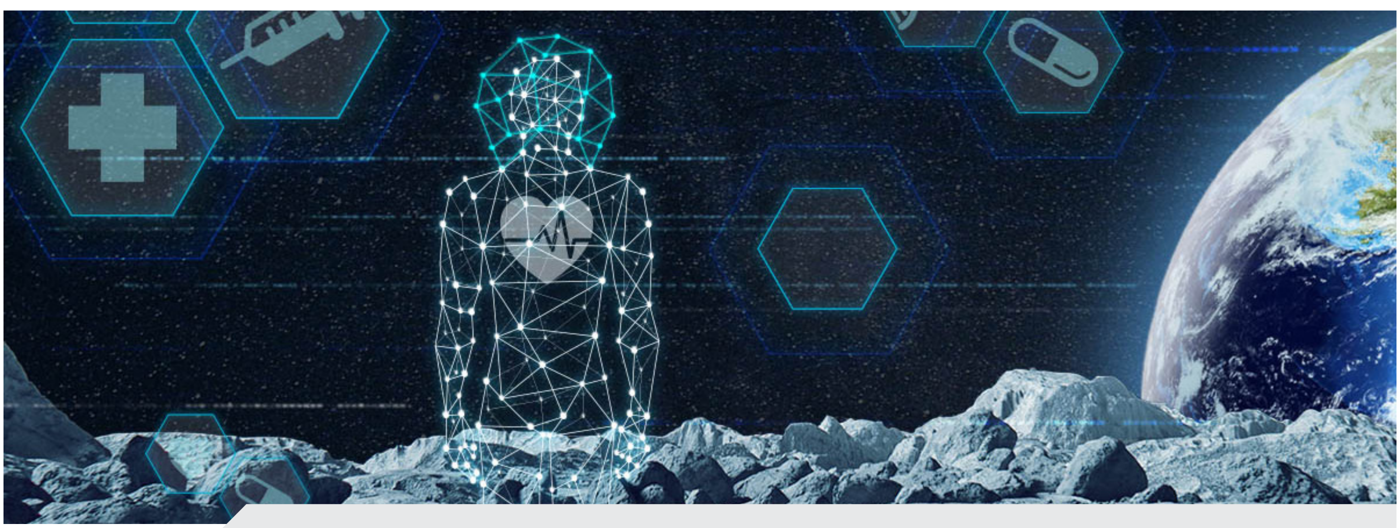
Broadcasting services encompass direct-to-home television and radio services delivered by satellite. The broadcasting services segment is a large contributor to the space economy but is in continual decline. When separating broadcasting, we can see that the decline has limited the ability for growth in the Canadian space sector in relation to revenues. Broadcasting revenues have declined by 39% (~$1.1B) over the last decade (2013–2023).

Conversely, total space revenues without broadcasting increased by 29% ($776M) over the same period and have largely recovered from the lows of the pandemic. As a result of these differences, the reported space sector revenues in Canada have been relatively flat.

As customers move away from broadcasting services, they are turning towards alternative products, including satellite-based Internet services. This shift also creates future opportunities for the space sector through satellite-based solutions given the strong demand for reliable Internet.

Total Revenues vs. Total Revenues without broadcasting vs. Total Broadcasting: 2013–2023 (in $M)





2024-02-28. Following a competition spanning over two years, the winner of the Deep Space Healthcare Challenge, run by the Canadian Space Agency and the Privy Council Office's Impact Canada, has been selected. Montreal-based MD Applications will receive $500,000 in grant funding as the grand prize winner. Their EZResus solution is already helping save lives on Earth and holds great potential for diagnosis and medical emergencies in space.

Credit: CSA.

Export Regions

Exports were reorganized by continental region this year, consistent with categorizations at Statistics Canada. Historical information has been reclassified and backdated to accurately reflect the changes.

In 2023, export revenues continued to recover, rising 9% and generating $2.2B in revenues. Increases were notable in North America, while most other regions declined.

North America remained the main destination for Canadian space exports, totalling 65% of all exports. Revenues derived from exports to North America expanded by 18%, or $212M, from $1.21B in 2022 to $1.42B in 2023. It is important to note that the United States constitutes 98% of North American export revenues.

Europe remained Canada's second largest market for space exports. Canadian exports to Europe decreased by 3%, or $12M, from $436M in 2022 to $424M in 2023. Europe accounted for 19% of total exports.

Exports to **Asia** increased by 4%, or $8M, from $171M in 2022 to $179M in 2023. Asia accounted for 8% of total exports.

Exports to **Central America, South America, and the Caribbean** decreased by 2%, or $2.3M, from $113M in 2022 to $111M in 2023. The region accounted for 5% of total exports.

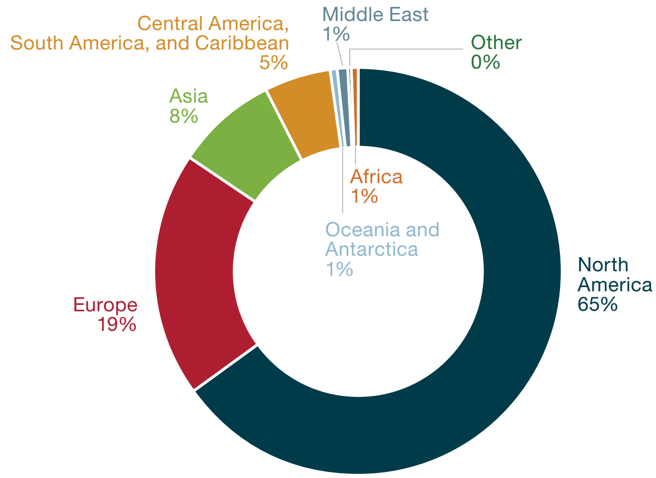
Exports to the **Middle East** declined by 49%, or $15M, from $32M in 2022 to $16M in 2023. This region accounted for less than 1% of total export revenues.

Exports to **Oceania and Antarctica** decreased by 4%, or $0.6M, from $16.1M in 2022 to $15.5M in 2023. Oceania accounted for less than 1% of total export revenues.

Export revenues from **Africa** increased by 78%, or $4.5M, from $5.8M in 2022 to $10.2M in 2023. Generally speaking, export growth to this region has been uneven; years of strong growth have been followed by declines and vice versa. Africa accounted for less than 1% of total Canadian space export revenues.

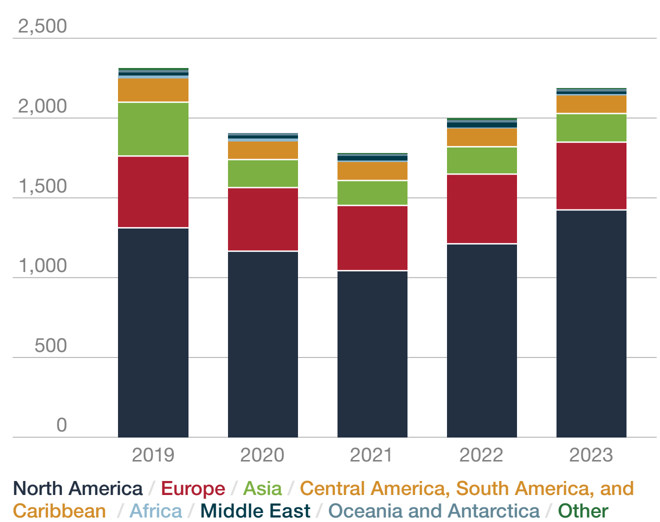
Finally, less than 1% of total exports, or $7M, were classified as Other and not allocated to a specific region of the world.

Proportion of Export Revenues: 2023



The most notable trends in exports between 2019 and 2023 were related to decreases during the pandemic from North America and Asia. Exports to North America have since recovered to $1.42B and are now 9% ($113M) above the highs from 2019. Revenues related to exports from Asia are down to $179M, a decline of 47% ($158M) from 2019. The remaining regions saw fluctuations, but had minimal impact given their overall small composition in exports.

Sources of Export Revenues: 2019–2023 (in $M)



MARKET SHARE BY CUSTOMER TYPE

Customers are categorized as either government or non-government. Government customers include domestic governments (municipal, provincial, federal) and foreign governments. Non-government customers include businesses, individual consumers and non-profit organizations or foundations (both domestic and foreign).

In 2023, 16% of the space revenues were derived from government customers and 84% from non-government customers.

Both upstream and downstream segment organizations derived revenues from non-government clients in 2023. The upstream segment derived 65% of revenues from non-government clients, whereas the downstream segment derived 91% of revenues from non-government clients.

MARKET SHARE BY VALUE-CHAIN SEGMENTS

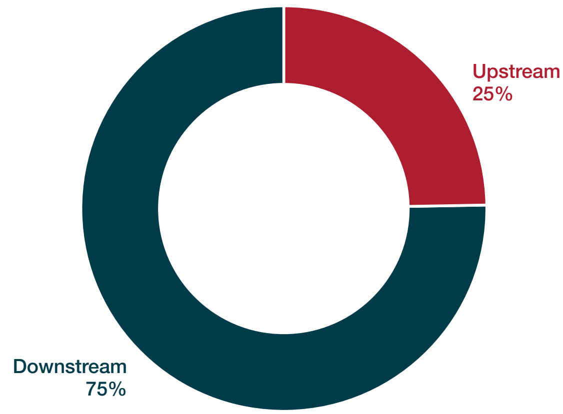
Space sector revenues can be broken down into value-chain segments and sub-segments based on the type of work that the organization is carrying out. The two main segments this analysis has been split into are upstream and downstream activities.

The upstream segment includes research, engineering and consulting; space systems manufacturing; and ground systems manufacturing. In 2023, it generated $1.27B (25%) of revenues, which is an +18% growth from last year.

The downstream segment includes satellite operations, products and applications, and services. In 2023, it generated $3.82B (75%) of revenues, which is a -4% decline from last year.

A detailed description of the value-chain categorization is provided in Annex C.

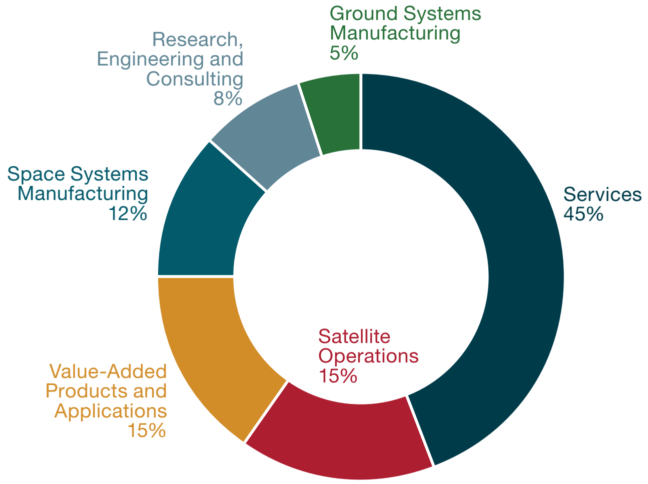
Upstream vs. Downstream Revenues: 2023



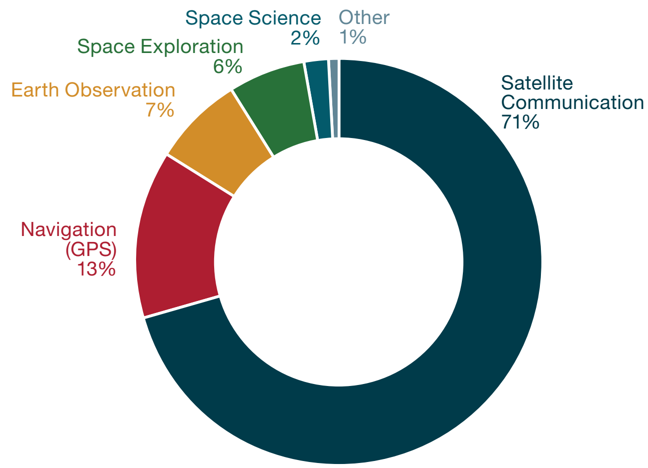
Revenues in each sub-segment can be broken down as follows:

- **Research, Engineering and Consulting** amounted to $425M in 2023, a 1.5% decrease ($6M) from 2022. This sub-segment accounted for 8% of total revenues in 2023.
- **Space Systems Manufacturing** amounted to $601M in 2023, a 29% increase ($136M) from 2022. It accounted for 12% of total revenues in 2023.
- **Ground Systems Manufacturing** amounted to $244M in 2023, a 39% increase ($68M) from 2022. It accounted for 5% of total revenues in 2023.
- **Satellite Operations** amounted to $781M in 2023, a 6% decrease ($49M) from 2022. It accounted for 15% of total revenues in 2023.
- **Products and Applications** totalled $781M in 2023, a 17% increase ($116M) from 2022. It accounted for 15% of total revenues in 2023.
- **Services** amounted to $2.3B in 2023, a 9% decline ($223M) from 2022. It accounted for 45% of total revenues in 2023.

Proportion of Revenues by Space Value-Chain Segments: 2023



Proportion of Revenues by Sector of Activity: 2023



Market Share by Sector of Activity

Space sector revenues can also be divided into sectors of activity based on the type of work that the organization is carrying out. In 2023 growth was mixed as many sectors have recovered from the lows of the pandemic. A detailed description of the sectors of activity categorization is provided in Annex C.

Revenues for each sector of activity are as follows:

- **Satellite Communication** generated $3.6B in revenues in 2023, decreasing by $184M (-5%), and accounting for 71% of total space revenues.
- **Earth Observation (EO)** revenues totalled $366M in 2023, growing by $17M (+5%), and accounting for 7% of total space revenues.
- **Space Exploration** revenues totalled $308M in 2023, increasing by $77M (+33%), and accounting for 6% of total space revenues.
- **Navigation** revenues grew to $688M in 2023, increasing by $138M (+25%), and accounting for 13% of total space revenues.
- **Space Science** revenues totalled $100M in 2023, decreasing by $1.5M (-1.5%), and accounting for 2% of total space revenues.
- **Other** revenues decreased by 10%, falling to $34M, and accounting for 1% of total space revenues. Activities that fall into the "Other" sector are by nature variable and subject to re-categorization; therefore, changes in this sector are less statistically relevant than for the previously noted sectors.

2024-04-08. A spectacular and rare celestial event unfolded over Canada, the United States and Mexico – a total solar eclipse. As the Moon aligned perfectly between Earth and the Sun, temporary darkness swept across parts of the country, captivating countless spectators.

Artist's rendition of a total solar eclipse. Credit: CSA.

4 Workforce

HIGHLIGHTS

- The space workforce in Canada increased by 5.9% in 2023 to 13,888 space-related jobs – 70% of which were STEM-related jobs. The total workforce has increased 19% over the past five years.
- The space sector supported a total of 26,480 jobs in 2023 through direct, indirect, and induced impacts on the Canadian economy.
- Many occupational categories have grown over the last five years: engineers and scientists (+1,461), students/interns (+635), other and health professionals (+249).

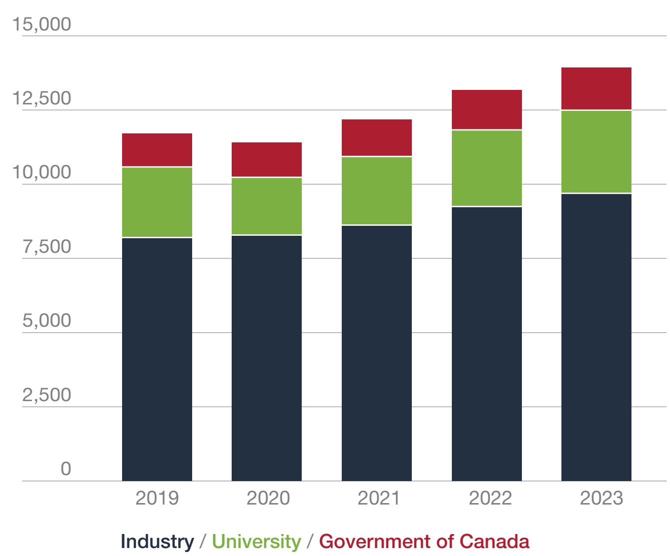
TOTAL WORKFORCE

Updates to the workforce methodology took place this year in terms of adding a broader representation of government departments contributing to the space sector. All data were backdated to account for trends.

In 2023, the Canadian space sector workforce totalled 13,888 direct jobs, a 5.9% (773 jobs) increase from last year. Over the past five years the total workforce has grown by over 19%, supporting growth despite the impacts of inflation and the pandemic.

The majority of the space sector workforce is in the private sector (90%) while the remainder is in the Government of Canada (10%). Within the private sector, 61% of the jobs are in the upstream segment, and 39% of jobs are in the downstream segment. The larger proportion of the workforce in the upstream segment can be attributed to the disproportionate contribution from Universities and Research Centres.

Space Sector Workforce: 2019–2023



ECONOMIC IMPACT – WORKFORCE

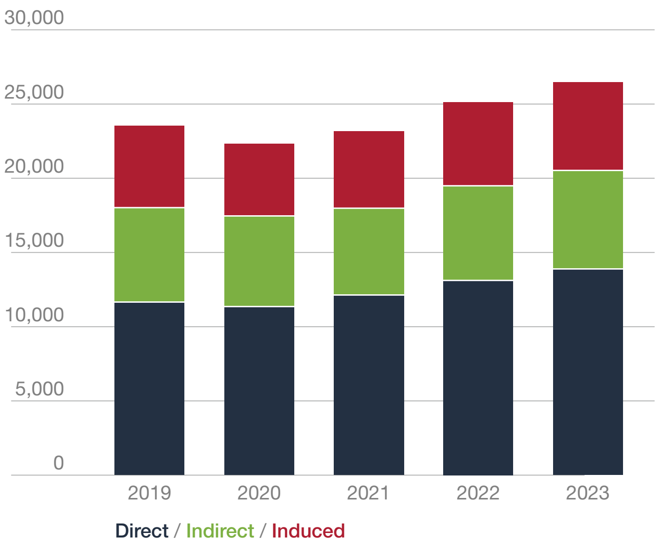
The space sector supported a total of 26,480 jobs in Canada. The total workforce contribution was broken down into the following:

- 13,888 direct space sector jobs; and
- 12,592 indirect and induced jobs:
  - 6,636 supply industry jobs; and
  - 5,956 jobs created and supported as a result of consumer spending by associated employees.

The space sector creates jobs in the broader economy with a multiplier of 1.9. In other words, every job in the space sector supports an additional 0.9 jobs in the broader economy.

From 2019 to 2023, the workforce of the Canadian space sector increased by 12.6% (2,960 jobs), translating into a 3.0% CAGR. This growth has been influenced more significantly by increases in direct jobs in the space sector, as the indirect and induced impacts have been more modest.

Total Workforce Impact Trend: 2019–2023 (number of jobs)

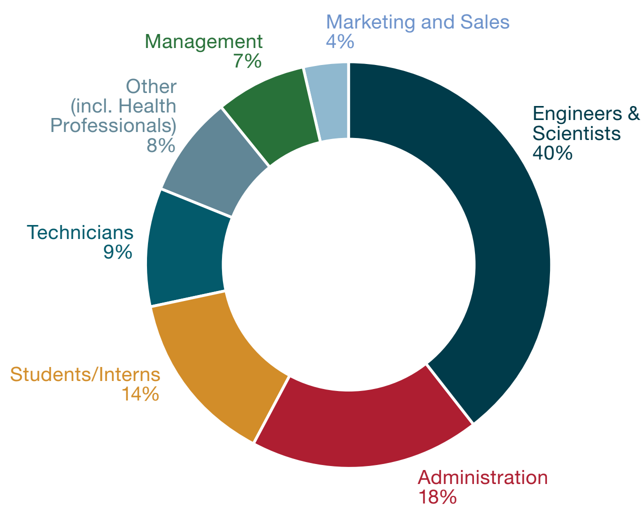


*Note: Changes occurred to workforce impact multipliers this year due to various methodological adjustments. Details can be found in Annex B.

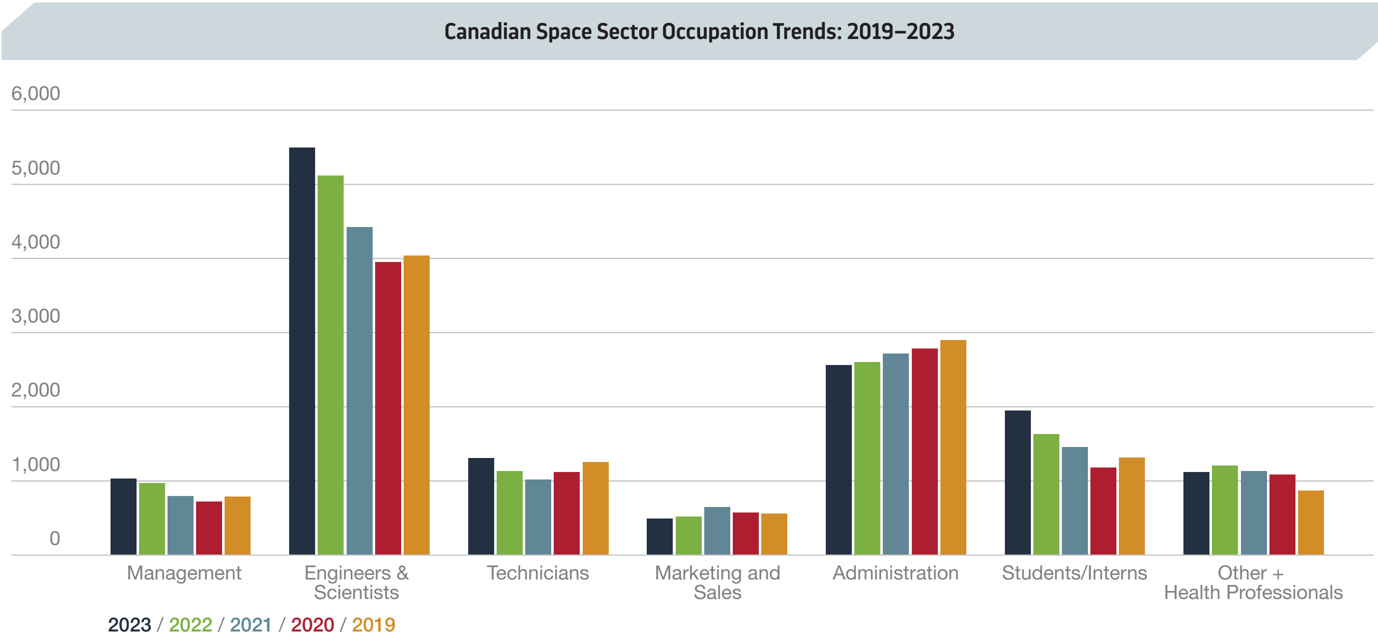
OCCUPATIONS

The Canadian space workforce is divided into eight main occupational categories: Engineers and Scientists, Technicians, Management, Administration, Marketing and Sales, Students, Health Professionals, and Other Employees. The composition of the workforce in 2023 was relatively unchanged, with a variability of +/-2%, similar to previous years.

Canadian Space Sector Occupations: 2023



While there have been minimal year-over-year changes in the space workforce composition, the trend in occupations from 2019 to 2023 displays consistent growth in many key categories. Growth was concentrated amongst engineers and scientists (+1,461), students/interns (+635), other and health professionals (+249), and management (+241). The technician category remained relatively stable, but the administrative staff and marketing and sales staff categories showed a decline.



STEM EMPLOYEES

The STEM workforce indicator tracks the number of engineers, scientists, technicians, management, health professionals and students working in the space sector. STEM employees grew +11% and totalled 9,773 jobs in 2023, which represented 70% of the total Canadian space workforce.

Definition of STEM Employees

- STEM = Engineers, scientists, technicians, management, health professionals, and students

There are significant differences between the upstream and the downstream segments. In 2023, 85% of the workforce in the upstream segment were STEM, while only 50% of the workforce in the downstream segment were STEM. The STEM workforce stood at 61% for Government of Canada employees.

HIGHLY QUALIFIED PERSONNEL (HQP)

The HQP workforce indicator identifies the number of space sector employees with at minimum a bachelor's degree. HQP employees grew +12% and accounted for 10,100 jobs in 2023, which represented 73% of Canada's space workforce.

Definition of HQP Employees

- HQP = Employees having completed at least a bachelor's degree

The differences between HQP jobs in the upstream and the downstream segments are less pronounced than for STEM employees, but are still significant. While 79% of the upstream workforce were HQP in 2023, only 65% of the downstream workforce were HQP. The HQP workforce stood at 68% for Government of Canada employees.

SPACE LABOUR FORCE CHALLENGES AND NEEDS

The competitive nature and specialization of expertise within the space sector in Canada has led to persistent challenges related to labour force needs. In 2023, the majority of Canadian space companies (54%) stated that they faced difficulties hiring personnel to the extent that positions went unfilled.

The professions for which companies had the most difficulty finding employees were unchanged in 2023, and included engineers, scientists, technicians, and management, which is similar to the types of jobs that have been difficult to hire for since 2017.

The main reasons highlighted for hiring difficulties were competition from other industrial sectors for the same talent, followed by applicants lacking the skills required for the position, and a lack of relevant experience.

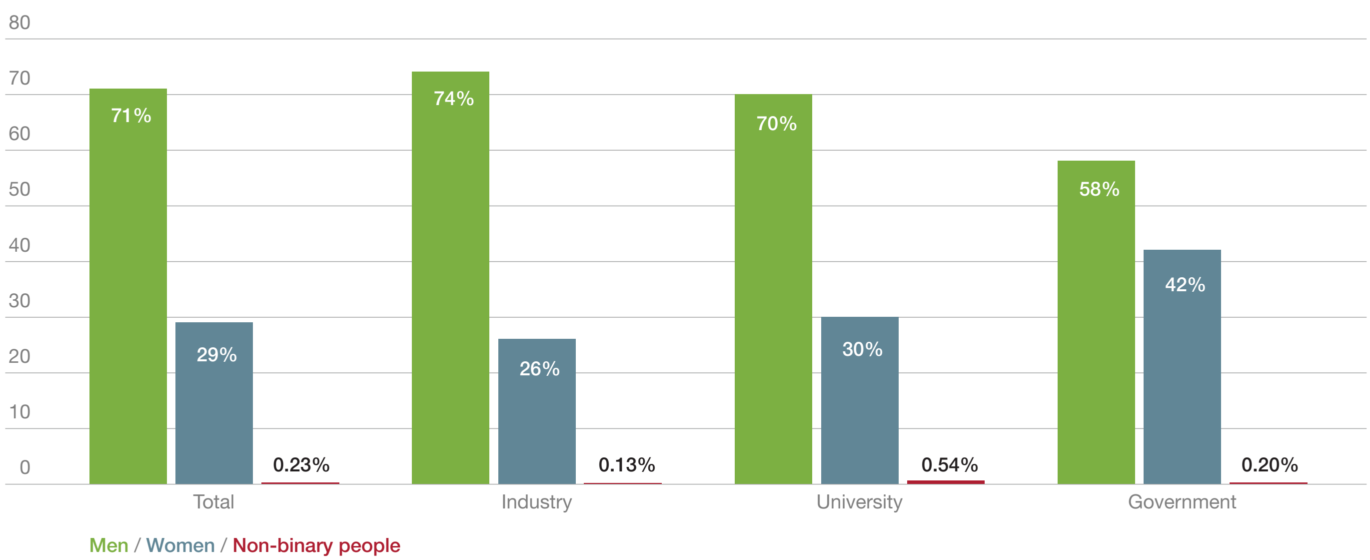
Companies dealing with employee shortages used three main strategies to deal with the problem: they offered overtime for existing employees, provided internal training to their employees, and/or outsourced some of the work.

Over the next five years, Canadian space companies will be looking for employees with sought-after skills related to software development, business development, applications of artificial intelligence, and mechanical engineering systems. In the last few years we have seen a steady rise in the demand for expertise in artificial intelligence, which is now in the top three for sought-after skills in the space sector.

GENDER DISTRIBUTION OF EMPLOYEES

In 2023, the Canadian space sector workforce was primarily made up of people who identify as men (71%) and people who identify as women (29%), while those who identify as non-binary people represented 0.2% of employees in the Canadian space sector.

Space Sector Workforce Gender Distribution 2023



Notably, the government workforce had the highest composition of women, followed by universities. Non-binary people had the highest representation at universities, while the industry segment of the space economy had the highest representation of men.

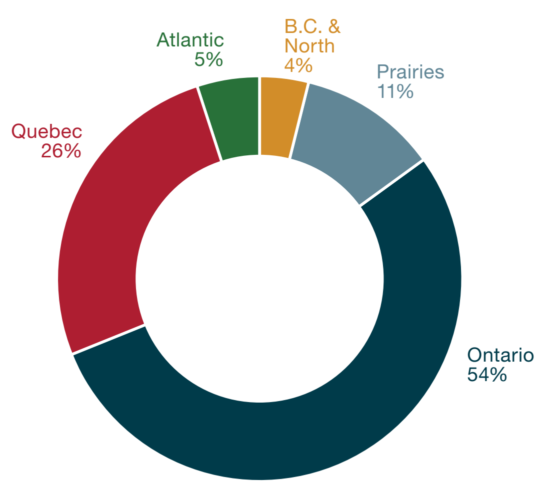
5 Regional Distribution and Trends

HIGHLIGHTS

- Revenues were stable in most provinces. Outliers include an increase in the Prairies of +22% ($103M), and a decrease of -29% (-$95M) in the Atlantic region.
- Growth in revenues varied from 2019 to 2023 – led by the Prairies (+55%) and B.C. (+18%), while declines were noted in Ontario (-14%) and the Atlantic region (-46%).
- Employment continues to be concentrated in Ontario (39%) and Quebec (36%). Most regions saw employment growth in 2023, while the Atlantic region declined significantly (-31%).

In 2023, the proportional share of total revenues and employment by province remained relatively stable (±2%) from year to year.

Regional Distribution of Total Revenues: 2023



REVENUES AND WORKFORCE BY REGION

British Columbia and North

- **Revenues**: $192M (4%) of total space revenues, a slight decrease of 1% ($2M) from 2022.
- **Workforce**: 6% (866 jobs) of Canada's space workforce, an increase of 18% (133 jobs) from 2022.

Between 2019 and 2023, total revenues increased by 18%, which was driven by a surge in domestic revenues by 71%. Over the same period, export revenues declined slightly (-13%).

Note: The North (Yukon, Northwest Territories and Nunavut) are normally integrated with British Columbia due to the small number of responses. However, no regional information was received from the North this year.

Prairies (Alberta, Saskatchewan and Manitoba)

- **Revenues**: $570M (11%) of total space revenues, an increase of 22% ($103M) from 2022.
- **Workforce**: 14% (1,960 jobs) of Canada's space work-force, an increase of 25% (394 jobs) from 2022.

Between 2019 and 2023, total revenues grew by 55%, primarily driven by a surge in domestic revenues by 167%. Exports grew a significant 37% in the same period.

Ontario

- **Revenues**: $2.76B (54%) of total space revenues, remaining stable (+$4M) from 2022.
- **Workforce**: 39% (5,400 jobs) of Canada's space workforce, an increase of 6% (315 jobs) from 2022.

Total revenues in Ontario decreased by 14% between 2019 and 2023. Domestic and export revenues declined 9% and 21% over the same period, respectively. Revenues in Ontario are struggling to reach pre-pandemic levels and are influenced by the decline in broadcasting.

Quebec

- **Revenues**: $1.33B (26%) of total space revenues, an increase of 2.5% ($32M) from 2022.
- **Workforce**: 36% (5,024 jobs) of Canada's space workforce, an increase of 4% (212 jobs) from 2022.

Between 2019 and 2023, Quebec's total revenues increased by 2%, which has largely been driven by robust growth in exports (+62%), while domestic revenues declined 14% over the same time period.

2024-10-05. Canada celebrated 40 years of Canadians in space, a journey that started with Marc Garneau's historic first flight in 1984.

Credit: NASA.

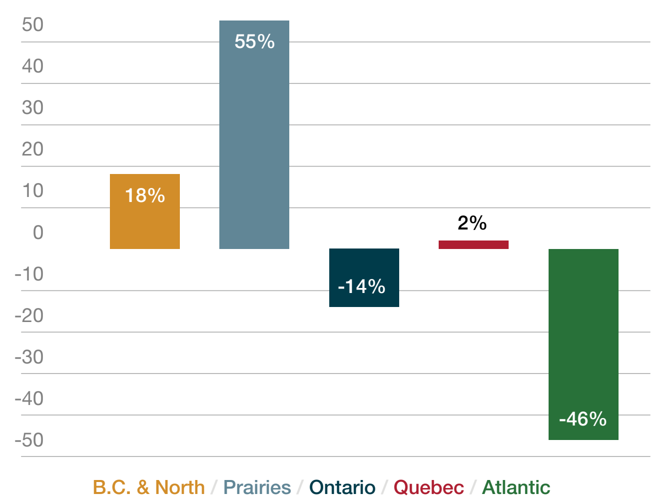
Atlantic (New Brunswick, Newfoundland and Labrador, Nova Scotia and Prince Edward Island)

- **Revenues**: $233M (5%) of total space revenues, a decrease of 29% ($95M) from 2022.
- **Workforce**: 5% (638 jobs) of Canada's space workforce, a decrease of 31% (281 jobs) from 2022.

Between 2019 and 2023, total revenues in the Atlantic region declined by 46%. This is explained by a decline in both exports (-55%) and domestic revenues (-37%). Multiple organizations in the Atlantic region have seen declines in recent years, explaining the significant impacts on revenues and workforce for the region.

Further regional workforce composition details on Gender, STEM, and HQP can be found in Annex A.

Percentage Change of Total Revenues by Region: 2019–2023



6 Innovation

HIGHLIGHTS

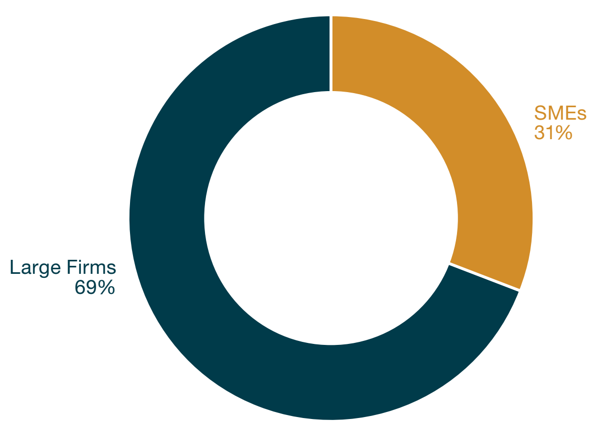
- Business Expenditures on R&D (BERD) increased by 10%, from $593M in 2022 to $650M in 2023. This marks a new all-time high.
- R&D intensity for space manufacturing was 12 times higher than the average for manufacturing in Canada.
- Return on Investment (ROI) for CSA space development programs after five years is 3.6 : 1.
- Space sector organizations reported a total of 340 inventions and 135 registered patents, demonstrating significant growth compared to previous years.

BUSINESS EXPENDITURES ON R&D (BERD) (COMPANIES ONLY)

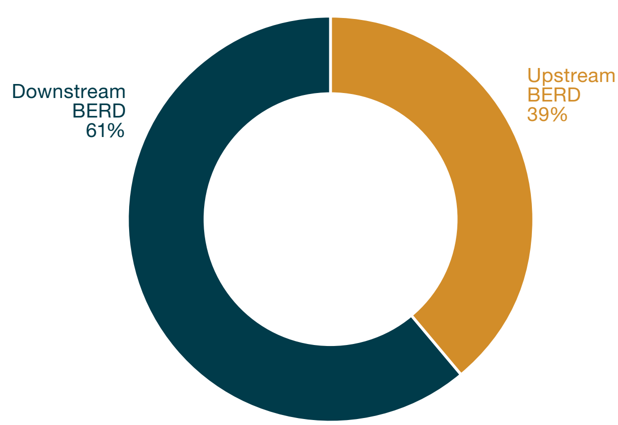
In 2023, there were 113 companies engaged in R&D activities, with BERD reaching $650M. This represents a 10% increase from the $593M spent in BERD in 2022, and a 73% increase in the last five years. SMEs accounted for 31% of BERD in 2023, while large firms made up the remaining portion (69%). Upstream organizations were responsible for 39% of total space sector BERD, while downstream organizations represented the bulk of investments at 61% of total space sector BERD.

R&D spending in 2023 was financed through internal sources (e.g. company profits reinvested in R&D) at 71% ($463M), while the remaining 29% ($187M) was financed through external funding sources (e.g. government grants and contributions).

Proportion of Business Expenditures on R&D by Firm Size: 2023

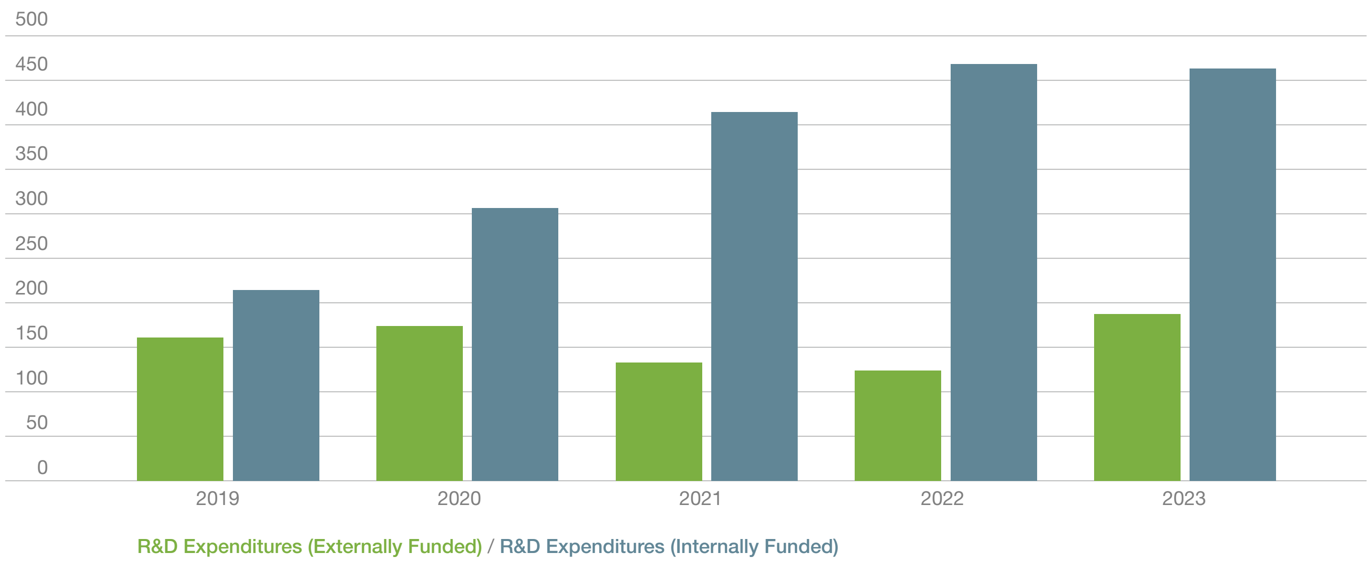


Proportion of Business Expenditures on R&D by Market Segment: 2023



The trend in BERD expenditures over the past five years has seen dramatic increases from internal sources in the private sector, while external funding has been relatively consistent.

BERD Trend: 2019–2023



R&D INTENSITY LEVEL (COMPANIES ONLY)

The industrial R&D intensity indicator reflects the ratio of BERD spending relative to the GDP contribution of the space sector. It serves as an indicator of the level of effort and investment by a company (or by an industry as a whole) in innovative activities such as the creation of new products, services and technologies, or the improvement of business functions such as production techniques. Industrial R&D intensity for companies operating in the space sector was 47% in 2023. The upstream segment is less R&D intensive than the downstream: upstream R&D intensity is 37%, while downstream R&D intensity is 57%.

The R&D intensity for the manufacturing sub-segment (in the upstream) is 44%, which is 12 times higher than the average for manufacturing in Canada.

RETURN ON INVESTMENT

For the past seven years the CSA has been surveying companies to determine the return on investment (ROI) from CSA space development programs. Overall, respondent companies indicated that 81% of CSA-financed projects generated additional positive reputation benefits.

On average, CSA space development program investments see an ROI of 3.6 : 1.0, five years after the completion of the project. This means that for every dollar invested, the sector generates $3.60 in additional revenue.

The analysis is conservative in nature, as the projects for which companies did not provide responses in successive years are counted as generating an ROI of zero.

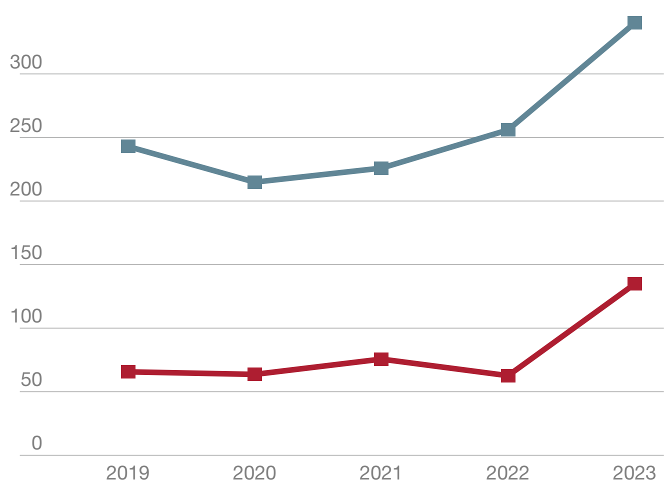
To date, these measures have shown that CSA space development programs demonstrated success in generating follow-on revenues for companies. The intent is to continue to follow CSA-funded projects that have ended, in order to determine the cumulative total ROI for each space development project.

INVENTIONS AND PATENTS (ALL ORGANIZATIONS)

In 2023, the number of organizations reporting having made an invention was 68 (+33%) and registering a patent was 22 (+5%) compared to 2022. Between 2019 and 2023, the number of organizations with inventions increased by 19% (from 57 to 68), while the number of organizations registering patents decreased by 12% (from 25 to 22).

There has been a significant increase in activity related to inventions and patents after being flat for many years. The number of inventions climbed to 340 in 2023, a +33% increase in the last year and a +40% increase from 2019. Registered patents rose to 135 in 2023, a dramatic +114% in the past year and a +105% increase since 2019.

Inventions and Patents Trends: 2019–2023



2024-06-27. The Honourable François-Philippe Champagne, Minister of Innovation, Science and Industry, announced that Brampton-based company MDA Space would receive $999.8 million to continue work on Canadarm3 and begin detailed design, construction and testing. This milestone marks the last steps to finalize the design, construction and testing of this sophisticated robotic system before delivering Canada's contribution to Gateway, the next major international collaboration in human space exploration.

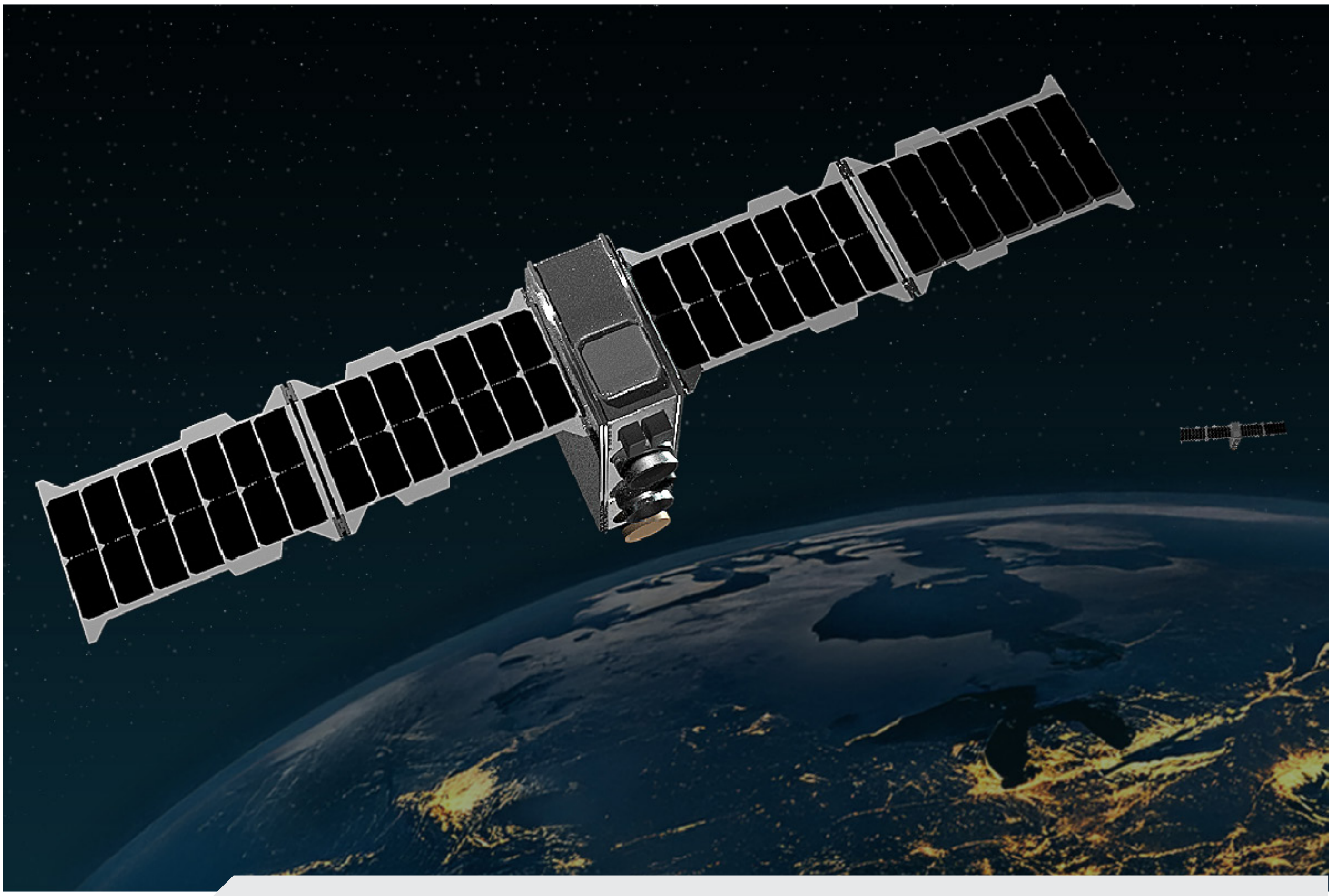
Credit: NASA, Bradley Reynolds, Alberto Bertolin.

7 Conclusion

The economic impact of the Canadian space sector continued to surge in 2023. Revenues grew 0.8% to reach $5.1B in 2023, led by growth in exports of 9%, while domestic revenues declined by 5%. This divergence in growth is a result of declines in satellite communication (broadcasting), despite growth in the Earth observation, space exploration, and navigation sectors of the space economy.

In addition, other areas of the space economy are seeing an increasing impact – GDP grew 4.1% in real terms to reach $3.4B; workforce increased almost 6% to reach over 13,888 jobs, another new peak; and BERD has also been booming, again reaching a new high of $650M, a 10% increase over the previous high in 2022.

Through this report, it is evident that the space economy is making important contributions to the broader Canadian economy. The CSA will continue to monitor the health of the Canadian space economy to ensure its impact is uncovered and told.



2025-02-07. Canada's boreal forest is vast and experiences some of the world's largest and most intense wildfires. On average, about 8,000 wildfires burn over 2.1 million hectares of forest every year, representing a territory equivalent to almost half the size of Nova Scotia. About $1 billion is spent each year in Canada to combat wildfires. The Government of Canada recognizes this growing threat and remains committed to protecting its communities, natural resources, and wildlife habitats.

Credit: CSA.

A Annex A Trends: 2019–2023

Total Space Revenues ($M)	
	TOTAL REVENUES
2019	5,489
2020	4,898
2021	4,896
2022	5,049
2023	5,091

Sources of Domestic Revenues Public vs. Private ($M)		
	Public Revenues	Private Revenues
2019	342	2,839
2020	318	2,678
2021	392	2,725
2022	428	2,623
2023	583	2,323

Domestic vs. Export Revenues Overall ($M)					
	Domestic	%	Exports	%	Total
2019	3,180	58%	2,309	42%	5,489
2020	2,996	61%	1,901	39%	4,898
2021	3,117	64%	1,779	36%	4,896
2022	3,052	60%	1,997	40%	5,049
2023	2,907	57%	2,185	43%	5,091

Sources of Export Revenues ($M)					
	2019	2020	2021	2022	2023
North America	1,310	1,164	1,042	1,210	1,422
Europe	449	402	408	436	424
Asia	337	171	157	171	179
Africa	20	16	11	6	10
Other	15	1	9	13	7
Central America, South America, and Caribbean	147	113	114	113	111
Middle East	16	21	28	32	16
Oceania and Antarctica	16	14	11	16	15
Total	2,309	1,901	1,779	1,997	2,185

Revenues by Sectors of Activity ($M)						
	Satellite Communication	Navigation (GPS)	Space Exploration	Earth Observation	Space Science	Other
2019	4,563	418	119	248	111	31
2020	3,998	421	132	226	90	31
2021	3,891	440	164	270	94	37
2022	3,779	550	231	349	101	38
2023	3,595	688	308	366	100	34

Total Workforce vs. STEM Employees			
	Total Workforce	STEM	HQP
2019	11,657	7,379	7,713
2020	11,353	6,956	7,260
2021	12,132	7,678	8,158
2022	13,115	8,834	8,991
2023	13,888	9,773	10,100

Workforce by Canadian Region (Jobs)					
	2019	2020	2021	2022	2023
British Columbia and North	739	746	809	733	866
Prairies	1,116	1,109	1,324	1,566	1,960
Ontario	4,918	4,469	4,717	5,085	5,400
Quebec	4,089	4,287	4,514	4,812	5,024
Atlantic	795	742	768	919	638

Revenues by Region, Domestic vs. Export Trend ($M): 2019 & 2023				
	2019		2023	
	Domestic	Exports	Domestic	Exports
British Columbia and North	61	102	103	88
Prairies	51	317	135	434
Ontario	1,832	1,393	1,660	1,104
Quebec	1,015	287	869	465
Atlantic	222	209	139	94
Total	5,489		5,091	

Revenues by Canadian Region 2019–2023 ($M)	2019	2020	2021	2022	2023
British Columbia and North	163	165	184	193	192
Prairies	368	386	396	466	570
Ontario	3,225	2,785	2,703	2,760	2,764
Quebec	1,302	1,188	1,251	1,301	1,334
Atlantic	431	373	361	328	233

Canadian Space Sector Occupation Trends: 2019–2023	Management	Engineers & Scientists	Technicians	Marketing and Sales	Administration	Students/ Interns	Other including health professionals	Total
2019	782	4,028	1,245	549	2,889	1,302	862	11,657
2020	711	3,942	1,113	566	2,774	1,168	1,079	11,353
2021	784	4,413	1,011	640	2,710	1,447	1,126	12,132
2022	959	5,113	1,121	511	2,591	1,621	1,199	13,115
2023	1,023	5,489	1,299	479	2,550	1,937	1,111	13,888

Workforce Group by Region: 2023	Management	Engineers & Scientists	Technicians	Marketing and Sales	Administration	Students/ Interns	Other (including health professionals)	Total
British Columbia and North	66	414	98	37	45	152	54	866
Prairies	147	861	217	22	47	617	49	1,960
Ontario	464	2,342	497	235	710	618	534	5,400
Quebec	282	1,749	383	149	1,671	477	315	5,024
Atlantic	65	123	104	36	78	73	159	638
Total	**1,023**	**5,489**	**1,299**	**479**	**2,550**	**1,937**	**1,111**	**13,888**

Gender Composition by Region 2023				
	Men	Women	Non-binary people	Total
British Columbia and North	72%	28%	0.3%	100%
Prairies	73%	27%	0.1%	100%
Ontario	74%	26%	0.5%	100%
Quebec	68%	32%	0.0%	100%
Atlantic	56%	44%	0.2%	100%

STEM Workforce: 2023				
	Total Workforce	Total STEM	% of STEM Relative to Total Regional Workforce	% of STEM Relative to Total Number of STEM in Canada's Space Workforce
British Columbia and North	866	730	84%	7%
Prairies	1,960	1,854	95%	19%
Ontario	5,400	3,932	73%	40%
Quebec	5,024	2,893	58%	30%
Atlantic	638	365	57%	4%
Total	**13,888**	**9,773**	-	**100%**

Distribution of Highly Qualified Personnel in the Canadian Space Sector: 2023				
	Total Workforce	Total HQP	% of HQP Relative to Total Regional Workforce	% of HQP Relative to Total Number of HQP in Canada's Space Workforce
British Columbia and North	866	747	86%	7%
Prairies	1,960	1,526	78%	15%
Ontario	5,400	4,083	76%	40%
Quebec	5,024	3,357	67%	33%
Atlantic	638	387	61%	4%
Total	**13,888**	**10,100**	-	**100%**

Breakdown of Sectors of Activity along the Value Chain: 2023 (in millions)

	Upstream			Downstream					
	Research, Engineering and Consulting	Space Systems Manufacturing	Ground Systems Manufacturing	Satellite Operations	Value-Added Products and Applications	Services	Upstream	Downstream	Total
Satellite Communication	73	429	200	696	334	1,863	702	2,893	3,595
Navigation (GPS)	7	0	0	1	394	286	7	681	688
Space Exploration	202	44	1	2	3	57	247	61	308
Earth Observation	56	91	38	81	47	53	185	181	366
Space Science	80	13	2	2	2	0	95	4	100
Other	6	24	2	0	1	0	32	2	34
Total	425	601	244	781	781	2,260	1,269	3,822	5,091

B Annex B Methodology

QUESTIONNAIRE

In order to measure the changes taking place in Canada's space sector each year, the CSA uses a questionnaire to collect baseline data. Questionnaires are sent to private sector enterprises, not-for-profit organizations, research centres and universities in Canada that engage in space activities. The questionnaire follows a census model and therefore aims to be as inclusive and exhaustive as possible. It has been conducted annually since 1996.

Most organizations that responded to the 2024 questionnaire reported on a fiscal year (generally ending March 31, 2024), with the remainder reporting on a calendar year, from January 1 to December 31, 2023. As in previous years, the questionnaire had a high response rate covering 215 organizations, including all major space players.

Additionally, the CSA performs quality control measures on the survey data to ensure the accuracy of the findings.

ATTRIBUTION

Data are also supplemented based on CSA transfer payments (Contracts, Grants, and Contributions) in cases where this information has not been included as part of the survey responses to more fully capture revenues.

In addition, there is a limited number of cases where data are compiled from publicly disclosed reports (e.g. for publicly traded companies) and verified through consultation with company officials.

ECONOMIC TRENDS

The economic trend analysis for this report assesses the past five years (2019–2023). For information on the economic trends prior to 2019, readers are invited to consult previous editions of this report.

ECONOMIC IMPACT ANALYSIS

As described in the OECD's 2022 Handbook on Measuring the Space Economy: 2nd Edition, measuring economic impacts in the space sector is a challenging task, as there is no single statistical/industrial classification for space activities. In order to overcome this difficulty, a model was developed jointly by the CSA and Innovation, Science and Economic Development Canada to calculate the space sector's contribution to GDP (gross domestic product or value added). This process involved taking into account the various industrial classifications, weighing them and categorizing them using a value-chain approach, in order to develop a set of multipliers based on Statistics Canada's Input-Output tables. These multipliers are used to determine the impacts on GDP and employment of the space sector, the suppliers to the space sector, and the consumer spending by employees associated with both the space sector and its supply industry.

A detailed explanation of the Economic Impact Model follows:

1. North American Industry Classification System (NAICS) codes were retrieved for each space company through Statistics Canada's Business Register.
2. Canadian space companies were categorized into a value-chain model based on the goods and services they provide.
3. Universities, research centres and associations were grouped together under Research, Engineering and Consulting, as in most cases their space sector activities are related to R&D.
4. The grouping of NAICS codes in each of the value-chain categories were weighted for their relative categories. Weighting was established on the basis of workforce.
5. Economic multipliers were then built for each value-chain category based on Statistics Canada's input-output accounts (using NAICS codes), divided into three levels: space sector, supply industry and consumer spending.
6. Employment levels for each space value-chain segment are entered in the Economic Impact Model. The economic multipliers are then applied to generate the space sector's total GDP and workforce impact numbers.

Note: Adjustments to GDP and Workforce methodology took place this year due to the following activities: Internal reclassification of organizations to better reflect activities in the space sector (impacted multipliers), the addition of Government of Canada employees (beyond the CSA), impacts of inflation, and adjustments to Statistics Canada multipliers.

Annex C Definitions

CANADA'S SPACE SECTOR

The Canadian space sector is defined as organizations (private, public and academic) whose activities include the development and use of space assets and/or space data.

SPACE VALUE-CHAIN CATEGORIES

This report uses a methodology developed by the Organisation for Economic Co-operation and Development's (OECD) Space Forum to characterize Canadian space activities on the basis of a value-chain approach.

This means data have been organized into categories that align with the stages of producing space goods and services: Research, Engineering and Consulting; Space Systems Manufacturing; Ground Systems Manufacturing; Satellite Operations; Products and Applications; and Services.

UPSTREAM SEGMENT

The upstream segment refers to the effort required to design, test, build, integrate, and launch[2] assets into space.

- **Research, Engineering and Consulting**: Research and development (R&D) related to non-commercial or pre-commercial activities; applied science; design and testing of spacecraft, satellites and payloads or components thereof; support services directed at enabling other space sector actors throughout the value chain, including outreach activities, legal services, insurance provision, market research, policy and management services.
- **Space Systems Manufacturing**: Building and integration of spacecraft, satellites, payloads or any component thereof.
- **Ground Systems Manufacturing**: Building and integration of facilities and equipment on Earth for satellite operations, often known as "ground stations."

2 Note that launch-related activities do not represent a significant area of activity in the Canadian space sector, hence why it is not included as a separate value-chain category in this report. Launch-related activities include the building and integration of space transportation vehicles (rockets), launch pads, space ports and related technologies, as well as launch service provision.

DOWNSTREAM SEGMENT

The downstream segment refers to the effort required for the day-to-day operation of space assets, manufacturing of products and software applications that transform space data and signals into useful end products, and services provided to end-users.

- **Satellite Operations**: Day-to-day management of satellites and spacecraft once they are in space, e.g. telemetry, tracking and command; monitoring, recovery operations and collision avoidance; mission planning for satellite passes; uplinks and downlinks for signal processing to reception facility; lease or sale of satellite capacity.
- **Products and Applications**: Manufacturing/development of software or hardware that enable the transformation of space-derived resources into a usable/useful format, e.g. computer software applications, chipsets, Very Small Aperture Terminals and other terminals, antennas, satellite phones, video and audio receivers-decoders, and GPS devices. This category also includes publishing digital or print books, atlases and maps using space-based data.
- **Services**: Provision of services which are dependent on space-based signals or data to various end-users (individual consumers, government departments, or businesses), e.g. subscriptions to satellite radio, phone, television or Internet services; engineering, architectural and environmental consulting based on the processing and analysis of Positioning, Navigation and Timing (PNT) or Earth Observation (EO) data; support services provided to users of space-based products and applications, such as provision of computer consulting and facilities agement, data processing, Web hosting and portals, and streaming services.

SECTORS OF ACTIVITY

The activities of space organizations can also be broken down, as has been done in previous reports, according to the ultimate use or purpose of the research carried out or the goods and services produced. Space sector activities can serve commercial, civil or military purposes, and refer to activities across the value chain:

- **Navigation**: The development and use of satellites for localization, positioning and timing services. Navigation is used for air, maritime and land transport, or the localization of individuals and vehicles. It also provides a universal referential time and location standard for a number of systems.
- **Satellite Communication**: The development and use of satellites to send signals to Earth for the purpose of fixed or mobile telecommunications services (voice, data, Internet, and multimedia) and broadcasting (TV and radio services, video services, Internet content).
- **Earth Observation (EO)**: The development and use of satellites to measure and monitor Earth (including its climate, environment and people) for a number of purposes such as resource management, mineral exploration, disaster assessment, security and defence.
- **Space Exploration**: The development and use of crewed and uncrewed spacecraft (space stations, rovers and probes) to investigate the reaches of the universe beyond Earth's atmosphere (e.g. the Moon, other planets, asteroids). The International Space Station and astronaut-related activities are considered in this sector.
- **Space Science**: The various science fields that relate to space flight or any phenomena occurring in space or on other planets (e.g. astrophysics, planetary science, space-related life science).
- **Other**: Generic technologies or components that are not destined for use on a specific space system or for a specific space application. This could be the case for early-phase research, small off-the-shelf components used in various systems, or services based on integrated applications. This category also captures launch activities.

RETURN ON INVESTMENT (ROI)

ROI is defined as the ratio rate of return between net income and investment.

JOBS

Jobs impact is reported on an annual average basis and measured in terms of full-time equivalent (FTE) employment.

HIGHLY QUALIFIED PERSONNEL (HQP)

HQP is defined as space-related employees who have at least a bachelor's degree. This definition aligns with Statistics Canada's definition of HQP, enabling comparisons with other sectors of the economy.

SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) EMPLOYEES

STEM employees are space-related employees involved in science, technology, engineering or mathematics activities. For the purpose of this survey, STEM employees include engineers, scientists, technicians, management, health professionals and students working in the space sector. Management employees are included in the STEM indicator because the vast majority of employees in this category are managing STEM-related activities. Similarly, students were included in this indicator, because the vast majority of students employed by space companies are directly involved in STEM activities. This approach aligns more closely with Statistics Canada's and the OECD's definitions of STEM employees.

GOVERNMENT OF CANADA EMPLOYEES

The report now includes data on Government of Canada employees as members of the space sector. For consistency in location, it has been assumed that outside of the CSA, Government of Canada employees are in Ontario (Ottawa). Data related to employees have also been backdated to be consistent with trend analyses throughout the report.

BUSINESS EXPENDITURES ON RESEARCH AND DEVELOPMENT (BERD)

BERD measures the spending towards R&D activities in a company. The source of funds could include their own internal private investment (cash on hand, debt, private injection) or external funding sources (government funding, other).

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