



Canadian Space
Agency

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STATE OF THE CANADIAN SPACE SECTOR 2000

*EXTERNAL RELATIONS DIRECTORATE
CANADIAN SPACE AGENCY*



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MISSION STATEMENT
About the Authors
About this Report

The Canadian Space Agency is committed to leading the development and application of space knowledge for the benefit of Canadians and humanity.

About the Authors

The External Relations Directorate manages the strategic relationships between the Canadian Space Agency and its domestic and international partners. Key mandates include the development and implementation of policies and strategies relating to co-operation partnerships with domestic stakeholders (Federal and Provincial governments, industry and academia) and international agencies and industries. External Relations plays a pivotal role in supporting the commercial initiatives of Canadian space companies on world markets - a core mandate of the CSA - and in providing stakeholders with strategic and timely information.

About this Report

The State of the Canadian Space Sector report provides those working in the space sector, government and industry alike, with insight into the sector in which we operate. In turn, this information supports decision-makers in their endeavor to make informed and strategic choices for the future.

For more information

Information specific to Canadian space business and industry, including an electronic version of this report, is found at the following address: www.space.gc.ca/business/.

Acknowledgments

The CSA wishes to acknowledge the important contribution of the many organisations, both public and private, without which this report would simply not be possible.

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MESSAGE FROM THE PRESIDENT



Marc Garneau
CSA President

I am very pleased to report that the first year of the new millennium for Canada's space industry produced steady revenues in the ever-volatile space marketplace. At C\$1.43 billion, a slight increase over 1999 results, our space sector continued to garner the benefits of inroads into new and existing foreign markets. Export revenues rose fifteen percent to \$656m in 2000, representing a record forty-six percent of total receipts compared to thirty-one percent five years earlier. Taking the lead once again were telecommunications activities – at the core of Canada's legacy in space – generating over sixty percent of overall revenues.

Numbers aside, it is becoming increasingly apparent that technological advancements in orbiting space technologies are giving way to innovations in their utilization. From the conservationist using remote sensing images to monitor forestry operations to the weekend backpacker using GPS to locate the trail, space is no longer out of reach for the average Canadian. Moreover, it is being applied to an even greater degree by governments at all levels to support public service activities, from surveillance to education to healthcare.

As we continue to push the boundaries of space exploration, our space sector is transforming knowledge and technology into industrial prowess, in all regions of the country. The voyage is certainly not an easy one, with market forces sometimes as harsh as the space environment itself. Still, the prevailing confidence in Canada's space industry should prove invaluable through the ongoing quest for novel ideas, new opportunities and exciting discoveries – exploited for the benefit of all Canadians.



EXECUTIVE SUMMARY

In 2000, **Total Revenues** in Canada's space sector remained stable, increasing less than 1% from \$1.425b to \$1.431b¹. Growth was due to increases in the export revenues of Canadian space sector companies. Although **Domestic Revenues** fell by \$80m or 9%, from \$855m to \$775m, **Export Revenues**, on the other hand, rose a healthy 15%, from \$571m to \$656m. As a result, export revenues' proportion of total revenues rose from 40% to 46%, a level similar to 1997 and 1998. Between 1996 and 2000, overall export revenues increased by nearly 120% compared to 16% increases in overall domestic revenues - results that indicate an increasingly export-oriented space industry.

Of the four **Space Categories**, Space Segment and Ground Segment registered the strongest growth rates, up 41% (\$602m) and 52% (\$227m) respectively. Applications and Services dropped in comparison to previous results, off 29% from \$816m to \$584m, representing 41% of total revenues. The decline meant that for the first time since 1996, the Space Segment category surpassed the Applications and Services category in terms of proportion of total revenues.

Telecommunications continued to dominate **Space Activities** in Canada, generating 63% (\$920m) of total space revenues. Earth Observation followed with 18% of overall revenues (\$254m), representing a modest increase of 3%. On the downturn were Canada's Robotic activities, sliding 10% in 2000, along with Space Science which fell 23%. Navigation activities, on the other hand, recorded revenue increases of 15%, from \$58m to \$67m.

In terms of **Regional Space Revenues**, Atlantic Canada surged 56% from \$103m to \$160m of which over 80%, more than any other region, was derived from exports. The Prairies also registered sound revenue growth of nearly 20%, breaking \$100m for the first time since 1996. British Columbia, another region with positive growth, brought in 3% more revenues in 2000 than in 1999 whereas Ontario and Quebec revenues dropped 2% and 15% respectively in 2000.

For Canada's **Space Sector Workforce**, the industry experienced a decline of 7% from 6,408 to 5,950. Despite the drop, the growth rate between 1996 and 2000 remained positive, up a respectable 24%. Growth rates in 2000 were strongest in Atlantic Canada, up 66%, followed by the Prairies, up 21%.

OVERALL RESULTS: 1996-2000

Year	Total Revenues	Domestic Revenues		Exports Revenues		Workforce n
	\$	\$	%	\$	%	
2000	1,430,941,403	774,729,039	54	656,212,364	46	5,950
1999	1,425,256,188	854,455,411	60	570,800,777	40	6,408
1998	1,420,153,485	802,255,204	56	617,898,281	44	5,930
1997	1,256,362,092	690,006,322	55	566,355,770	45	5,336
1996	968,849,042	667,678,276	69	301,170,766	31	4,812

¹ All currency in Canadian dollars.



OVERVIEW OF THE REPORT

In order to measure the changes taking place in Canada's space sector, the CSA undertakes an annual survey and publishes the results in the *State of the Canadian Space Sector* report. The 2000 edition profiles the sector over the course of January 1 to December 31, 2000. Data is provided in the following areas:

- Overall space revenues;
- Domestic v. export revenues;
- Revenues of Canada's Top 30 organisations developing and/or using space to generate revenues;
- Revenues by space categories (Space Segment, Ground Segment, Applications and Services, and Space Research);
- Revenues by sectors of activity (Telecommunications, Robotics, Earth Observation, Space Science, and Satellite Navigation);
- Regional Revenues (British Columbia, Prairies, Ontario, Quebec and Atlantic Canada);
- Workforce characteristics.

METHODOLOGY

Questionnaires were sent to over 200 private sector companies, research organisations and universities in Canada who have a defined strategic interest in the space industry. Additional data were collected through internal consultation with CSA and government officials whose dealings with stakeholders were deemed statistically relevant.

It is important to note that the company-specific information used to compile this report remains strictly confidential and cannot be released in a manner other than in an aggregate form.² Consequently, in certain circumstances, the authors are prevented from providing a more detailed explanation or in-depth analysis of the results.

ANNUAL STATISTICAL REVIEW

In order to ensure high levels of reliability, the CSA conducts recurring reviews of survey results with its industrial partners. During the review process conducted throughout 2001 for the 2000 survey, certain companies reported that results submitted and reported in previous years, in particular 1998 and 1999, required adjustments. As a result, overall space revenues in 1998 were revised downward from \$1.65b to \$1.42b. In 1999, overall revenues were adjusted from \$1.83b to \$1.43b. The results presented in this report reflect these modifications.

² CSA acknowledges a margin of error in the final results of approximately 2.5%.

DEFINITION OF CANADA'S SPACE SECTOR

The Canadian space sector is defined as organisations (private, public and academic) whose activities rely on the **development and use** of space assets and/or space data. Accordingly, the sector encompasses the following activities:

Space Segment: Research and Development (R&D), manufacturing, testing, integration and launch of platforms (satellites, spacecraft and robotic systems), complete systems, subsystems and components.

Ground Segment: R&D, manufacturing, testing, and integration of facilities on Earth for controlling space-based systems and satellites, for linking satellites to operational terrestrial networks and for processing satellite-derived data.

Applications and Services: Development and/or provision of services and value-added products and technologies that are derived from the use of space systems and/or data, and the provision of consulting and engineering services.

Space Research: Primarily research related to non- or pre-commercial space activities.

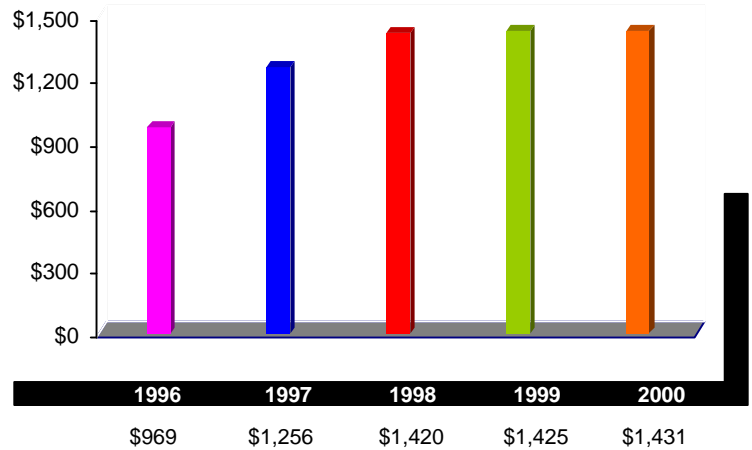


REVENUES Overall Revenues Domestic v. Export Revenues

OVERALL REVENUES

In 2000, total revenues in Canada's space sector remained stable, increasing less than 1% from \$1.425b to \$1.431b. Over the three-year 1998-2000 period, the sector experienced flat growth, rising a negligible 0.8% from \$1.40b to \$1.43b. However, the overall growth trend has been strong, rising 48% between 1996 and 2000, from \$969m to \$1.431b.

Total Space Revenues: 1996 - 2000 (C\$m)

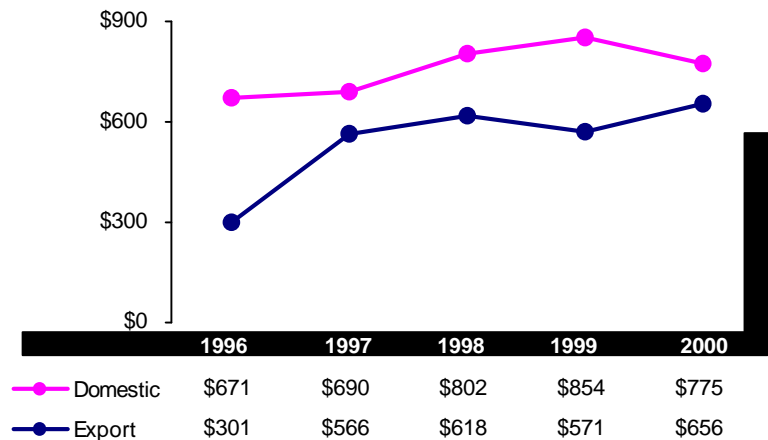


DOMESTIC v. EXPORT REVENUES

From 1999 to 2000, revenues derived from domestic sources declined \$80m (-9%) from \$855m to \$775m. This decline was offset by an increase in export revenues, up \$85m (+15%) from \$571m to \$656m.

The decline in domestic revenues resulted in a further decline in their proportion of overall revenues, slipping from 60% (\$854m of \$1.43b) in 1999 to 54% (\$768m of \$1.41b) in 2000. Alternatively, export revenues' proportion of overall space revenues rose from 40% to 46%. Over the 1996-2000 timeframe, total export revenues increased by 118% - indicating an increasingly export-oriented space industry. By comparison, domestic revenues increased 16% over this same period, from \$671m to \$775m, peaking in 1999 at \$855m.

Domestic v. Export Revenues: 1996-2000 (C\$m)





REVENUES Domestic Revenues Export Revenues

DOMESTIC REVENUES

In 2000, of the \$775m total domestic revenues, non-governmental sources ("Private") declined nearly 40% from \$583m to \$353m. Domestic revenues attributed to government sources ("Public"), on the other hand, were up 55% from \$271m to \$422m, indicating an important public sector clientele for space-related products and services.

The rise in revenues from government sources resulted in a noticeable change in the overall ratio between government/non-government sources of revenues - from 32/68% in 1999 to 54/46% in 2000. It marked the first year since data collection began in 1996 that revenues from government sources outweighed those from non-government sources.

EXPORT REVENUES

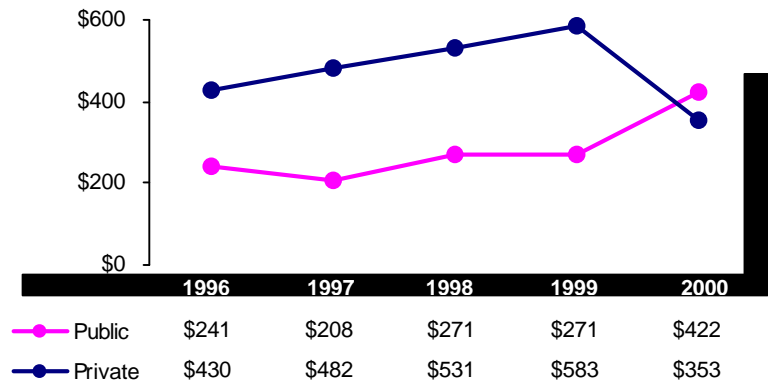
The **U.S.** market remained the dominant source of export revenues for Canada's space organisations, registering \$348m or 53% of the \$656m in total export revenues. Yet while results between 1996 and 2000 indicated a solid 94% increase in export revenues from our neighbors to the south (from \$180m in 1996 to \$348m in 2000), numbers have slid since the peak in 1998 (\$383m), dropping 3% to \$370m in 1999 and another 6% in 2000 to \$348m.

Revenues from **Europe** rose nearly 10% in 2000, up from \$110m to \$121m. In spite of this increase, Europe's proportion of the overall \$656m export revenues remained relatively unchanged in 2000, accounting for 18% of the export market compared to 19% in 1999. With the exception of 1998, revenues from Europe have consecutively increased since 1996 - up 71% over this five-year period.

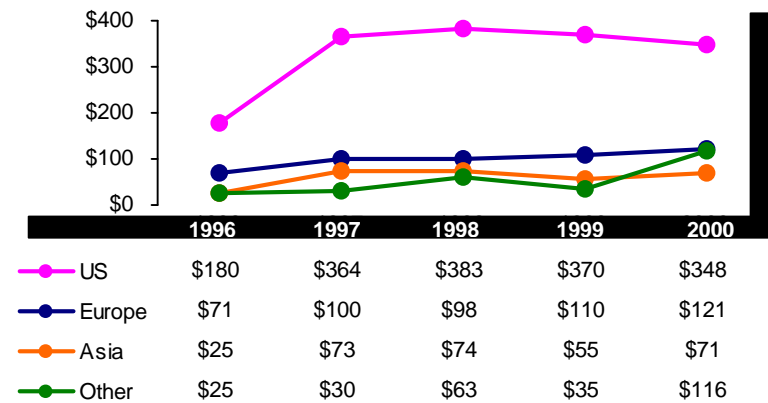
Revenues from **Asia** recovered in 2000, rising \$16m or 29% from \$55m to \$71m (11% of total export revenues). This compares to a 25% decline registered between 1998 and 1999, a result of fluctuating Asian economies over this period. On the whole, Asia has proven a good source of revenues for Canada's space industry, up 180% between 1996 and 2000.

In 2000, Canada's space industry conducted more and more business outside of traditional trade channels. In 2000, revenues from "**Other**" regions grew a remarkable 231%, from \$35m to \$116m. In fact, revenue levels in this category increased 356% from the initial low of \$25m in 1996. Sources of revenues in this category include Canadian industrial activity in Australia, Africa, Central and South America, amongst others.

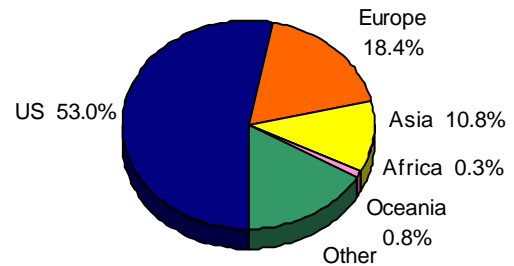
Sources of Domestic Revenues: Public v. Private 1996-2000 (C\$m)



Sources of Export Revenues: 1996-2000 (C\$m)



Sources of Export Revenues: 2000





REVENUES Revenues of Canada's Top 30 Revenues by Space Categories

REVENUES OF CANADA'S TOP 30 SPACE ORGANISATIONS

The Top 30 Canadian organisations developing and/or using space assets account for 97% of the total space revenues in 2000. This was up from the 1999 level of 94%, and is consistent with the upward trend since the 1996 level of 86%. Of the total number of respondents in 2000, 44 organisations reported revenues equal to or in excess of \$1m, a sum that has remained relatively stable since 1997 (42 in 1997, 44 in 1998 and 45 in 1999). By comparison, these numbers fall short of the 1996 results in which 77 companies reported revenues equal to or in excess of \$1m.

REVENUES BY SPACE CATEGORIES

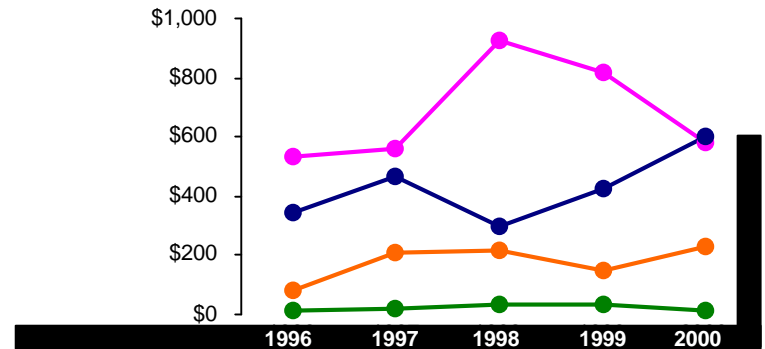
Space Segment: continued to climb, up 41% to a new level of \$602m over \$425m in 1999. Overall, a 76% increase since 1996. The Space Segment category accounted for 42% of total revenues compared to 30% in 1999.

Ground Segment: even stronger growth rates in 2000, up 56% to \$228m from \$147m in 1999. This result meant a recovery to levels consistent with those of 1997 and 1998, registering \$211m and \$213m respectively. As a proportion of total revenues, the Ground Segment category rose from 10% in 1999 to 16% in 2000.

Applications and Services: 2000 results were in the order of \$584m compared to \$816m in 1999, a drop of 29%. For the first time since 1996, the Space Segment category (42%) surpassed the Applications and Services category (41%) in terms of proportion of total revenues, a category that had previously occupied 57% of the revenue returns in 1999 and over 60% in 1998.

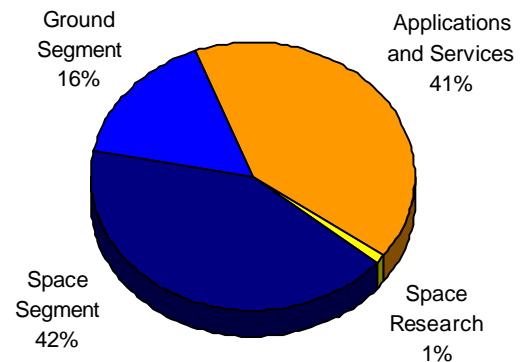
Space Research: the upward trend registered between 1996 and 1999 reversed significantly in 2000, with revenues falling 56% to \$16m. 2000 revenues from the space research category returned to levels recorded in 1996, where they accounted for 1% of total revenues.

Total Revenues by Space Category: 1996-2000 (C\$m)



	1996	1997	1998	1999	2000
Apps & Services	\$532	\$558	\$929	\$816	\$584
Space Segment	\$342	\$466	\$294	\$425	\$602
Ground Segment	\$79	\$211	\$213	\$147	\$229
Space Research	\$16	\$21	\$34	\$37	\$16

Proportion of Revenues by Space Category: 2000





REVENUES Revenues by Sectors of Activity

REVENUES BY SECTOR OF ACTIVITY

Telecommunications: Telecommunications continued to dominate Canada's space sector activities in 2000, generating 63% or \$920m of total revenues. This represents a 2% increase over the 1999 results of \$901m yet is below the 1998 peak of \$960m. Between 1996 and 2000, telecommunications activities rose 59%, from \$580m to \$920m.

Earth Observation: Earth Observation (EO) activities made up the second largest space sector activity in 2000 with revenues in the order of \$254m, up 3% from the 1999 results of \$246m. In comparison to other sectors, EO comprised 18% of total space revenues in 2000, a proportion similar to 1999 and registered the most significant increase between 1996 and 2000, up \$147m or 137%.

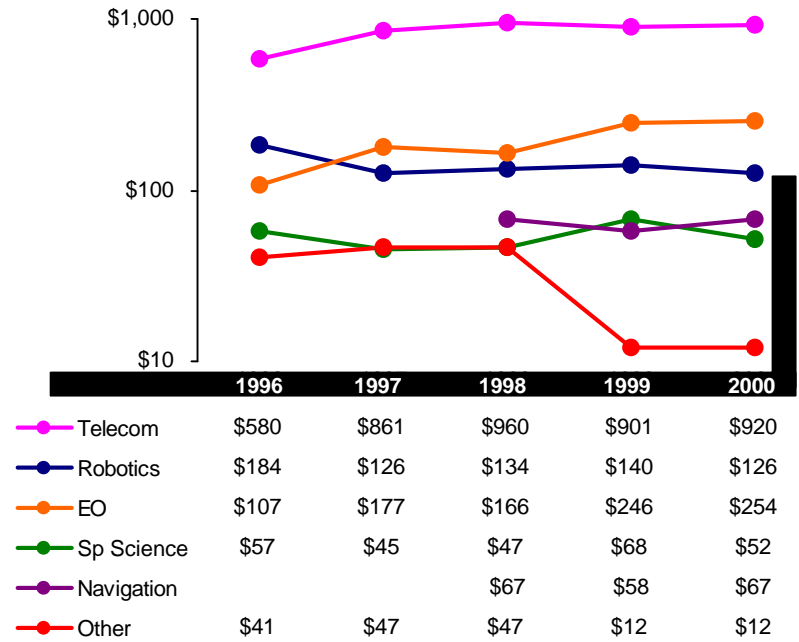
Robotics: Canada's Robotic activities fell by 10% in 2000, from \$140M to \$126M. Between 1996 and 2000, this activity declined by 32%. As a proportion of all activities, revenues generated from Robotics activities continued to hover around the 10% level (10% in 1997, 9% in 1998, 10% in 1999 and 9% in 2000).

Space Science: A downturn in the Research category was matched by a similar decline in Space Science activities, down 23% in 2000 to \$52m from the 1999 plateau of \$68m. As a proportion of all activities, revenues generated from Space Science activities in 2000 constituted 4% of total revenues. Over the five-year 1996 to 2000 period, revenues in the Space Science sector declined by 9%.

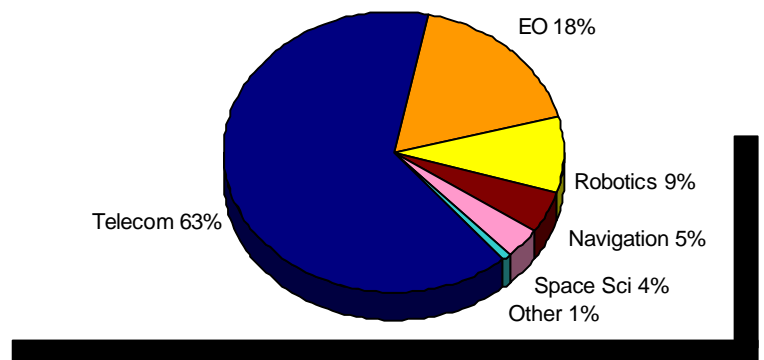
Navigation: Navigation activities, principally those exploiting the Global Positioning System (GPS) satellite network, recorded revenues of \$67m in 2000, up 15% from 1999 (\$58m). Since being separated from the "Other" sector, Navigation revenues have registered limited growth rates, around 1% since 1998. Navigation generated approximately 5% of total revenues in 2000.

Other: Organisations reporting space-related activities in a sector of activity "Other" than those mentioned above recorded similar revenues in 2000 (\$11.9m) as in 1999 (\$12.3m).

Revenues by Sector of Activity: 1996 to 2000 (C\$m)



Proportion of Revenues by Space Activity: 2000





REVENUES Revenues by Region

REVENUES BY REGION

British Columbia: British Columbia (B.C.) ranked third in terms of total revenues (15%) and brought in 3% more revenues in 2000 than 1999, from \$211m to \$217m. Despite a decline in 1999 (-8%), B.C. has generated strong revenue growth since 1996, up 195% from \$74m to \$217m. Accordingly, its share of total revenues rose in 2000 from 8% to 15%.

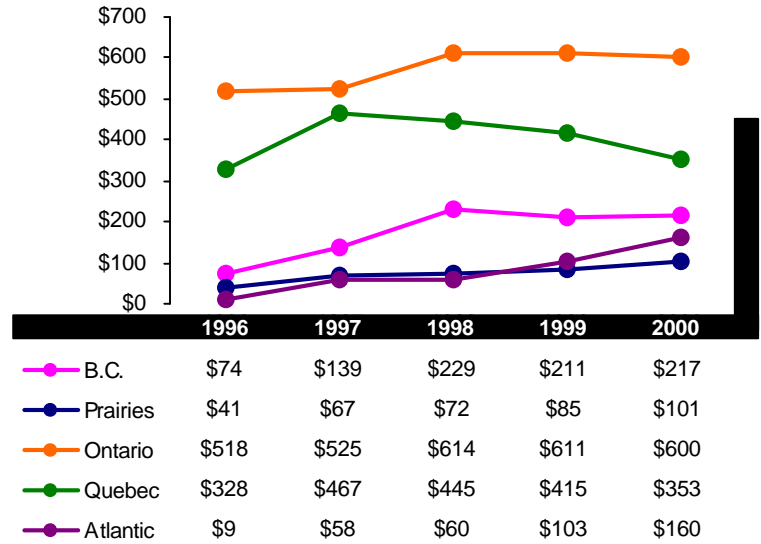
B.C. also remained domestically oriented, with over 60% of the region's space revenues (\$132m) derived from domestic sources, compared to nearly 40% (\$85m) from exports. Between 1996 and 2000, B.C.'s domestic space revenues increased by over 240%, from \$38m to \$132m. Exports fared equally well, up 142% from \$35m to \$85m.

Prairies: Canada's Prairie region (defined by Alberta, Saskatchewan and Manitoba) registered sound revenue growth of nearly 20%, breaking \$100m for the first time since 1996. Between 1996 and 2000, its ratio of total revenues rose from 4 to 7%. In 2000, the region registered an almost even 50/50 (\$48m/\$53m) domestic/export revenue split. Over the 1996-2000 period, domestic revenues rose over 200%, from \$15m to \$48m. Exports were equally healthy over this same period, growing by over 100% from \$26m to \$53m.

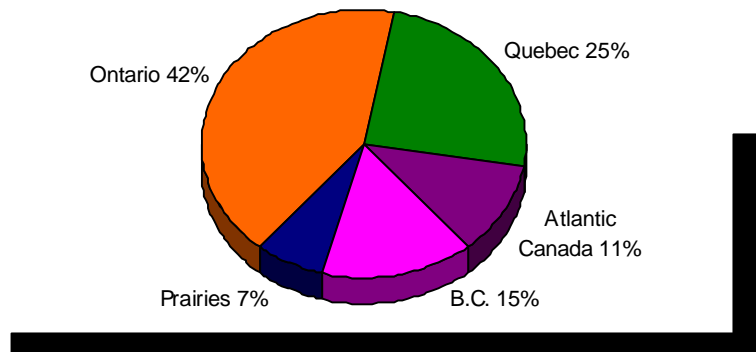
Ontario: Though generating more revenues than any other region, Ontario experienced a 2% decrease in 2000, from \$611m to \$600m. The province's ratio of total revenues also declined further from the 1996 peak of 53% to 44% in 2000. Domestic revenues dominated at 74% (\$446m) compared to 26% (\$154m) from exports. Between 1996 and 2000, growth rates of domestic v. export revenues moved in opposite directions; space revenues derived from domestic sources rose 32% from \$338m to \$446m whereas export revenue sources declined 14% from \$179m to \$154m. Overall, the five-year rate of revenue growth in the province rose 16%.

Quebec: Revenues generated in Quebec experienced the sharpest drop in 2000, down 15% from \$415m to \$353m. As such, the province's share of total space revenues slipped from 29% to 25%. In spite of a third consecutive decline since the peak of \$467m in 1997 (\$445m in 1998, \$415m in 1999 and \$353m in 2000), Quebec still registered a positive growth rate of 8% between 1996 and 2000. This growth was predominantly due to stronger export revenues: In 2000, over 66% (\$234m) of the \$353m of provincial revenues came from exports, an increase of 27% over 1999 (\$183m). By comparison, returns from domestic revenues were \$120m, a drop of nearly 50% over 1999 (\$232m to \$120m).

Revenues by Region: 1996-2000 (C\$m)



Regional Proportion of Total Revenues: 2000





REVENUES Revenues by Region

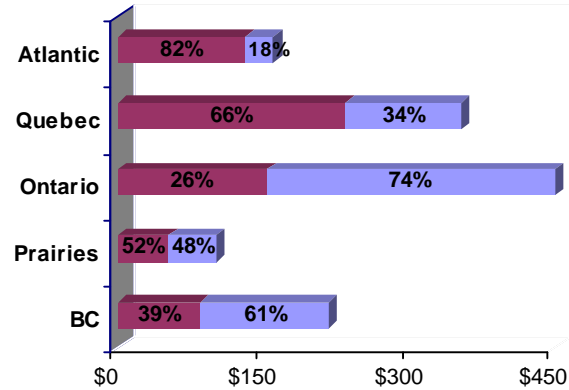
REVENUES BY REGION CONT.

Quebec cont.

Over the course of 1996 to 2000, the trade-off between Quebec's domestic and export revenues was noteworthy. In 1996, 82% of Quebec's space revenues were derived domestically compared to 18% from exports. By 2000, domestic revenues had dropped to 34% of the provinces overall revenues while exports had risen to 66%. Between 1996 and 2000, exports increased by 88% from \$58m to \$234m. Domestic revenues subsequently declined by \$151m, or 56%, from \$270m to \$120m.

Atlantic Canada: On Canada's east coast, Atlantic Canada (defined as Newfoundland, New Brunswick, Nova Scotia and Prince Edward Island) revenues grew by 56% from \$103m to \$160m. The region's share of the national revenues also rose rather soundly from 7% to 11%. Similar to Quebec, Atlantic Canada is increasingly export oriented with 82% of the region's space revenues generated from abroad, a jump of 46% over 1999.

Export v. Domestic Revenues by Region: 2000 (C\$m)



	BC	Prairies	Ontario	Quebec	Atlantic
Domestic	\$132	\$48	\$446	\$119	\$29
Export	\$85	\$53	\$154	\$234	\$131

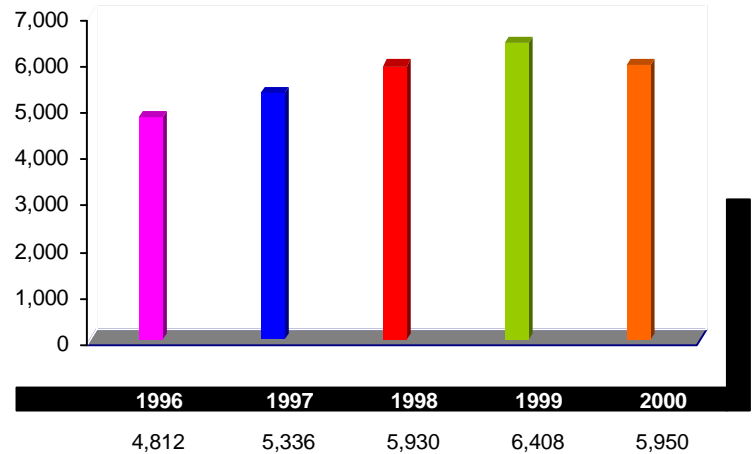


SPACE SECTOR WORKFORCE Workforce Groups

SPACE SECTOR WORKFORCE

In 2000, the workforce in Canada's space industry declined 7%, from 6,408 to 5,950 - a level similar to that of 1998. Nevertheless, the growth rate between 1996 and 2000 remained positive, growing 24% from 4,812 to 5,950.

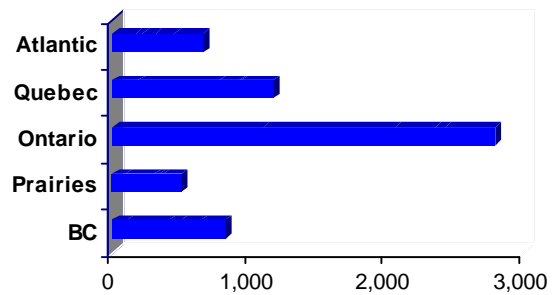
Space Sector Workforce: 1996-2000



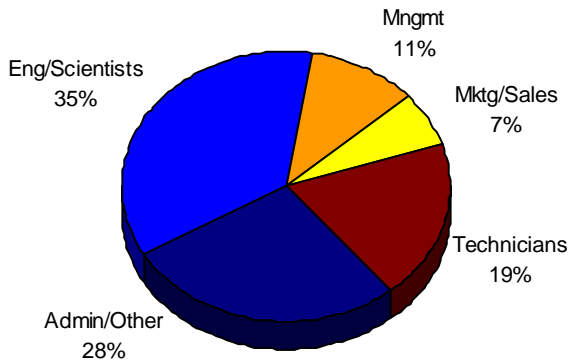
WORKFORCE GROUPS

Of the five main sector employment groups, the "Engineers and Scientists" group comprised the highest number of employees, 2,128 or 36% of the total workforce. Below is a chart that outlines the results for all employment groups:

Workforce Groups by Region: 2000



Workforce by Space Employment Categories: 2000



	BC	Prairies	Ontario	Quebec	Atlantic	Total
Technicians	172	130	369	240	215	1,127
Mktg/ Sales	147	23	74	17	137	398
Mngmt	81	40	285	142	94	642
Eng/ Scientists	303	217	970	587	51	2,128
Admin/ Other	115	89	1,095	190	168	1,658
Total	818	499	2,794	1,177	665	5,953



SPACE SECTOR WORKFORCE Workforce by Region

WORKFORCE BY REGION

British Columbia employed 817 or 14% of the nation's space workforce in 2000, a 32% decline from the 1999 high of 1,193. Between 1996 and 2000, however, the growth rate was 13% from 721 to 817, with the ratio of the national workforce remaining constant at around 14-15%.

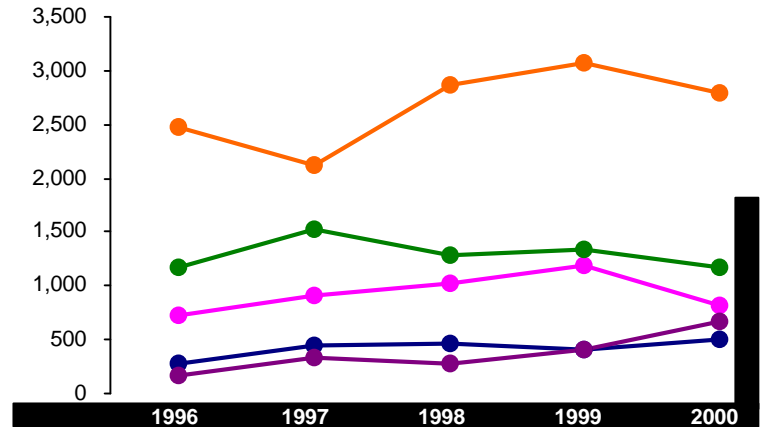
As a reversal to the 11% drop in 1999, the workforce in the **Prairies** rose 21% in 2000, from 414 to 499, which represented 8% of the national workforce. Between 1996 and 2000, this region's overall space sector workforce increased by over 70%, from 288 to nearly 500.

In 2000, **Ontario** continued to employ nearly half, 2,793 or 46%, of the nation's space sector workforce. This figure, however, represented a drop of 273 employees (-9%) from 3,066 to 2,793. Between 1996 and 2000, Ontario's workforce rose by 13%, from 2,470 to 2,793.

Similar to Ontario, **Quebec** recorded a 12% decline in its workforce in 2000, slipping from 1,335 to 1,176. Quebec employed nearly 20% of the overall workforce in 2000. Over the five-year period, Quebec's space sector workforce underwent little to no change, from 1,172 in 1996 to 1,176 in 2000.

Atlantic Canada employed 11% of the country's space sector workforce in 2000, jumping an unprecedented 66% from 401 to 665. Since 1996, Atlantic Canada jobs linked to space-related assets rose more than any other region, up over 300% from the 1996 results of 161 workers, largely due to a strong telecommunications service sector.

Space Sector Workforce by Region: 1996-2000



● B.C.	721	905	1,023	1,193	817
● Prairies	288	447	463	414	499
● Ontario	2,470	2,115	2,870	3,066	2,793
● Quebec	1,172	1,534	1,291	1,335	1,176
● Atlantic	161	335	282	401	665