Canada's Space Policy

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November 1984

This paper was presented to a conference entitled: Tracing New Orbits: Competition and Cooperation in Satellite Development.

Introduction

Canada has been involved in space almost since the dawn of the space age. Throughout this past quarter century our space policies have evolved to reflect the increasing importance and complexity of our space program. They are still evolving, as indeed they must in order to keep up with this rapidly changing, leading-edge, technology. What I would like to do in the time available is to trace the development of Canadian space policy and explain the critical factors that have affected it.

Space Policy Development

Over the years, Canadian space policy has provided the guidance required to pursue two fundamental objectives of the Canadian space program. These objectives have been stated differently at different times, but in essence they have been with us since the inception of the program. They are:

(a) to encourage the use of space technology to meet national needs; and

(b) to develop an indigenous space operations and manufacturing industry.

Before looking at our policy development, a word or two on our progress in achieving these two fundamental goals. On the applications side, Canada was the first nation to establish a domestic communications system using geostationary satellites, not by accident but because communications is our lifeblood. We are now one of the world's largest users of space systems, meeting national needs in fields as diverse as telecommunications, broadcasting, remote sensing for resource management and surveillance, weather forecasting, search and rescue, and navigation.

In the process of ensuring that Canadians benefit from the application of space technology, we have been able to develop a world-class space industry that in the past few years has been growing at about 50% per year. Annual sales have reached almost $300 M (Canadian) with over 70% exported. A recent study by the OECD shows that Canada is the only country where the sales of its space industry exceed the space budget of the government. This has been the case since 1978.

We are proud of our accomplishments, particularly in view of our relatively small space budget. This year, the government will spend about $150 million on space. This level of expenditure places Canada eighth in the free world in terms of space expenditures as a percent of GNP.

The Importance of International Cooperation

International cooperation is a fundamental policy guiding how we conduct our space program. All of our major government space programs have been jointly undertaken in cooperation with other nations. More and more Canadian space industries are entering into teaming arrangements or partnership arrangements with firms in other countries. This emphasis on international cooperation is in recognition of our relatively small domestic market, the relatively small size of our industry, and the very high cost of exploratory space programs.

Our space program has benefited remarkably from this policy of internationalization. Cost sharing has allowed us to undertake more than we otherwise would have. Work sharing has allowed us to concentrate on our areas of expertise. For example, on the L-Sat (or OLYMPUS) program with ESA we are doing the solar arrays and certain communications payload elements. Technology sharing has prevented unnecessary duplication of effort. A good example of this occurred on the Communications Technology Satellite program when NASA supplied us with the 200 watt travelling wave tube. International industrial arrangements have opened up export markets for our expertise and have given us access to the best foreign technology for our own needs.

All of our international joint programs have been very successful. This is because the following criteria were met in each case:

a) a common set of objectives was agreed;

b) program commitment was made at an adequate level;

c) good working relationships were established; and

d) free and open exchange of data occured.

Industrial Aspects of Space Policy

Canada's expertise in space technology developed initially in government laboratories and our first satellite, ALOUETTE I, was designed and built by a team of government scientists and engineers. By the time the satellite was launched in 1962, there was a realization on the part of the government that space technology could be used for practical applications as well as for scientific exploration. The commercial implications were foreseen and a very important policy decision was taken to transfer the technology to Canadian industry. This policy decision was the first major step in encouraging a Canadian industrial space capability.

The mechanism chosen for transfering the technonology also had a marked impact on the long-term development of a close government/industry relationship in space technology and applications. Industry personnel came and worked with the government team on ALOUETTE II and then gradually, on our next two satellites, government involvement was reduced until industry took complete responsibility for meeting specifications on ISIS II in the early 1970s. Not only was this an effective technology transfer process, it built the personal relationships necessary for the continued government/industry partnership that is one of the strengths of the Canadian space program.

With the development of an indigenous space industry as a prime objective, subsequent policy decisions have more or less been concerned with ways and means for its implementation. One of the more innovative steps was taken when the government established Telesat Canada. The Company's charter requires it to do two things: first, provide telecommunications services on a commercial basis; and second, utilize Canadian industry to the extent practicable, bearing in mind the Company's commercial nature. Thus, through the use of offset arrangements and Canadian content provisions, Telesat procurements have been, and will continue to be, vital elements in the development of the Canadian space industry.

The development of a prime contractor for satellites has been the major thrust of our space industry development policies for almost a decade. This policy thrust has not always received whole-hearted support within government or from all segments of the

space industry. However, with the recent success demonstrated in the export market, it is now generally agreed that having a prime contractor has been a stimulus to the development of our industry and the achievement of substantial economic benefits.

While the reasons for the prime contractor policy may be specific to the Canadian context, it will be worthwhile to say a few words about why we felt we needed a prime contractor before describing the policies and programs we put in place to implement the policy. By the end of the ALOUETTE/ISIS series of scientific satellites, Canadian industry had demonstrated its capability to design and manufacture experimental satellites for the government. There were expectations that the industry would supply Telesat's communications satellites. The ANIK-A procurement, however, demonstrated that our industry was far from being commercially competitive. We could not match the price, delivery, or performance guaranteed by Hughes Aircraft in their bid to Telesat. The letting of the ANIK-A satellite contract to Hughes Aircraft was a major disappointment to Canadian industry and was cause for an indepth analysis by the government of its space policy.

At issue was the question of whether it was in our long-term national interest to have our domestic satellite communications systems supplied by our own industry or to purchase the systems off-shore. The factors that were considered included: sovereignty; security of supply; balance of payments; economic development; high quality employment; export potential; and the cost of achieving success. In the end, the government decided that we should continue to develop our industry so that we could meet our own demand for satellite systems.

The ANIK-A procurement had shown that Canadian industry did not have all the technology necessary for commercial communications satellites; that the industrial structure was inappropriate for bidding on commercial systems; and that the industry did not have the facilities required to integrate and environmentally test complete satellites. In short, while our industry had strength in various subsystem areas, it lacked the structure and capability to be a prime contractor. If we were to meet the government's expectations for supplying our own needs, we would have to have a prime contractor.

The objective was clear. We also clearly understood our industrial deficiencies--structural, facilities and technological. Policies and programs were then put in place to address each of these. On the technological front, it was realized that we should address the up and coming technologies that were likely to be required five to ten years down the road rather than attempt to catch up with current technology. The Communications Technology Satellite program (later called HERMES) was initiated to develop 12/14 GH_z (or K_u-band) communications payloads, to develop experience with 3-axis stabilization, and to develop large flexible solar arrays. The program was jointly undertaken with NASA and we were able to tap that organization's immense pool of technology. When launched, HERMES was the most powerful communications satellite in the world, and the first to operate in the new frequency band.

The satellite also paved the way for Telesat to provide commercial service in this band. Their next satellite, ANIK-B, included a K_u-band transponder designed and built in Canada using technology developed on HERMES.

The second major program was also undertaken during this period. The Remote Manipulator System project, or CANADARM as it is now called, was initiated as Canada's contribution to the U.S. Shuttle program. Our objective was to continue the technological development of our industry in a specific area of specialization where industry felt it could exploit the technology commercially. The program also offered the distinct advantage of giving us first-hand experience with the complete shuttle system - an experience which would be invaluable in future space programs.

As an aside, it should be noted that the CANADARM project, because it was so clearly associated with the manned space program, has captured the imagination and interest of the general public to an extent far beyond anything else we have done in space. This interest provided the necessary base of public support for the decision for Canada to enter into manned space activities with the establishment of the Canadian Astronaut Program. Our first astronaut flew in October.

Technology and industrial development was also a primary thrust behind Canada's decision to seek a cooperative agreement with the European Space Agency. Through this agreement, Canadian industry has been able to participate in and benefit from R and D work

sponsored by the Agency. Our participation in major ESA projects such as L-Sat, now called OLYMPUS, has enabled Canadian industry to continue to develop their technological excellence in some of their areas of expertise (in this case solar arrays and communications payload equipment) and to develop close industrial linkages with European firms. We expect these linkages will become of strategic importance as the space industry around the world matures.

We have recently renewed our cooperative agreement with ESA as a result of the positive industrial benefits we achieved during our first five year agreement. Our participation in the general budget of the Agency has increased in recognition of our increased overall involvement with the Agency.

To address the facilities question, it was decided that the government would invest in a National Facility for the integration and environmental testing of satellites. The first phase of the facility (now called the David Florida Laboratory) was constructed for the HERMES program. It has since been expanded once and is now undergoing a further expansion. The government owns and operates this world-class testing facility and industry is charged a fee for its use. This arrangement where the government makes an up-front investment because industry is unable to do so and then charges a fee for use has been a very important element in the development of our space industry.

The structural problem was more difficult to address. No single Canadian company had the expertise to be a prime contractor. However, in theory we did have the necessary expertise spread throughout several companies. The initiative for re-structuring had to come from industry, a fact recognized by the industry. They addressed the problem several times, looking at various consortia or teaming arrangements, but none of these attempts at rationalization was successful. Eventually, one company, SPAR Aerospace Ltd., undertook to purchase the space expertise located in two of the other major companies. This gave SPAR the capability to be a prime contractor.

With the prime contractor capability in place, supported by a strong sub-system and component industry, and with the necessary space facilities established, government policies in support of the space industry could now be directed towards the longer-term issue of

ensuring commercial success for the industry in both the domestic and export markets. This is the phase that we are now in. The government has put into place a number of policies and programs aimed at taking advantage of our domestic requirements, both commercial and government, to further develop the technical and commercial capabilities of our industry and to ensure a healthy export business.

Perhaps one of the more important policies was the joint government/industry decision to define the prime contractor policy more precisely as the "limited prime contractor policy". By this, we mean that our prime would not have to have an in-house capability to design and produce all major sub-systems. Instead, SPAR would be encouraged to develop commercial partnership arrangements with foreign companies to gain access to specific technologies (for example, the space bus or platform) and to enhance the export market potential for our own technologies. To cement these relationships, SPAR would be able to bring to the table its own technologies and enhanced access to the Canadian domestic market. So far two of these relationships have been established to the benefit of all concerned.

Our technology support policy has been augmented to ensure that the R&D undertaken can be driven by market opportunities perceived by industry as well as by the mission needs of the government. The support programs put in place recognize the main beneficiary of the program so that the more industry benefits, the less is the government's share of the funding.

Support for export marketing follows normal government policies and includes, as necessary, our trade commission service, export financing, aid programs, technology transfer agreements, training agreements and Ministerial support.

The MSAT Program

The proposed MSAT program provides a good example of government/industry cooperation. It is also a good example of how international cooperation can assist in the development of new space-based services even when there will be intense industrial competition for the supply of hardware.

Since 1980, NASA and Canada have been studying the use of satellites in the 806-890 MH_z band to improve mobile communications in both countries. These studies have shown that a satellite system could provide cost effective mobile radio and telephone services to a variety of low-cost mobile terminals (land, sea, and air). These studies have shown that the nature of mobile communications via satellite is such that regional frequency and orbital slot coordination/sharing is fundamental to success. In addition, there are considerable benefits to be obtained if the U.S. and Canada cooperate to obtain systems and equipment compatibility, joint procurement of the space segment hardware, service restoral arrangements for space and ground facilities, sharing of non-recovery costs, and the sale of unused capacity on an interim basis between the systems of the two countries. Thus, in 1983 NASA and the Canadian Department of Communications (DOC) signed an Agreement for cooperation in the definition of a space communications program leading to the joint development of a mobile satellite communications system to meet the needs of both countries. Because Canadian and American commercial interests are willing to become involved in the establishment of a commercial MSAT system, the Arrangement is structured to encourage cooperation not only between governments but also involve appropriate commercial telecommunications carriers in the two countries.

The Mobile Satellite Communications cooperative program envisioned by the Arrangement would have the following objectives:

1. provide an operational commercial mobile-satellite communications capability to the U.S. and Canada;

2. provide an experimental and test capability for both countries;

3. foster the development of mobile satellite technology, systems and services;

4. develop and evaluate system networking techniques, mobile terminal technology, space segment technology and mobile satellite systems and services in the 806-890 MH_z band designed to provide ubiquitious nationwide mobile radio, telephone, and data communications in North America;

5. characterize systems and link performance in an operational-type environment;

6. develop and evaluate frequency reuse and spectrum-efficient techniques;

7. identify frequency sharing and interference criteria to help define the regulatory framework for commercial satellite services.

Both NASA and DOC are encouraging U.S. and Canadian telecommunications carriers to work together to design and procure the space segment to meet government requirements as well as their own; to initiate early commercial satellite service; and to secure appropriate frequency allocations from their respective governments.

As a result of this cooperative Arrangement, it is foreseen that the first Mobile Satellite System would involve investments by four parties: the U.S. government; the Canadian government; the U.S. private sector; and the Canadian private sector. Such extensive cooperation in an area of the commercial use of space is probably unique.

Within this framework of cooperation, however, both governments are initiating the development of technologies by their respective manufacturing industries to ensure that both countries share in the industrial benefits that could acrue from building the system. The projected market for mobile satellite ground terminals is substantial and it is expected that the competition of supplying these terminals will be intense.

For the space segment, there will be substantial savings if a common procurement can be achieved. This fact should encourage cooperation between Canadian and U.S. industries to ensure the equitable sharing of space segment hardware contracts. If this is accomplished, it could lead to joint exploitation of the international market for similar systems.

Conclusion

Canada has benefited substantially from the atmosphere of international cooperation that has characterized space research and development in the past. We believe our partners have equally benefited. As a result of this cooperation, nations such as Canada

has been able to participate in and contribute to a number of space activities in areas such as communications, remote sensing, science, and search and rescue.

Our experience with communications satellites has shown that even in an intensely competitive commercial area it is still possible to undertake cooperative programs while at the same time encouraging the industries of the partners to achieve their business objectives. It has been shown that cooperation and competition can be compatible objectives in the conduct of space activities. It is our hope that as we rush towards the commercialization of space in many new and promising areas such as remote sensing and space-based manufacturing our experiences in the field of communications are remembered. International cooperation can play a vital role in furthering the development and use of space technology and can, in fact, lead to constructive competition for the supply of space hardware and associated services. We are looking forward to the challenges of the future with the expectation that cooperation will continue to be a significant factor in the space programs of the world.