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## **National Space Awareness Workshop 2006**

*Redefine Canada's Global Vision for Space.  
Why space? Why do we care? Why should we pay for this?*

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**Workshop Report  
Carleton University  
Ottawa, Ontario  
November 19, 2006**

**Workshop hosted by the Canadian Alumni of the International Space University  
and the Canadian Space Society**

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## Introduction

The National Space Awareness Workshop (NSAW) is a biennial event organized by the Canadian Alumni of International Space University (CAISU) for University-level students and young space professionals. The workshop aims at promoting space awareness among participants and the community in general by having the participants working on topics in a space-related theme.

The 2006 edition of the NSAW was held on November 19, 2006 at Carleton University in Ottawa, in conjunction with the Canadian Space Summit, hosted by the Canadian Space Society. This year's workshop theme was:

*Redefine Canada's Global Vision for Space:  
Why space? Why do we care? Why should we pay for this?*

University students and young professionals from across Canada came together with an ambitious agenda: to chart Canada's vision for space development, from a science, engineering, population awareness and space education perspective. In an intense one-day program the students met to agree on a common vision of what Canada should aim to do in space. This report is the result of these young people's thoughtful and creative deliberations of competing priorities.

Participants had the opportunity to find innovative ways and develop creative strategies to reshape the Canadian Space Program to help increase general public interest and government funding in the space sector through a very dynamic and interdisciplinary setting. During the morning lectures, the participants heard from several experts in the field from many different backgrounds that presented their vision of Canada's role in space development. Following what these experts provided and in part on their own perspective, the participants were broken down into three teams and spent the rest of the day crafting their own vision for Canada in space.

CAISU, the organization that sponsored the 2006 National Space Awareness Workshop, approaches space studies and activities from an international, intercultural and interdisciplinary mode, and it is with this philosophy we hope has set the tone of the conference and its subsequent report. It is, after all, one of the most important aspects of the international space industry that the participants absorbed during their discussions.

This report presents the results of the discussion of each of the three working groups. We invite you to read on. We hope that you will be as fascinated as we were to find out how young Canadians today see Canada's future role in space development.

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## Team 1 Report

*Paul Harrison*

### Canadian Space Policy Objectives

In terms of overall Canadian space policy, five key areas were identified:

- Public engagement
- Harnessing of Canadian expertise
- Support of leading Canadian science
- Support of innovation
- Participation in international forums

### Public Engagement

It is the opinion of this group that much more needs to be done in terms of establishing and maintaining public interest in Canadian space activities. Ultimately it is the Canadian public that pays the cost of these activities, so it is essential to connect with the population at large and make clearer the tangible benefits of being in space. To this end, three target areas for improvement were noted.

Firstly, the Canadian Space Agency and Canadian space industry need to create an increased presence in the nation's schools at the elementary, secondary, and post-secondary levels. A dual-pronged approach is envisioned, in which provincial educational boards are encouraged to adopt space studies as a key part of their curriculum and visits to schools by space personnel (e.g. astronauts, space scientists and engineers) are increased and used to convey the goals of Canada's space activities in a direct and meaningful way. A project such as the National Mobile Space Station, which was presented and discussed earlier in the workshop, is an example of the many ingenious ways in which children can be engaged and stimulated while introducing themselves to aspects of space studies, presented in a multi-disciplinary fashion. The consensus is that even more needs to be done, however, to promote space (and particularly Canada's role in space) among the nation's youth.

Secondly, more attention needs to be drawn to areas of public concern that are currently being addressed through Canadian space activities. The SCISAT-1 mission, for example, has since 2003 been providing precision measurements of ozone and other important gases and aerosols in the Earth's atmosphere that help us better understand the complex chemistry that exists at high altitudes and that affects the environment for life on the ground. The data generated by this mission after its first three years (one year beyond its original design life) is being lauded throughout the atmospheric science community for its quality and breadth. Canada's expertise in SAR-based satellite imaging, with the RADARSAT and upcoming RADARSAT-2 missions, is put to great use in monitoring land and sea resources. With the prospect of a navigable waterway opening up in Canada's Arctic waters in the near future, remote sensing will become a critical tool for detecting unauthorized incursions into the region, as well as watching for sources of man-made pollution that could threaten the delicate northern ecosystem. These space technologies are addressing key areas of interest to our

nation's political sovereignty and environmental health, yet the names SCISAT-1 and RADARSAT would hardly be at the tips of the tongues of most Canadians. A lot of public criticism of space expenditures being wasted on "frivolous" activities could be dampened somewhat by the knowledge that issues critical to the national interest are being presently addressed by Canadian space technology.

Finally, and in a related vein to the previous two points, it is the opinion of this group that the media profile of Canadian space activities needs to be raised significantly from where it presently stands. The Canadian Space Agency has certainly been successful at promoting its manned space program, with impressive coverage of Steve Maclean's recent Space Shuttle mission and the continued construction of the International Space Station (ISS). The Remote Manipulator System (RMS) being used on the ISS and the extension boom to the Canadarm that allows inspection of the Shuttle's protective heat tiles have received considerable media coverage as well. However, it is felt that there are many other Canadian space activities that do not receive as much attention, despite their success at extending the realm scientific knowledge and in bringing tangible benefits to Canadians. The MOST microsatellite, launched in 2003, has been performing high-precision photometry of stars that has turned many previous hypotheses about stellar physics on their heads, while also being used to support the search for extrasolar planets. The cases of the SCISAT-1 and RADARSAT missions have previously been mentioned. The upcoming CASSIOPE mission will study upper atmospheric particles and phenomena such as aurorae that affect telecommunications. Yet the public profile of these missions has been comparatively minimal; quite often the major news media do not pick up on these missions until shortly before they are launched, and frequently do not follow up on the actual results. A fostering of relations between the Canadian Space Agency, space industry, and the media on a wider range of space activities would complement the effective promotion of the manned spaceflight program, and further demonstrate to Canadians the value received for the money invested in space.

## **Harnessing Canadian Expertise**

It is believed that Canadian efforts in space should continue to apply technological expertise that we have already well developed as a nation either in space or in the terrestrial realm. A prime example of where such technological expertise has been successfully applied is in the field of telecommunications. As the world's second-largest country, with widely separated population centres and remote northern communities, Canada was the first in the world to have its own domestic communications satellite. The telecommunications sector still comprises a significant percentage of Canadian space activities, and there is still room for growth, not just in the commercial sector but also in supporting space science activities. It was pointed out in our discussions, for example, that the Deep Space Network used for tracking deep space missions is quickly reaching its capacity, which may open up opportunities for Canadian telecommunications technology to assist in its operations, whether in terms of ground systems or communications satellites.

Robotics is an area in which Canada has considerable space expertise, with the Canadarm and RMS, and could continue to play a role in orbit activities and space exploration. Earth observation and remote sensing have also traditionally been of interest to Canada, given our large, sparsely-populated

landmasses and abundant natural resources. The ongoing search for these natural resources has also given our nation significant expertise in mining and prospecting, including geological and geophysical surveying. This expertise could be easily tapped for use in space exploration, for example in studying lava tubes on the moon, and in surveying and drilling on planetary and asteroid/comet surfaces.

Another area of Canadian terrestrial expertise is power generation. The nuclear industry in particular is well developed, harnessing the benefits of CANDU technology. For advanced propulsion concepts and exploration of the outer solar system, this technology could find some application. It was noted, however, that public resistance to the expansion of nuclear technology (even in space) could pose a significant barrier.

## **Support of Leading Canadian Science**

A crucial role for government agencies, including the Canadian Space Agency, to fulfill is the support of scientific research. The MOST and SCISAT-1 missions have successfully demonstrated that cutting-edge science spearheaded by Canadian researchers can be supported with space technology that is designed and built in Canada.

We as a group have noted the importance of demonstrating that space-based science can address areas of topical concern to Canadians. It is also evident that areas of scientific research offering near-term commercial benefits are likely to receive considerable support, not just from government but also from industry. We as a group also recognize, however, that some scientific research will need to be supported independently of commercial results, particularly where the conceivable benefits are longer term or less quantifiable. This type of research is much less likely to receive support from private industry, and so the government has an important role to play in assuming at least some of the associated research risk and creating opportunities for this research aboard space-based platforms – preferably ones designed and developed in Canada.

## **Support of Technological Innovation**

In addition to supporting scientific research, another important government function is to encourage technological innovation in support of Canadian space activities. As with scientific research, the primary task of government in this regard should be the mitigation of technological risk, especially when the technology being developed may have longer-term rather than immediate application.

One idea that was discussed in our group was that of “micro-contracting”. Similar to the concept of micro-loans that has recently been making headlines in the news, the concept of micro-contracts is that a portion of the government’s total investment is distributed widely, with small amounts awarded to a large number of companies developing focused technologies. By keeping the individual investments small, the monetary risk of technology failure is reduced. Potential cost savings to the government could be realized by accepting the lower level of risk and reducing the human effort and paperwork required for project oversight. The wider distribution of investment also allows the government to support the creation of new industries in locations around the country where they presently do not exist.

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Our group believes that government can also have a role in the marketing of innovative technologies development under its funding, through domestic media exposure and through the connections the Canadian Space Agency has with the international space community at large. This would give Canadian space industries a needed initial boost when it comes to selling their technologies overseas.

## Participation in International Forums

Canada's role in the world space community was a key topic of discussion in our group. While Canadian space technology does enjoy a high degree of recognition internationally, in particular its successful application of robotics and small satellite technology, it was the general feeling in our group that Canada does not project a strong enough profile in international circles for Canadian industries to take effective advantage of foreign markets for selling its technology, nor for ensuring that Canada's own interests as a nation are promoted and realized.

One particular topic raised was that of international co-operation. Traditionally, as our nearest neighbour and largest trading partner, the United States has been the biggest source of foreign investment in Canadian technology. While no one disputes that our close relation with the U.S. will and should continue, it is felt that Canada should also explore other international avenues. Certainly our associate membership in the European Space Agency needs to be better utilized in terms of winning more contracts for Canadian companies on European projects, but there is also a large group of emerging and established "middle space powers" such as Australia, Brazil, China, India, and Malaysia. Many of these countries have similar apprehensions about competing on the world stage with the U.S. and Europe. We should take advantage of our common position as middle powers and find avenues for increased co-operation.

Another area where Canada could play an important role is in the development of space law and in spearheading international space agreements. Through the Montreal Protocol for the phasing out of ozone-reducing chemicals, and the Ottawa Treaty to ban anti-personnel landmines, Canada has earned a reputation as a facilitator for the world's nations to come together and make progress on issues of common interest. The development of space law would be a natural fit, given that we have a strong proficiency in this area. One area of concern that was raised in our group was the potential weaponization of space. The consensus was the presence of weapons in orbit might have a long-term negative impact, but that it is unlikely in the current political climate to be stopped completely. Based on our international stature and our traditional opposition to excessive armament, however, this could represent an ideal opportunity for Canada to assume a leadership role in bringing the various space powers together to agree on what the limits of space usage should be.



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Moderator

Bruno Sylvestre



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## Team 2 Report

*Catherine Clark*

### The Vision

It is important to have a vision for Canada in space, to keep people both motivated and focused. Our vision is to keep Canada as a leader in researching and developing space technologies, encourage public interest in the space sector, and to be a leader in responsible space exploration.

### Space Technologies

We have only just begun to explore space, and there is a lot of work to be done in researching and developing new technologies. Although Canada has specialized very successfully in areas such as robotics and telecommunications, it is time to consider if Canada should branch out into other areas. In this workshop, it was decided to stay the current course, but this idea should continually be revisited as we progress.

### Public Interest

It is important to generate interest from the general public in Canada's space program. People need to recognize that there are direct, practical benefits to them from space technologies, not just 'inspiration'. In order to do this, it is important to place the space mission/technology and its associated benefits side-by-side in any sort of public relations presentation. This would show the benefits of space technologies to the general population (Mars rovers help us find out how Earth was created; planetary comparison of Venus and Earth to look at the effects of greenhouse gases). There could also be commercial and material value, such as mining an asteroid or the moon for resources.

It is important to also select the material to promote public interest, as some space projects and their benefits are easier to 'sell' to the public. Not every project has to be promoted, but enough to keep the public interested and keep the 'wow' factor. Some other easily promoted benefits include science and technology education and northern sovereignty/surveillance.

### Responsible Exploration

Exploring space also comes with the responsibility of maintaining it. The main issues we see today are international guidelines on space debris and a ban on space weaponization. Reducing space debris is a huge problem, especially for manned space vehicles. Having international guidelines in place would ensure that every space-faring country helps with this problem rather than contributing to it.

### Challenges

There are many challenges to space exploration and arguments against why we shouldn't do it. Currently, there is no real 'destination'; we go up and then come right back down to Earth. The risks

are very high compared to the benefits, and development is only based on need so far due to the high costs.

## Conclusion

It is important for Canada to have a clear vision for space exploration and promote it to the public to keep them aware and inspired. Lately, space has been a hot topic in the news with the beginnings of a private, commercial space industry, but we still need more interaction with the public. It is also important not to underestimate the power the public has in keeping the space programs alive, look at Hubble Space Telescope for example and how it will be repaired again. To show the risks and failures as well as the successes, to prove we learn from our mistakes and can overcome these challenges.

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## Team 3 Report

*Braden Stenning*

Two aspects of the role of Canadian Space Agency (CSA) in space exploration were considered, increasing visionary goals of the CSA rather than focusing on responsive projects driven by other countries, and improving the public-private exchange to improve the process of commercializing spin-off technology. Three different directions for the course of space development in Canada were discussed: develop life sciences expertise, develop interplanetary transportation through international partnerships and a center of excellence, and finally promotion of space salvage by actively developing technology and creating component standards as well as creating the framework for salvage agreements. This last idea was considered the most interesting and will receive more attention in this report.

### Canadian Space Agency's Role in Space Development

The Canadian Space Agency (CSA) must continue to play a vital role in Canada's participation in the development of space. The CSA should position itself to take on more visionary goals rather than what is perceived as a more reactionary disposition working on small pieces of large projects headed by other countries. Canada has the expertise to take on larger complex missions where Canada is the lead partner, or the only partner.

Additionally the CSA should promote and facilitate technology commercialization. The transfer of the knowledge gained through space missions is very valuable to private Canadian companies and the CSA is ideally situated to aid the transfer of new technology from an academic or research setting into a private market. The CSA must continue this and look to expand wherever possible as this is a tangible and strong benefit from the space program, especially for Canadians who are not passionate about space and consider the current economic benefits to be much more important.

The Canadian Space Agency is well respected but perhaps not well known to most Canadians because the majority of the population is not particularly interested in space. However, the CSA can work as a systems integrator to lead larger projects and bring the benefits of those projects to all Canadians.

### Canada's Direction in Space Development

There are many recognized and important areas that need to be pursued in the development of space, but it is important to pick a direction that is well suited to both Canada's expertise and what Canada wants as expertise in the future. Three different paths are discussed below dealing with life sciences, interplanetary travel and most notably salvage and reuse of orbiting hardware.

#### *Expertise in Life Sciences*

Canada is well known for its health care systems and spends an incredible amount each year in this area. Health has long been one of the top priorities of individual Canadians and by focusing on related problems in the pursuit of space it may be possible to both tap into some of the available

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funding as well as make a valuable contribution to the advancement of life sciences, and this will benefit all Canadians by creating a healthier population as well as creating new products and knowledge that can be exported to the entire world.

### *Interplanetary Transport*

It is obvious that if people are going to travel to other planets, moons or asteroids they will need a vehicle to carry them. Canada at this time does not have much expertise in this area but it is going to be a very important capability in the next decades. If Canada were to devote attention and resources to key technologies and work in role as a major partner, Canada has the opportunity to become a world leader in an area that many countries have a clearly stated interest. And as a technology supplier Canada would have the ability to play an important part in multiple programs which could result in many chances for Canadians to travel on the vehicles that they have helped create.

### *Space Salvage and Modular Hardware*

Canada is a recognized leader in space based robotics and guidance systems such as LIDAR and these are two key aspects in creating a satellite that can rendezvous with another satellite in orbit and manipulate that satellite and its components. Salvaging orbiting components can reduce the cost of a mission by reducing launch costs and selling rights to used hardware. Canadian built orbiting salvage satellites could over a long period of time move about in orbit collecting desired components and either use these components to repair nearby satellites or preposition this inventory for later use at a space based manufacturing facility.

Space salvage or reuse of components that are already in orbit is not a new idea and it has some very difficult problems associated with it. One is that it is very difficult if not impossible to reprocess materials while in orbit, meaning that whatever is taken as salvage must more or less be used in that same form which leads to standard components. Standard building block pieces of hardware are becoming more common, especially in the microsatellite market in which Canada has experience, so the challenge then becomes manipulating the component for removal and installation. Here is where Canada's experience with space robotics creates a strong reason why Canada is both well positioned to create the manipulator system and also develop the standard interface that can be used to connect these components.

Additionally the Canadian experience with LIDAR and rendezvous technologies means that Canada has an advantage in solving this problem as well. Other key technologies may be developed by Canada as necessary, purchased internationally or supplied through partnerships with other agencies.

The result of reusing components that are already in space means that there is less large debris and lower mission costs and would change the way that space missions are designed and operate, making a less expensive and more efficient industry.

## **Conclusion**

In the discussion at the National Space Awareness Workshop there were several themes that were repeated in many of the ideas. First that the Canadian Space Agency should act as an integrator of

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the extensive Canadian space expertise and that of international partners as well as coordinating the commercial development of marketable technologies. Additionally Canada must build on expertise that exists with an aim to develop excellence in areas that are essential to Canada's future in space. Of particular interest is developing an international standard for attaching satellite hardware so that the components can be reused in orbit as well as developing a system that can salvage those components. Canada's recognized leadership in space robotics and remote detection places it in a unique position to undertake this rewarding next step in the development in space.

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## Summary

The three teams at NSAW 2006 concluded with ideas and findings that could be generalized under four main branches: Public Awareness, Technologies, Government Involvement, and Strategies.

### Public Awareness

The chief concern made by all three teams is that there is a major apparent deficiency of awareness by the public at large about space and its activities in Canada. In recognition, and praise, to CSA's public awareness efforts via the National Mobile Space Station, it was concluded that more projects such as this need to be made. There is a need to create an increased presence in the Nation's schools. A "Dual-Pronged" approach where provincial education boards adopt space studies as part of a curriculum while the current prong of space personnel visitations (such as astronauts and scientists etc.) are increased. The media profile of Canadian space activities needs to increase significantly as it is important that people need to recognize there are direct and practical benefits from space technologies not just inspiration. Programs such as SCISAT-1, RADARSAT and CASSIOPE are missions that are not publicized until launch and results of the missions are not usually followed up on. It is believed that if the public are at least aware of the space projects and its benefits, they are likely to indicate their support in favour of space activities in Canada.

### Technologies

Participants also commented on several ways to address Canadian technologies, recognizing that there is still room for much more growth. For example, opportunities for Canadian telecommunications satellites or ground systems can flourish as the Deep Space Network is quickly reaching capacity. The well known Canadian avenue of space robotics should focus on geological and geophysical surveying for studies such as lava tubes on the Moon, and drilling on planetary and asteroid/comet surfaces. Canada should also focus on power generation as an emerging space opportunity, referring to the well-known CANDU technology Canada has developed. Canada should explore propulsion concepts for exploration of the outer solar system, and find a strategic way to sell this to the public despite their resistance to expansion of nuclear technology. Last, salvage satellites and standard building block pieces of hardware in the microsatellite market should be investigated as a pretext to being able to easily manipulate components in orbit for removal and installation.

### Government Involvement

In concern of strategies for space activities in Canada, it was noted that Canada would play an excellent role as an integrator and coordinator of commercial development of marketable technologies. The CSA should continue to promote and facilitate technology commercialization, or at least, provide more awareness about such a program. Canada could lead in international guidelines on space debris, as a project in "space maintenance" for responsible space exploration, and lead guidelines in space weaponization. Most significantly, Canada is perceived to having no current real "destination" for space activities. It is important for Canada to define a clear vision for space exploration and promote that to the public for awareness and inspiration. Interaction with the

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public needs to occur more often *in addition* to current media efforts. For example, the event of the end-life of the Hubble Space Telescope illustrates the influential power the public has to keep a space program alive. Lastly, it was suggested to increase visionary goals of the CSA rather than focusing on responsive projects driven by other countries, and improve public-private exchange to foster the process of commercializing spin-off technologies. While Canada is a leader in robotics and telecommunications, it is time to consider branching out into other areas.

## Strategies

The government also has a role in supporting Leading Canadian Science; specific scientific research need to be supported independently of commercial results – projects with longer term or less quantifiable benefits for example. “Micro-contracting” is way of distributing portions of the government’s total investment, with small amounts awarded to large number of companies developing focused technologies. By keeping the individual investments small, the monetary risk of technology failure is reduced. Concerning international participation, the current sentiment is that Canada is not projecting a strong enough profile for our industries to take effective advantage of foreign markets for selling technologies. International cooperation should go beyond the US; Canada should better utilize the ESA membership and cooperate with “middle space powers” such as Australia, Brazil, China, India, and Malaysia. Canada can also create a niche in Space Law, and would be an excellent Nation to spearhead and facilitate international agreements.

In conclusion, Canada’s road to a healthy space-faring national status in next few years can be summarized as dependent on four global entities: Having a renewed direction and vision for space for the country; encouraging emerging technologies and strategies in power generation and propulsion systems, planetary drilling robotics, and a space salvage framework; government participation in international space law facilitation; and finally, increasing awareness amongst the general public about Canada’s space activities and its tangible benefits to Canadians.

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## About CAISU

CAISU is the Canadian Alumni organization of the International Space University. It is a private, non-profit association whose main objectives are as follows:

- Provide for the promotion and preservation of contacts between all Canadian alumni of the International Space University (ISU).
- Inform any interested party in Canada about the affairs of ISU.
- Co-operate with other interested organisations in Canada in promoting the cause of peaceful space activities.
- Represent the members when dealing with the various institutions of ISU and its representatives.
- Advance space education and space research in Canada

Founded in 1989, CAISU has more than 200 members across Canada and around the world. A Board of Directors who are CAISU members elected by the membership runs the CAISU programs. This Board and all CAISU members are active in pursuing CAISU objectives as well as promoting ISU and its programs. CAISU is also organising programs of university space-education in Canada.