Ottawa

12 August, 2011

COM DEV

Pre-Budget Consultations Brief for the House of Commons Standing Committee on Finance

1. Summary: The purpose of this presentation is to suggest an alternate, interim approach to the implementation of Canada's Space Program, which takes into consideration the nation's unique technological strengths, its leading niche technology position in international markets and most importantly, is cognizant of Canada's fiscal challenges over the near and mid-term. In addition to introducing COM DEV to Members, this document will provide some perspective on Canada's space heritage, a discussion of the current state of the Canadian Space Program and offer workable recommendations aimed at protecting Canada's incredible success at turning seed technology investments by the Canadian Space Agency (CSA) into an export market that annually total more than ten time CSA's annual budget. An important component of continuing this space export success, at least for the period while CSA's budget is seriously constrained by the need to restrict all government spending, needs to be a heavy focus on more, "smaller space", lower-cost projects, rather than on big space projects. We also recommend a serious look at funding large space projects outside CSA's budget using a Public-Private-Partnership (PPP) model and we suggest some examples of the type of alternative small-space projects that Canada could consider.

COM DEV. COM DEV is Canada's second largest space hardware company, with over 1000 employees in Cambridge, and Ottawa, Ontario. We are a leading global designer and manufacturer of radio and optical systems for space satellites and other platforms. We are Canada's primary source of space instruments and technology that support global weather and climate monitoring, Canadian maritime safety, and security. We build the search and rescue transponders that provide satellite-based safety-of-life for the global community, and make possible across Canada and globally, the communications that connect Canadians to each other and the world. Our equipment makes possible the satellite broadcasting that reaches every community in Canada and a broad range of other satellite communications equipment used by our telephone networks, cable TV, Internet and mobile phone services, newspaper publishers, air-traffic control systems as well a facilitating most Canadian economic transactions and military operations. In addition, for more than 30 years, COM DEV has been leveraging Canadian government investments in space to generate four times the value of its sales to the Canadian government in exports, to a broad range of international customers.

2. Canada in Space – Some Perspective

a. Canada as a nation is one of the world's space pioneers. Canada was the third nation in space, after the Soviets and the USA. Initially, space investments in civil and commercial communications satellites were motivated by a bold Canadian government vision of bringing Canadians together; providing vital communication links across a vast, sparsely populated country. By ensuring relative equality of communications services to all Canadians regardless of where in Canada they lived, satellite communications became an engine of growth for the Canadian economy. Today, these extra-terrestrial links are largely taken for granted. However, they are used in virtually every aspect of modern life on Canada; from printing your morning newspaper to gas pump transactions, to the inner-most workings of our financial system. Space is now so interwoven with Canada's economic life-blood that its' fundamental contribution to our national infrastructure is often forgotten. It is estimated that space-based resources touch the lives of every Canadian 20-30 times per day every day.

b. The space business by its nature entails large investments, complex technology development and implementation, long lead times and extended intervals between major contract awards. As such, it is a constant challenge for Canadian companies to maintain the critical mass – in knowledge and capability – that is required to

remain internationally competitive, without consistent government investment. In most nations, government's give priority to the development of their domestic space industry as a national strategic sector, by investing through research and development contracts as a component of funding major domestic space projects to meet national requirements – both civil and military. In doing so, they enhance their respective national space industrial-base and contribute significantly to their competitive advantage in the international civil and commercial space sectors. Like defence spending, space sector spending is not subject to WTO or NAFTA rules; and national investments in space are notably focused on meeting national needs. Canada's space sector has developed along similar lines, albeit with considerably smaller net government investment. For example, on a per capita basis, US government space spending is 117 times that of Canada's; while Japanese government space spending is five times larger.

c. Around the world, space activities are dominated by governments, particularly those making large investments due to defence sovereignty concerns that require national space systems able to provide; secure communications, space domain awareness plus national and global surveillance. Globally, government programs represent 80 percent of all space spending, and leading G-8 nations compete aggressively to field and sell a broad range of military and civil space capabilities. Space is generally seen as the zenith of high-technology achievement by most nations. As a result, most first-world countries and many emerging economies are investing heavily in the development of domestic capacity to launch and operate space assets, as an integral part of a national strategic objective related to national defence, security, economic growth, core infrastructure needs and national "branding".

d. Canada has never considered becoming a first-order space power to be affordable. In terms of its investments in space, it has always been a middle-rank player. However, by following a targeted niche technology strategy that has consciously avoided duplicating technical capability in different companies, Canada has emerged as a niche technology leader with the capacity to both meet its own national needs and generate substantial export revenues, while concurrently "branding" Canada as a global technology leader. Canadian companies lead the world in many important space technologies developed first to satisfy Canadian needs, including, advanced telecommunications, Earth remote sensing and observation, robotics, atmospheric sensing, space optics and space science. Canada's space story is in fact one of amazing success notwithstanding a modest national space budget by international standards. Canadian space firms successfully compete and win against some of the largest aerospace corporations in the world and are also sought out as critical suppliers. COM DEV is an excellent example of this success, with exported products consistently representing more than 80 percent of its annual revenue. No other nation in the world can boast a scale of space exports success equal to Canada's. In 2010, annual revenues from Canada's space industry were $3.5 Billion, more than ten times the CSA's $300 Million annual A-base budget. By comparison, the United States, with the next-best export record, exports of space products and services that total only 60 % of its annual space budget.

3. <u>State of the Canadian Space Program Today</u>

a. Despite modest Canadian government investments in the Canadian space program, Canadian companies such as COM DEV, Telesat and MDA (and about 200 other suppliers from coast to coast), are global export market success stories. For example, many COM DEV space products enjoys as much as 50 percent global market share. Its electronic and optical systems are onboard over 800 satellites/spacecraft launched to date - more than any other company in the world.

b. Since Canada became the third country in space, consistent government-industry-university collaboration has been the centre-piece of Canada's economic success in space. In fact, our success could not have been possible without this close informal public/private partnership – sometimes referred to as "Space Team Canada". Collectively, the team has cooperated to avoid duplicating their capabilities in the Canadian market and collaborating to win against the competition that they saw as international, rather than domestic.

c. Canada's space industry should be well positioned to continue growing its space-export sector. It has excellent, globally-competitive technology; outstanding international partnerships with NASA, ESA, NASDA, and close relationships with global prime-contractors around the world, largely due to partnering opportunities created by working together on international space projects. And, due to its excellent reputation for being able to deliver on the most demanding technical requirements. At home however there is an emerging crisis. The disappearance of most technology seed funding from the Canadian domestic space budget is putting the continuation of this grand success at serious risk of collapse. As a result of more than ten years without a budget increase, inflation has seriously eroded CSA's ability to operate. It currently has almost no funds to invest in new or emerging technologies, or to take advantage of new international partnering opportunities. Its available discretionary budget is almost fully committed in the near-term to the CSA's share of a single large project (Radarsat Constellation Mission), and there appears to be little chance of the situation improving any time soon without a significant infusion of additional funding for CSA or a radical change in the way CSA is organized and allocates it budget.

d. Industry also needs to see a long term plan for CSA. Without a long-term CSA plan, Canada's space industry has no basis to plan for technology evolution to meet national needs, much less to leverage export market performance. Space projects typically have execution periods of two to five years; and each project follows an equally long period of requirements analysis, concept/project definition and technology definition and development. Given this model, all projects require long planning horizons and seamless communications between the government, university and industry players in order to effectively maximize the return on their highly trained work forces and specialized research/manufacturing facilities. Since the Canadian space industry's ability to compete internationally is critically tied to achieving synergy through dovetailing its activities with those of Canadian universities and the CSA, to meet both Canadian needs and the changing needs of global export markets, the Canadian space industry and to a lesser extent Canadian universities quickly become at serious risk of losing important critical mass if the CSA leg of that three legged "Space Team Canada" stool seriously weakens or disappears. Once lost, that critical mass will be difficult, if not impossible to recover as other nations will quickly step into the vacuum with their own replacement technologies. In particular, many developing nations have ambitious and well-funded space *programs* that make them immediate threats. The national space organizations of India and China are likely to move quickly to fill any gaps vacated by Canada. But they are not alone. Other countries like the UK, France, Germany, Korea, Norway and Spain are also serious threats. Recognizing the unique opportunity to generate new long-term sustainable, high-value jobs in space, their governments, have aggressively increased their investments in advancing their space-technology base, even in the face of very difficult financial conditions forcing major cuts elsewhere in their budgets.

4. A Way Forward for the Canadian Space Program. So, what can be done to re-energize the Canadian Space Program, in full awareness of the government's need to reduce government spending and return Canada to a balanced budget? The history of Canada's involvement in space to date can mostly be summarized as a series of "big space" investments: such as, large telecommunications satellites, radar satellites, and robotics projects for the Space Shuttle and the International Space Station. The cost of these major projects has been in the hundreds of millions, and in some cases, billions of dollars. Today, with our ability to invest constrained by encroaching economic realities, we believe it is time to consider another path. We are proposing - at least in the short term – that government pursue a "small-space" strategy and introduce the use of Public-Private-Partnerships (PPPs), as alternatives to funding the large space projects needed to for Canada's essential national space infrastructure. By freeing up cash for more, smaller projects this way, CSA could sustain its role in the successful niche-leadership based "Space-Team-Canada" exports strategy, over the full range of space technologies where Canada is strongest, and also continue to create new opportunities by being able to participate in new collaborative international space projects. This global period of international budget constraint is in fact creating new opportunities for more Canadian participation in large international projects. Organizations like NASA and ESA are actively promoting more international cooperation as they too struggle with the affordability of their largest space projects.

a. Refocus the Canadian Space Agency – In our opinion the way CSA operates and procures space capabilities for the Canadian government, needs to be reconsidered and focussed on reinforcing "Space Team Canada" as an even bigger global export success strategy. We think it should concentrate more on developing the new science and technologies needed for future space projects, and reduce it role on domestic space projects to defining performance requirements for the space solutions needed to solve Canadian problems. In short, it should spend less time operating as a government procurement agency especially where previously demonstrated/proven technologies are involved. More is said on this in the PPP comments at paragraph #4.c below. When solutions using more mature technology are needed, we think it would be much cheaper and less labour intensive for the CSA to define the required services and leave it to industry to determine how to most efficiently and cost-effectively provide those services. Such a change would have the added advantage of placing much more immediately marketable IP and skills at play in Canadian industry and thereby increase the probability of it being successfully leveraged into new exports of Canadian space hardware and services. At the same time, we think the CSA should be encouraged to expand its critical and successful role incubating both new and established Canadian space companies through the funded early-development of new space technologies and applications needed by future export markets. We also recommend that CSA devote still more effort to exercising its relationships with other space agencies, particularly with NASA and ESA. It should be encouraged to proactively pursue more of the Canadian niche leadership roles on international space projects that have played such a large part in introducing Canadian companies to European and American space prime-contractors in such a way so as to create life-long supply-relationships that have endured decades after the programs finished. Finally, we believe that CSA continues to have a vital role to play in balancing the flow of contracts and work to all its industry and university stakeholders so as to ensure no organization excessively benefits or loses from the inherent lack of depth (lack of competition) in the Canadian space industry. (It is that lack of depth that makes possible much greater breadth and thus a much greater capacity of the Canadian space industry to satisfy most of Canada's national space requirements.)

b. Smaller (Lower Budget) Canadian Space Projects. Today, advances in technology make it possible to deliver sophisticated satellite solutions on much smaller platforms than was ever previously considered possible - even five years ago. For some applications, small satellite platforms weighing as little as 10-150 Kg can now deliver full mission performance, at a cost that is an order of magnitude lower than using a large satellites; (i.e. 10% of the previous "big-space" cost). The cost of large communications and radar satellites range from hundreds of millions to more than a billion dollars. The cost of the three RCM satellites now under construction is likely to exceed a billion dollars. In the current environment, it is unlikely that another project of this magnitude can be contemplated until Canada's fiscal situation returns to surplus. In the interim, the CSA should consider prosecuting more and smaller satellite programs that are able to deliver critically important applications; some of them revolutionary in scope and design. One example of such an opportunity is the Automatic Identification of Ships (AIS) micro-satellite solution now being implemented by COM DEV; and its subsidiary exactEarth. With four micro-satellites currently in orbit, and four more planned for launch over the next two years, the exactEarth constellation is delivering near-real-time operational ship-location intelligence to customers around the world. On both coasts, the AIS data from the exactEarth satellites is being fed directly into Canada's Defence Operations Centres. The majority of funding for this initiative has been provided by private sector investors, at home and abroad, including COM DEV. The cost of the entire exactEarth constellation, including its full development, eight satellites, ground receiving and control stations, computer processing and data storage centres, will be less than $100 million. With modest, but critical, seed investments from the CSA and DND as early operational users, exactEarth is proving the benefits of a "small-space" strategy. Other examples of potentially exciting, ground-breaking, new space applications that micro-satellites could provide (this list is illustrative, not exhaustive) include: monitoring and managing fresh-water resources; detecting and monitoring greenhouse gas emissions; collecting data from a wide range of low-cost ground sensors used for various measurements, from seismic vibrations to water-stress in agricultural crops and forests; locating and mapping radio emitters in Canada or around the world; and delivering code changes to security-sensitive broadband communications systems, by using the quantum entanglement phenomena to make the systems completely secure.

The small-space approach can also be extended to exploration pursuits. However successful, it seems unlikely that we can repeat our billion dollar investment in robotic technologies for the Space Shuttle and International Space Station. Rather than contemplate another huge exploration investment, CSA should consider less expensive, but equally exciting “small-exploration” alternatives. One such project is the Canadian Advanced Life-Support Systems (CanALSS) that COM DEV and the Environmental Sciences School of the University of Guelph are researching to make Canada the global” Centre of Excellence” for controlled-environment food production on planned, international, multi-rear, manned voyages to asteroids and Mars. It targets development of technologies for automated food productions that will provide fresh vegetables for astronauts, while renewing their on-board atmosphere and recycling water. Canadian industry would build and space-qualify the equipment needed to make the new systems work and survive in space. Importantly, there are also immediate and unique terrestrial spin-offs for Canada through the deployment of related new equipment and technologies to the Canadian greenhouse industry, notably facilitating its potential expansion to the establishment of high-rise urban farms in large cities, and small automated growing facilities providing food security to remote Arctic communities, well before the technology begins being operationally deployed to space, in about 15 years. The full cost of CanALSS development is estimated at about $10 million per year, or again about an order of magnitude less than the approximate $100 million annual cost of the Shuttle-ISS robotic developments.

c. Public-Private Partnerships (PPPs). PPPs are defined in many ways. For the purpose of this brief we mean it to be a form of government lease-to-own arrangement in which the government reduces its immediate capital requirement by spreading its payments over the expected service-life of the space project via a contract with a Canadian company to provide a specified space service(s) for the expected lifetime of the satellite. This form of PPP was pioneered in the UK where it is used to provide different services from new highways and hospitals, to constellations of defence communications satellites. A major additional attraction for government is that the contractor accepts and absorbs all the technical risk that typically drives cost over-runs on most government space projects. While this approach to space financing does not lend itself to every space requirement, for projects using proven technology, like communications and weather satellites, and where adjacent commercial markets in Canada or internationally, provide upside commercial opportunities for the contractor, the opportunity to provide service to the government this way could be well received by Canadian industry. We think such a PPP approach to meeting Canadian government’s space requirements, when it works, would also play well to the Canadian entrepreneurial spirit as described in references to Space-Team Canada, and which has made Canada’s space industry so successful in leveraging the provision of space solutions for Canada, into export sales valued at many times the size of the Canadian domestic sales. To make such PPP solutions possible in Canada would require a change of legislation to allow such “lease-to-own” service contracts covering periods equivalent to the 10-15 year lives of today’s space satellites. It would also require organizations like the CSA to get out of the labour-intensive business of defining new hardware in enormous detail, and concentrate instead on defining only the details of the service(s) required. Exactly how that defined service requirement would be met would be left entirely to the contractor’s discretion according to its need to minimize risk and costs. Other typical government concerns like schedule and Canadian content could be matters of negotiation between the government and the selected contractor.

5. Conclusion. A new Canadian Space Program that focuses in the short-term on “small space” projects and a new approach to space procurement would provide real benefits and opportunities to support a much greater cross-section of Canadian space industry and university stakeholders. Such an approach is more affordable and prudent in the current circumstances. We would welcome an open dialogue with all interested parties on how Canadian industry can work with government officials to better define this innovative and cost-conscious concept.