REGULATING REMOTE SENSING SPACE SYSTEMS IN CANADA – NEW LEGISLATION FOR A NEW ERA

Thomas Gillon[*]

On 23 November 2004, then Canadian Minister of Foreign Affairs, Pierre Pettigrew, announced the introduction of legislation to regulate the operation of remote sensing space systems. The press release said, "[t]he legislation is aimed at protecting Canada's national security, national defence and foreign policy interests, while supporting our continued leadership in the provision of remote sensing data and services to government and private sector clients."[1] The *Remote Sensing Space Systems Act* received Royal Assent in 2005 and came into force in April 2007. The legislation, and the regulatory regime that it creates, places Canada at the forefront of establishing rules for the operation of remote sensing space systems and for the dissemination of data and imagery generated by these systems. While it is recognized that the U.S. regulatory regime is one standard by which other such mechanisms will be assessed, the Canadian remote sensing regulatory system is uniquely Canadian.

From Whence it Comes

In the mid-to-late 1990s, advances in satellite remote sensing technology in the private sector started to drive the development of commercial space systems that were increasingly capable, matching in many cases, the performance capabilities that had previously been within the realm of military or intelli-

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[*] Dr. Thomas Gillon is currently the Remote Sensing Space System Policy and Licensing Officer with the Department of Foreign Affairs and International Trade. Previously Dr. Gillon was a Senior Policy Officer in the Directorate of Arms and Proliferation Control Policy in the Canadian Department of National Defence and was Senior Analyst/Acting Section Head-Policy and Cooperation in the Directorate of Space Development, Department of National Defence, Canada

[1] Press Release, Foreign Affairs Canada No. 136, Canada Tables Legislation Regulating Remote Sensing Space Systems (Nov. 23, 2004).

gence capabilities alone. With a note of concern, it was recognized that

> Public availability of timely high-resolution imagery represents a notable break with the past. We are moving from an era in which only a handful of governments had access to high-resolution imagery to one in which every government – and business, non-governmental organizations, and terrorist and criminal groups – will have such access. Non-state actors will be able to peer behind the walls of national sovereignty, accelerating a shift in power that is already under way. Yet, governments around the world are woefully unprepared for the coming era of global transparency. Most countries have chosen to ignore these recent developments. Others have devised flawed policies that will prove unworkable in the long-term.[2]

These developments in satellite technology were occurring globally and across a number of system types. Resolutions dropped, in spatial terms, from tens of metres to less than one metre (in the case of optical sensors) within the span of a single decade. In 1999, Space Imaging's *Ikonos* satellite, followed soon after by Digital Globe's *QuickBird* satellite, improved the best optical resolution available to the public to one meter and sixty-centimeter spatial resolutions respectively. While these systems were remarkable in the quality of the images that they produced, they are, nevertheless, limited by the very nature of optical systems – they cannot image at night or through cloud cover.

Synthetic aperture radar (SAR) systems provide a different sort of image than optical systems, however, in that SAR sensors collect reflected energy emitted from the satellites themselves, and do not collect naturally reflected energy in the form of light waves from the earth, as is the case with optical sensors. Given the active nature of SAR systems, they can penetrate cloud cover and be used to image at night – in short they can provide all weather/day-night coverage. Where U.S. companies

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[2] Jessica Tuchman Mathews, *Foreword* to YAHA A. DEHQANZADA & ANN M. FLORINI, SECRETS FOR SALE: HOW COMMERCIAL SATELLITE IMAGERY WILL CHANGE THE WORLD (Carnegie Endowment for International Peace 2000).

have been leading the international market for optical imagery, Canada has emerged as a world leader in the development of SAR systems.[3] *RADARSAT-1*, owned and operated by the Government of Canada, has provided eight metre resolution SAR imagery to the international market for over a decade now.

In an effort to further develop the Canadian space sector, particularly in the area of remote sensing, the Government of Canada made the decision in the late-1990s to increase private sector involvement in Canada's remote sensing missions, beginning with the ownership and operation of *RADARSAT-1*'s successor, *RADARSAT-2*. *RADARSAT-2*, owned and operated by MacDonald Dettwiler and Associates Ltd. (MDA),[4] with a commercially available spatial resolution of three meters and a significantly improved polarimetric capability, posed an interesting dilemma for the Government of Canada. While developing a viable space industrial base was the driving impetus behind the privatization of remote sensing, it was quickly realized that the capabilities of the proposed *RADARSAT-2* system raised concerns within the Canadian defence and security community and by Canada's allies. Three metre resolution satellite SAR imagery would provide detailed information to the public that had hitherto only been available to governments for arms control verification and monitoring of conventional weapon limitations, typically collected by aircraft operating under the Open Skies Treaty. SAR data, specifically, phase history data (or raw data), in the hands of a competent imagery analyst could also reveal more information than desired given the extra information contained within the phase information of the raw data itself. In

[3] Canada has been at the forefront of SAR technology development for several years and *RADARSAT-2*'s commercially available three metre image capability will be among the most advanced in the world. It should be noted, however, that several countries are pursuing SAR capabilities that equal, and in some cases surpass *RADARSAT-2* in terms of spatial resolution. For example, Germany's *TerraSar-X* has a one metre resolution capability, as will the Italian *Cosmo-Skymed* constellation. *RADARSAT-2*, however, also has full polarization capabilities that other systems do not. This will make it an extremely powerful tool for new data exploitation techniques. As a C-Band SAR system, *RADARSAT-2* will also offer better maritime and geological imaging than the X-Band sensors that will produce different types of images, including the tops of forest canopies. (Source?)

[4] As of writing, MDA is in the process of being acquired by the US firm Alliant Techsystems Inc. (ATK).

contrast, optical imagery will provide just magnitude information, but SAR imagery can also provide phase information that is more amenable to detecting changes and shapes in the images of the terrain below. Furthermore, fully polarimetric data available from *RADARSAT-2* would be the best available on the international market.

The first milestone in the Government of Canada's effort to come to grips with the privatisation of remote sensing space systems was formally announced on 9 June 1999, when then Minister of Foreign Affairs, Lloyd Axworthy, and Minister of National Defence, Art Eggleton, made public the Government's desire to develop new legislation to control commercial remote sensing satellites.[5] This policy established firm guidelines as to what the Government expected the legislation to look like, and furthermore, made it clear that the policy would apply to all commercial remote sensing space systems and to agreements between the operators of these systems and their international partners. As such, it is important to note that while *RADARSAT-2* was the immediate driver behind the regulatory regime, the regime itself was designed with an eye to systems that will be developed well into the future. The 1999 Access Control Policy, as it came to be known, focused on the two essential elements of remote sensing systems that comprised the bulk of the security concerns: the operation of the satellite and the dissemination of the data and images produced by the space system. The announced policy was comprehensive and set out in broad terms the parameters of Canada's nascent remote sensing access control regime (as no regulatory regime yet existed).

It is essential that the context of the period be understood. In addition to the rapid development of remote sensing technology, the military sensitivity surrounding high performance systems, and the shift of the operation of these systems into private hands, a number of other factors were at play that would influence the development of the Canadian regime. When the *RADARSAT-2* program was privatized and the contract awarded to MDA, MDA was, at that time, a wholly-owned Ca-

[5] Press Release, Foreign Affairs Canada No. 134, Canada to Control Imaging Satellites 1 (June 9, 1999).

nadian subsidiary of Orbital Sciences Inc., a U.S. aerospace company. To address jurisdictional issues related to the licensing of remote sensing satellites, Canada and the United States entered into an agreement to ensure that *RADARSAT*-2 would be licensed by Canada, as the United States would itself otherwise license the U.S. parent. This was because *RADARSAT-2*'s operations would be done from within Canada, while the administrative control obtained via ownership, would be held by a U.S. parent company.

The Agreement between the Government of Canada and the Government of the United States of America concerning the Operation of Commercial Remote Sensing Satellite Systems (Intergovernmental Agreement), June 16, 2000, Washington DC, set in place an understanding that both countries would ensure that remote sensing space systems would be controlled in such a manner "as to protect shared national security and foreign policy interests while promoting the commercial benefits derived from these systems."[6] Furthermore, the agreement recognized that "Canada and the United States share mutual interests in regulating and controlling commercial remote sensing satellite systems operating from their respective territories and subject to their respective jurisdictions."[7] In the end, it was concluded that Canada would establish a regime comparable to that already existing in the U.S., through the Land Remote Sensing Policy Act of 1992.

The United States' Presidential Decision Directive Number 23 (PDD-23) of 9 March 1994, also influenced the development of Canada's legislation. That document required a legally-binding agreement between the recipient of sensitive U.S. technology and the U.S. Government, before needed technology could be made available for export. At that time, *RADARSAT-2* was to make use of U.S. technology and to benefit from an American launch service provider.[8] The U.S. Government re-

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[6] Press Release, Foreign Affairs Canada No. 153, Canada and United States Sign Agreement Concerning Operation of Commercial Remote Sensing Satellite Systems 1 (June 16, 2000).

[7] *Id*.

[8] Ultimately, *RADARSAT-2* employed European technology still reliant on key US export controlled components, and it was finally launched on a Franco-Russian launch

quires such agreements to gain assurances from the recipient government that the technology will not be subsequently re-transferred to third parties without the U.S. Government's prior written approval. International agreements in Canada can require additional domestic legislation to give them effect, in this case, for the prohibition on the transfer of operational control of the satellite once it has been launched.

Coincidently, on 16 April 1999, the United States rescinded Section 126.5 of International Traffic in Arms Regulations (ITAR) – otherwise known as the Canadian Exemption. ITAR is the set of U.S. regulations that controls foreign access to sensitive U.S. technologies. As a cornerstone of the U.S. export control regulatory framework, ITAR is extremely important in determining the ability of foreign companies, particularly those that rely on U.S. technology, to do business. Only after a significant amount of additional regulatory effort in Canada, associated with Canada's Controlled Goods Programme, was a Canadian Exemption restored to ITAR. While the 2000 Intergovernmental Agreement and the 1999 Access Control Policy were focused specifically on the issues of regulating remote sensing satellites, and *RADARSAT-2* in particular, the ITAR episode served as an unwelcome backdrop that only exacerbated the otherwise simple conditions set out in PDD-23.

The policy process for Canadian officials was in so many ways mind-bogglingly complex, as it touched on so many areas. There are likely few areas of work in the Government of Canada that have addressed such complex technical (and technological), legal (Charter, commercial, and international law), and policy (economic development, foreign, defence, and national security) issues. In many cases, simply communicating among such a diverse set of interests and issues required educating and re-educating different sets of individuals as to the issues involved in other areas of the file. Lawyers required technical briefings on remote sensing satellite capabilities and technologies. Engineers required briefings on domestic and international law, as

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vehicle from Kazakhstan in December 2007, after the prime contractor encountered numerous technical and programmatic difficulties associated with building a state-of-the-art satellite system.

well as public and private law. Policy officers required a broad understanding of the file in order to ensure that it all fit under the roof of the 1999 Access Control Policy and Canada's 2000 Intergovernmental Agreement obligations. There was also the requirement for numerous consultations with industry to ensure that they were well aware of what the new regulatory structure would require of them, and to afford them the opportunity to provide their comments on that expectation during the lengthy process.

As the effort moved ahead it was quickly determined that amending existing legislation was simply not a viable option. While there is some legislation in Canada that deals with space systems, none offered the scope of Ministerial authority or had the flexibility to accommodate something as inherently complex as remote sensing. For example, the Radiocommunications Act and the Telecommunications Act both address satellite communications. Neither addresses remote sensing. Both of these Acts reside under the authority of the Minister of Industry. While an industry or economic development element exists within the remote sensing issue, the Minister of Industry lacked the authority to act in the defence of Canada or for foreign policy reasons.

Similarly, Transport Canada houses the Government Launch Safety Office that licenses launch activities in Canada. Again, satellites are not included under Transport Canada's authorities, nor typically are defence of Canada, foreign policy, or industrial or economic development. Placing the regulation of remote sensing space systems under a number of different pieces of legislation, and outside of a Minister's specified powers, was not seen as a practical option. Not only would it be extremely awkward and cumbersome, a timely response to a national security crisis would be virtually impossible. A new "stand-alone" Act would be required.

With the stage set by these efforts, it was acknowledged that there came a responsibility to ensure that the data and images produced by these systems did not place Canadians or Canada's allies in harm's way. To this end, the Government of Canada embarked on a lengthy and challenging journey, culminating in 2006 with the passing of the Remote Sensing Space

Systems Act. This Act ensures that remote sensing space systems are operationally controlled, and that the data and images that they produce are disseminated in a manner befitting a military utility dual-use technology. The Act and its regulations came into effect in April 2007. With a mandate spanning security, foreign policy, and international trade interests, the Minister of Foreign Affairs became the licensing authority for the Government of Canada.

Licensing Remote Sensing Space Systems

The cornerstone of the regulatory regime established under the Remote Sensing Space Systems Act is the licensing of the remote sensing space systems themselves. It is essential, particularly in the case of privately operated systems, that the Government has insight into the capabilities of a proposed space system and an element of control, should the capabilities of a space system warrant it, over the collection and distribution of data and imagery. As remote sensing satellite technology advances and resolutions improve, the dual-use nature of these systems has become increasingly apparent. The Government of Canada cannot license and regulate the operation of satellites owned and operated in other jurisdictions. It has a responsibility, however, to regulate systems operated by Canadians and persons that have a substantial connection to Canada.

The licensing of remote sensing systems in Canada addresses two primary concerns: the operation of the satellite itself and the distribution of raw data and remote sensing products produced by such satellites. With respect to the operation of the remote sensing satellite, the regime established in Canada is particularly interested in ensuring that such operations are secure from cradle to grave. In other words, under the Act, the government wants to ensure that positive control of a satellite is maintained at all times throughout its mission life, and that at the end of its mission life, the spacecraft is disposed of in such a manner that orbital debris risks are mitigated and the spacecraft is de-orbited safely. Positive control can be assured through the implementation of appropriate command uplink security measures, as well as by establishing robust security

protocols for the terrestrial infrastructure associated with a space system. By implementing such measures, risk to unauthorized access to the spacecraft and to the data it produces, can be significantly reduced.

Canada, in support of the recently established United Nations Orbital Debris Mitigation Guidelines, has also put in place through the Remote Sensing Space Systems Act a requirement for prospective licensees to demonstrate that they have in place an effective disposal plan for their space system. Following standards set by NASA, the objective is to see space systems deorbited safely upon the end of their mission life within 25 years.

While it is essential that spacecraft operations be licensed, what the regime is seeking primarily to regulate is the collection and distribution of raw data and remote sensing products generated by remote sensing space systems. There are, in fact, three inter-related definitions in the Act that give effect to the regulatory touchstone of the regime: the definitions of "raw data" (the zeros and ones of the digital information); "transform" (processing the data – the zeros and ones – to form an image such that it is impossible to reverse engineer the raw data); and, "remote sensing products" (i.e. finished products produced by this transformation, such as images or digital elevation models).

The raw data, particularly from high-resolution SAR systems, should be controlled. In the right (or perhaps wrong) hands it can be manipulated to reveal a great deal about the capabilities of satellites that might permit an adversary to develop methods to counter observation or to deceive observation by such systems. Controlling the raw data is important in that it works to keep the most sensitive information out of the hands of those who could use it against Canada or Canada's friends and allies.

As the Government, under the administrative leadership of the Department of Foreign Affairs (in cooperation with the Departments of National Defence, Public Safety and Industry Canada) licenses remote sensing space systems, a significant effort will be put into understanding as much about these systems as possible, in cooperation with prospective licensees. In addition to the technical elements of a license application review, the Government will need to understand the applicant's

business models; who will be its proposed system participants and clients; who will be operating the system; who will own the system; and, how the sensitive information will be managed. Ultimately, how the spacecraft will be disposed of, during or once the mission is over, will also be of interest to the regulators.

As a part of the licensing process, the Government in turn will ensure that the prospective licensee understands its obligations under the Act, including the concepts of shutter control and priority access; command and data protection (encryption and information assurance measures required); and, possible offenses and/or violations should the licensee contravene the Act, the regulations or the license. A license will only be granted once the Government is satisfied that the system and its raw data and remote sensing products are controlled in a manner sufficient to ensure that Canada's national security and defence interests are met along with Canada's foreign policy and international obligations.

One interesting aspect of the licensing section of the Act is the ability of the Minister of Foreign Affairs to exempt systems, on a case-by-case basis from the Act. This clause was incorporated in response to concerns raised regarding the need to license systems that would pose no threat to Canada or Canadians. If it can be demonstrated to the satisfaction of the Minister that a proposed system would pose no harm, if for example, it was of a sufficiently coarse resolution or that it would never distribute data outside of the Government of Canada, then the Minister could exempt it, relieving both the Government and the prospective licensee from the burden of going through the licensing process.

Review of System Participant Agreements

Virtually all remote sensing space systems have system participants that operate a part of the system, either for the licensee, or under commercial license to acquire, archive, process and distribute raw data and remote sensing products. This is most often the case where the operation of ground receiving stations and data processing and distribution are concerned. Re-

call that a system is comprised of the mission control segment, which provides commands to the satellite; the satellite itself that collects the raw data; and, the ground receiving stations with its attendant storage means, processors and distribution channels for the production of raw data; and, remote sensing products. In most cases, the licensee would operate the command facilities and the satellite, but given the global nature of remote sensing and the laws of orbital dynamics, a satellite may downlink its raw data to a receiving station anywhere in the world for subsequent processing and distribution by yet other system participants under license.

Due diligence is required on the part of the Government of Canada to review each agreement between the licensee and its system participants to ensure that they operate the system with no less rigor than the licensee must. The licensee, for its part, must bind the system participants to the rules established in the license issued by the Minister of Foreign Affairs and to the undertakings of their command and/or data protection plans. Rules established in the license for the release of raw data and remote sensing products must also be adhered to by the system participants. As the Government will likely have little or no jurisdiction directly over the end-users or foreign system participants, the Canadian licensee will have to ensure that their system participants and their end-users comply with the rules. If it should be discovered that there has been a disregard of the rules established by the Government, the licensee could face the repercussions that range from administrative penalties, through revocation of the license or, in the most extreme cases, criminal offences.

Interruption of Normal Service (Shutter Control)

Despite the fact that licensing and the review of system participant agreements will comprise the bulk of the effort with respect to regulating remote sensing space systems, most attention has been focused on the Government's ability to invoke shutter control to interrupt the normal service of the satellite, and on the Government's ability to order priority access service. Beginning with shutter control, it should be noted that this par-

ticular authority, while essential as a last resort, is not expected to be used often. The U.S. has had such authorities in its legislation for over a decade and has never invoked shutter control.

Normal service can only be interrupted at the Ministerial level and only for the most serious of national security, national defence, and foreign policy/international obligations concerns. In keeping with the intent of the Act to respond as appropriate to a whole spectrum of circumstances, shutter control is a highly tailorable concept. Imagery may be restricted over specific areas, for specific times, and at specific resolutions. It is not necessarily the case that a licensee will be ordered to stop collecting and distributing images of a particular area. Instead, distribution of images could be delayed or the resolution at which they may be acquired may be limited to coarser resolution collection modes. As shutter control could affect the business activities of a private company, the threshold for invocation has been set at the Ministerial level. This is to ensure that it is only invoked for the most serious of reasons. It is therefore expected that shutter control will be invoked only in the rarest of circumstances.

Priority Access

Priority access to satellite imagery may be required in cases of emergency response (i.e. during ice storms, forest fires, or floods), in support of requests for aid of a civil power, or in support of Canadian Forces operations where access to remote sensing satellite images could be beneficial. While the International Charter on Space and Major Disasters makes satellite imagery available globally,[9] the priority access provisions of the Act are

[9] The Charter is based on voluntary contributions, by all parties, of Earth observation satellite data. Its main purpose is to supply states or communities whose populations are exposed to risk or have been affected by a natural or technological disaster with data providing a basis for anticipating and managing potential or actual crises. It relies on limited space capabilities offered by the parties but "this is a focused, concrete demonstration of what a more ambitious programme of global environment and security monitoring can deliver to disaster mitigation and crisis management authorities," said Jose Achache, Director of Earth Observation Programmes for the European Space Agency. Press Release, European Space Agency, N° 31-2004: Space and Major Disasters

specific to Canadian satellites. It is anticipated that the majority of Canadian uses for such imagery can be managed through normal sales channels, and therefore, priority access will not be invoked regularly. It could, however, be invoked more often than shutter control, and as such, the threshold has been set at the level of Deputy Minister.

Deputy Ministers and, in the case of the Canadian Department of National Defence, the Chief of the Defence Staff will have the authority to order priority access service should it be determined that the Government of Canada requires timely and/or assured access to satellite imagery for significant events. Priority access simply moves the government to the front of the order queue for satellite imagery in order to ensure timely or guaranteed access to the collection of raw data. It is the government's intent that commercial providers will be paid for any services that they provide, using a prescribed formula to determine the price of such payments.

CONCLUSION

It has been observed that,

> One of the new millennium's defining features is rapidly growing global transparency. This trend is driven by a combination of factors, including more open political and economic institutions, rising expectations about public access to information, and an explosion of information technologies. Key technologies include global telecommunications networks, the Internet and the World Wide Web, commercial and civil observation satellites, and other enabling technologies that encourage worldwide connectivity and awareness. [Earth] Observation satellites are playing a leading role in expanding transparency on a global basis because they offer a broad range of actors (i.e. governments, corporations, the new media, NGOs, and even individuals) and unprecedented ability to acquire relevant infor-

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Charter agencies strengthen ties with UN-Colloquium at UNESCO, Paris (June 15, 2004), http://www.esa.int/esaCP/Pr_31_2004_p_EN.html.