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**MAKING REMOTE SENSING OPERATIONAL: A CHANGING WORLD
REQUIRING CHANGING APPROACHES TO DATA POLICY¹**

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ABSTRACT

Making remote sensing operational has long been a goal of remote sensing activities in Canada. Over the past thirty years there have been significant changes in a number of areas that have influenced how remote sensing has developed in Canada as well as in many other countries and regions in the world. Some of these changes include the growing realization that remote sensing must be better integrated with other areas if the full benefits of the technology are to be realized. In particular, remote sensing must be better integrated with geomatics or the geospatial sciences. At the same time remote sensing must pay attention to the specific needs of those who may benefit from the use of remote sensing, be they in forestry, geology, agriculture, environmental studies, or disaster response. In two words, remote sensing has had to become more flexible and at the same time more focused. These have proved to be interesting challenges.

The need to be flexible has necessitated a re-thinking of the importance of standards, data access, and related data policies, as well as the role of the research community and commercial entities in the development and delivery of products and services. The need to be more focused has seen a shift in how priorities are set and in the balance between the importance of academe, government and industry. This paper explores the changing data policy environment from the perspective of the author who has held senior positions in government and industry, as well as having served as an advisor to major university programs, a number of agencies of the United Nations and major space agencies.

¹ Mr. Jean-Marc Chouinard of the Canadian Space Agency offered comments on an earlier version of the ideas in this paper. The opinions expressed on policy are those of the author and are not necessarily those of any agency of the Government of Canada.

1. INTRODUCTION

The history of remote sensing in Canada has been documented elsewhere (Sayn-Wittgenstein et al, 1999). The importance of industry and the links between remote sensing and GIS and other elements of geomatics have also been explored. (op.cit. and the Geoconnections Study of Human Resources in Geomatics in Canada). An element that has been less well studied in Canada and, especially, elsewhere, is the role of data policy in the development (or lack of development) of the field. This paper attempts to address that short-coming.

While data policy is important and complex in every country individually, the complexity internationally comes from the plethora of different policies adopted by those providing remote sensing data. The remainder of this paper details the range of these complexities – domestic and international, the importance of data policy, and attempts to identify how one might arrive at a policy that can meet national needs while remaining consistent with international law and precedent as well as with the policies of the larger players involved in formulating data policy.

2. THE NEED FOR A DATA POLICY FRAMEWORK IN REMOTE SENSING

The world is more digital and now relies on the Internet. Over the past few years there has been a movement of the entire world to use more digital solutions for data – be they airborne imagery or that which is used to populate the number of rapidly emerging and changing GIS systems. Over time, with the significant shift in what data are being used (digital), how they are being delivered (over the Internet), there have been and will continue to be data policy issues to be solved. To solve them we must be flexible, forward looking, and open-minded.

Remote sensing data policy is important in operationalizing remote sensing to the benefit of those countries investing in and using the technology. Our analysis behind this paper suggests that there is a need for a comprehensive approach to data policy to meet a number of needs for a range of players in every country.

For a country to be truly sovereign, it must have information at hand about its country and resources that are at least as good as that information possessed by its competitors. This has been a driver of remote sensing in Canada for thirty-five years. To meet this goal one must not only have the information (as was the early goal at the Canadian dawn of remote sensing), but the ability to both understand **and** use it. This implies a data policy that can respond to the many nuances associated with remote sensing data's application.

One of the important reasons for involvement in data policy and the related technical standard is to ensure that international policies are consistent with the goals and aspirations of each country – be they commercial, related to ease of use, or sovereignty of information. In the past it was clear that the best way to do that was to help set that standard. This has been suggested in a more global sense by Welsh (Welsh, 2004), and is

clearly manifested in the activities in such fora such as the Open Geospatial Consortium, the Committee on Earth Observing Satellites (CEOS) and TC211.

Countries are coming to rely on remote sensing data as part of their desire to remain at the forefront of the knowledge economy. There are a number of additional reasons that would seem to call for involvement in remote sensing data policy. These reasons are tied to reliance on such data as the foundation of knowledge for resource management, transparency in decision making, and the contribution to good governance that comes with broadly shared information, be it in a developed or developing country.

A comprehensive remote sensing data policy is required if the promise of remote sensing is to be met in addressing global issues. One of the overarching reasons behind the need for a more comprehensive data policy is the fact that at the same time as there are growing concerns about global processes and human impacts on them, there is now the possibility of obtaining vast amounts of information from spaceborne remote sensing over large and previously inaccessible areas to monitor these processes and the changes being induced, including those areas of the world under perpetual cloud cover. One may now get information faster, easier, and at less cost for the more remote parts of the world where airborne data could not previously be easily obtained. These same factors also enable us to obtain information on remote areas where there are concerns related to disasters, be they human induced or natural. To bring these massive quantities of information together for comparisons to allow decision making requires that data be comparable. Data policies are needed to ensure that data can be obtained when needed, overlaid, and integrated with other data with assurances that any differences in what the data portray are real and not artefacts within the data.

Remote sensing data policy is clearly one of those enabling policies in which a small investment can lead to significant returns, or in which a lack of investment or lack of attention can cause missed opportunities, additional costs, and reduced competitiveness not only in remote sensing, but in all sectors of the economy that might beneficially use remote sensing, including forestry, agriculture, mineral and petroleum exploration.

3. THE PLAYERS IN DATA POLICY

The complexity of the data policy issue is underlined by the growing number and range of interests of organizations and others interested in and offering opinions on the topic of the application of satellite remote sensing and associated data policies. These players are both international and domestic.

Among those engaged one would expect to find the research-oriented scientific and technical organizations such as the society of professional societies involved in remote sensing and mapping - the International Society for Photogrammetry and Remote Sensing (ISPRS) (Harris, 2003), and its member organizations such as the American Society for Photogrammetry and Remote Sensing. Both have contributed opinions and information to

the on-going policy discussion, as have to a lesser extent other similar organizations in Canada and around the world.

As the potential for remote sensing has developed, many others have weighed in on the topic of data policy. These include a number of international organizations such as the Committee on Earth Observing Satellites (CEOS) which represents those countries and agencies with civilian earth observing space assets or an interest in their application. CEOS has played a key role in organizing science and certain technical issues, as well as having placed remote sensing in front of major international political fora such as the World Summit on Sustainable Development (WSSD). (<http://www.ceos.org/>).

Several CEOS members have themselves been leading in the policy discussions. These include NASA, NOAA (Withee et al, 2004.), and the USGS in the USA, ESA in Europe, NASDA in Japan, and various agencies of the United nations (FAO, UNESCO, OOSA, etc).

While this civilian discussion has been going on, the military (especially in the United States) has been forced into more public discussions as the line between military and civilian use of remote sensing has increasingly been blurred since the early 1990s, and especially since 9/11. Studies on the potential use of publicly available geospatial information by enemies of the state have been carried out - with somewhat surprising results. Less than one per cent of the data sets studied were deemed to have any value – and most of those that did were likely available elsewhere. (Baker et al, 2004)

However, it has not just been the research community largely housed in academe and agencies of governments that have become actively engaged in remote sensing and, by extension, data policy. As noted above, there has been political interest shown at the WSSD, and in two Ministerial conferences held in the ESCAP region of Asia (in Beijing in 1995 and New Delhi in 2000 - see UN-ESCAP, 1995 and 2000), as well as in the Ministerial level Earth Observation Summit convened by the United States in July of 2003. (Ohlemacher, 2003; www.earthobservationsummit.gov/terms_of_reference.html.) Political interest continues to grow along side the range of applications of remote sensing. In Canada the growing political support was shown by the fact that after some years of cut-backs, the first substantial addition to remote sensing funds in some years was approved in the Government of Canada Budget tabled February 23, 2005.

Others who have offered opinions on remote sensing and associated data policies include industry groups such as MAPPS in the USA, and the Geomatics Industry Association of Canada. As stakes have become higher and as the potential for commercialization has grown, there has also been an increase in interest by major corporations in the USA (Lockheed-Martin, Boeing, Orbital Sciences, Raytheon, etc), Europe (Dornier, Alcatel, and later Astrium), and Japan (NEC, Iochu, etc). Making life interesting for these have been parastatal companies such as Surrey in the UK which builds low-cost systems for both developed and developing countries, and the Israeli entry in the arena of high resolution dual (civilian/military) satellite sensing systems.

Data policy has long been a critically important area that has received far too little attention within the remote sensing community. Had it received more attention earlier, perhaps we would not be in the complex and difficult situation in which we find ourselves today. However, while the topic is complex and solutions appear to be elusive, there are some useful approaches and analyses that can be drawn from the experience in the geospatial (or geographic or geomatics) community. In that community there has been a great deal of interest in the topic of data policy. Lessons that may be learned from activities in that area are explored below.

Why is the situation so complex and why is there this interest by so many different groups world-wide? One can respond with a simple answer: self-interest. Everywhere the research community wants low cost access to data for their research and teaching needs, while at the same time assuring themselves that they will not see someone else access their data set before they have had an opportunity to publish. At the same time, the academic community wants digital data for teaching and laboratory purposes that they may freely copy and use in student assignments. The emphasis on digital data should be recognized. For those of us teaching in the late 1970s and early 1980s, we were able to do so with photographic products. That is no longer the case: the use of digital data presents a whole new series of issues.

Governments around the world are a many-headed hydra with highly variable data policy interests. Some parts of government are concerned about security. Others want access to low-cost data to meet their mandates – be it ice monitoring, weather prediction, geological mapping, base mapping, forest inventory, or some other thematic mapping requirement. Still others in government want to use these data sets to develop industrial capabilities and export sales. Finally, some in government are interested in research – much like their colleagues in academe. One therefore finds a need and desire for cooperation, while at the same time there is often intense competition between these different sectors and sub-sectors either to use data or restrict its use.

Overlaid on this complex national tableau is an even more complex international situation. However, the complexity internationally comes from the plethora of different policies adopted by those providing remote sensing data. The remainder of this paper details the range of these complexities –national and international, and attempts to identify how one might arrive at a policy that can meet a country’s needs while remaining consistent with international law and precedent as well as with the policies of the elephants in whose remote sensing bed we mice from smaller nations are sleeping.

4. UNDERLYING PRINCIPLES FOR A REMOTE SENSING DATA POLICY

Data policy has two contexts – one domestic and one international. In Canada, for example, there are the relevant United Nations Principles, **and** the strategies associated with space and earth observation published by the Canadian Space Agency. (CSA, 2005)

While United Nations Resolutions are non-binding, and have no basis in law, these principles have been widely cited, undisputed, and followed by the states most active in remote sensing for so long that they are now regarded by some as a part of customary International Law. (Gabrynowicz,1999.) The basic UN principles are paraphrased in Table 1. (Tables are at the end of the document.) For most nations, no data policy can be developed that is in any significant way contrary to these stated principles. These United Nations Principles provide the first filter through which one must consider a data policy. The second filter through which one must pass a data policy are the domestic policies and principles on space, data security, approaches to data use and applications, and the like.

To illustrate the issue, the principles for Canada are summarized (in no particular order) in Table 2 under two headings: those external to Canada, and those generally within Canada's purview. Within Canada these could be the responsibility of one or more of the federal government, provincial governments, industry, and/or academe. While no attempt has been made to separate out who is responsible for what, it is clear that without internal agreement and consensus building, it would not be possible to adhere to the principles listed. Further, some of those listed would appear to require a greater input and involvement of aid agencies than has usually been the case.

The shared responsibility among so many players points to the complexity of the problem not only within Canada, but in most other countries in the world. This complexity is the primary challenge faced by those considering data policy, whether in Canada, another developed country or a country in the throes of development.

5. THE IMPORTANCE OF A REMOTE SENSING DATA POLICY

The first stage of demonstrating the importance of a remote sensing data policy in general is to show the importance of remote sensing itself. Much has been written about the state of remote sensing and its history. A relatively recent Rand Corporation study (O'Connell et al, 2001.) details the potential for growth by linking it to the rapidly growing market for geospatial information. They cite a study that claims while 75% of business data have some geospatial data content, fewer than 10% use such data.

The National Academy of Public Administration study on geospatial information suggests that geographic information plays a role in 50% of the economic activity of the United States. One should note that the key word is information – not data or technology. Having said that, the potential has hardly been tapped and the geospatial market is growing rapidly. It is estimated that 140,000 organizations world-wide are using GIS, and it has been reported that ESRI trains 200,000 people per year in the use of GIS. (Lemmens, 2004). The fact that ESRI has recently commissioned a book on remote sensing tied to GIS with a release date of July 2005 certainly shows where that major vendor is seeing the future. (Dr. S. Aronoff, the book's author, Personal Communication.)

The future keeps looking better. The US Department of Labor has identified geotechnology as one of the three most important emerging and evolving fields. (Gewin,

2004.) The role for remote sensing is not yet well understood universally, but increasingly it is seen as playing a central role in conjunction with GIS in a symbiotic relationship. In some cases GISs feed off of remotely sensed data as a source of the raw information that a GIS requires, while remote sensing is given structure and purpose through its intelligent use within a GIS. However, in a cautionary look to the future, O'Connell et al (2001) state that one should not expect that remote sensing from space will grow and develop the same "killer applications" or sales levels in the geospatial field as have either GPS or GIS.

How is remote sensing data used in the geospatial context? In the simplest case, remote sensing can simply serve as a backdrop for depicting information or as a base for image maps. However, the use of remote sensing is no longer just following the old adage that a picture is worth a thousand words, nor is remote sensing just used for resource inventory and environmental assessments. Remote sensing data are increasingly being seen as a useful tool in helping with decision-making in urban and regional planning, resource management, disaster response, exploration, and transportation – anywhere that information is required or used in a geographic or spatial context. In one such use (of hundreds that could be documented) far from the traditional uses of remote sensing, Coca Cola delivery routes in Morocco are planned with the use of a GIS and IKONOS imagery. (Van der Voort and Tilout, 2004.)

One of the overarching reasons behind the need for a more comprehensive data policy is the fact that at the same time as there are growing concerns about global processes and human impacts on them, there is now the possibility of obtaining vast amounts of information from spaceborne remote sensing over large and previously inaccessible areas to monitor these processes and the changes being induced. One may now get information faster, easier, and at less cost for the more remote parts of the world where airborne data could not previously be obtained. These same factors also enable us to obtain information on remote areas where there are concerns related to disasters, be they human induced or natural. To bring these massive quantities of information together for comparisons to allow decision making requires that data be comparable. Data policies are needed to ensure that data can be obtained when needed, overlaid, and integrated with other data with assurances that any differences in what the data portray are real and not artefacts within the data.

We can thus see that there is potentially a bright future for remote sensing in terms of its use by a very diverse international community. However, that future is contingent on more data being used. For the data to be used more, there are a number of challenges that can be related back to awareness, perception (of costs and complexity), technologies, and various data policies associated with satellite remote sensing data that tend to either restrict use or make use more difficult compared to aerial photography, for example. As noted above, one factor that is often ignored or omitted from discussion is data policy or rights of access. For example, in a July 2004 comparison of satellite remote sensing data available, none of the comparisons included information on data distribution or access policies. (Spikes, 2004) Perhaps this is a reflection of the incredible amount of verbiage

needed to describe most access policies and the limited space available in that publication.

There are also issues of standards to assure compatibility with other data sets that increase the usefulness of remote sensing data, as well as comparability over time of different data sets. Other policy-related factors of importance are reliability, access (as noted above), and security (the last two related to proprietary information and security of the state). There is also the question of the management of the rights associated with the use of the data, an especially vexing issue with the widespread use of the Internet from which one can extract information from data without ever having had physical possession of the data. Finally, there is the matter of the integration of remote sensing with other data, and which rights may have precedence. One way that commercial satellite data providers are addressing this concern is by going down market to provide complete information solutions, rather than simple data. All of these factors must be considered in any data policy being considered.

While the work on Landsat and other standards was a major contribution with commercial overtones, the subsequent development of CEOS was a shining example of international cooperation true to the principles of the United Nations. However, with the exception of some work with CEOS and the early work on standards and those related to geographic information, until relatively recently there has generally been little attention paid to data policy and standards where they intersect with the world of the user, and industry. Indeed, in the United States much of the interest on policy has not been on data policy, but rather on the larger policy issues of licensing commercial satellite operators, related matters of security, and ensuring that there is a continuation of the highly successful Landsat program. (O’Connell et al, 2001; Williamson and Baker, 2004) Indeed, Williamson and Baker refer to the “tortured policy history and mixed market success of Landsat” and note that the “start-up experiences of the US commercial remote sensing industry have been less than satisfactory”.

This inattention to data policy and pricing policy flip-flops have made the development of sustainable applications more difficult than was necessary. Indeed, the spur to more fully examine data policy has come from the realization over the past few years that data policy is important, and too highly variable from country to country and supplier to supplier if remote sensing is to be taken seriously within the broad user community. In effect, we have largely ignored these issues and remote sensing has largely been unaffected by the knowledge gained within the geospatial community, notably the Open Geospatial Consortium. However, an increasingly sophisticated user community is now routinely discussing data policy and data rights in the context of the exploding geospatial information market. Those whose primary interest is remote sensing would do well to listen to these discussions and learn from the geospatial community where data policy has been the topic of serious study for some time, impacting as it does many aspects of data creation and use. If a national remote sensing data policy does not pay equal attention to these issues, it will fail to deliver on the principles and objectives as have been laid out in the preceding tables. For supplier nations their data will remain difficult to use - or relegated to being an interesting backdrop for other data, rather than being regarded as a

viable source of useful information in its own right. The geospatial community's approach to data policy is explored in the following section.

Returning to a more generalized perspective on remote sensing data policy, there are a number of trends that can be identified in remote sensing over the past few years. These trends taken either singly or together have a significant impact.

First, the role of government is changing in terms of delivering data, using data and doing research, especially when compared to the role of the private sector. Secondly, there are growing security concerns on several levels. Part of that concern comes from a third trend that can be identified: many of the remote sensing data now in use are considered to be “dual use” – of use in both civilian and military applications. The fourth trend is the proliferation of new remote sensing systems. As many as a hundred are expected to be in orbit in the coming five years. At the same time as there has been this proliferation, a fifth trend sees increasing attention being paid to assessing how remote sensing can respond to societal needs and meet the public good. This has been a major focus of attention coming from the Earth Observation Summit. Lastly, it has been noted that access to data has been made easier in some areas and some applications, leading to increased interest in and use of remotely sensed data. While some of these trends lead to increased use, others lead to decreased use and are impediments to data use. These impediments are discussed in the next section.

6. IMPEDIMENTS TO THE MORE WIDESPREAD APPLICATION OF REMOTELY SENSED DATA

Impediments to the use of remote sensing have been explored by a number of authors, including the previously cited Rand Report which looked at economic, awareness, perception and data access issues, albeit primarily from the point of view of satellite data providers. (O'Connell, 2001.) Another study considered the factors that seemed to lead to the uptake of remote sensing in developing countries – where the primary uses were typically associated in some way with natural resources or disasters – largely public good or non-commercial activities. (Ryerson and Quiroga, 2001.) Table 3 identifies a number of the limiting factors or user concerns (illustrated by repeating the questions or comments as users would pose them) identified by the author and others whose work is referenced here. Analysis shows that many of them are related to issues which fall within the purview of data policy.

7. TOWARDS A DATA POLICY FRAMEWORK

A key discussion in the geospatial realm has centered on data for the “public good.” Such data are seen to have value to society and thus their availability should in some way be subsidized by governments. We have identified several approaches one could take to the issue of public good vs. commercial for satellite remote sensing data. The reader should note that no one approach is perfect for any one country: they are simply options that will depend upon policy and national goals.

The evidence suggests that we must separate out remote sensing data policy from what we will call the derived information policy. It would appear that satellite data provision is not yet commercially viable in and of itself. But public good applications, however they are defined, depend on satellite data being available. The discussion following is thus only referring to data. As this discussion evolves, it seems that we must either support one group or another of companies – data suppliers or those providing value-added services. What we recommend considering is not company based, but rather based on the reality that provision of data alone is not a viable market unless there are key anchor tenants or buyers (as is the case for Digital Globe, as is no longer the case for Space Imaging) or significant system subsidies. However, once data are available, provision of value-added services can be a viable business proposition once the imagery reaches the hands of the user or value-added supplier.

Approach 1: The first approach to data policy would see government agencies pay for all satellite system development and provide data at minimal cost to derive the benefits across a broad spectrum of users, based on the premise that the provision of data is not commercial. Government may contract industry to run an order desk, satellite operations, and/or data provision. The Government would obtain its imagery under COFUR (Cost of Furnishing the User Request). All value-added firms would have equal access to data.

Approach 2: The second approach would see shared risk between a commercial supplier and government. This is essentially the basis of the model that was used for RADARSAT-1. Government agencies would obtain data at minimal cost through pre-purchase, and through various support programs to R&D and for development. All other data use is, by definition, commercial. Other levels of government may elect to bulk-purchase data, as may development agencies. Under this approach a data supplier may continue to develop its value-added business, while also encouraging channel partners who may be given exclusive market areas. Since the business viability is assured by the government's pre-purchase, it may elect to support other value-added firms' right to access data in a non-discriminatory manner from the supplier, keeping in mind that the intention is to neither unfairly support the supplier or its competitors. One must at all times be careful that the policy does not support otherwise weak suppliers: such support would cause long-term damage to the industry by limiting competitiveness and efficiency.

8. POLICY FRAMEWORK: A SUGGESTED RESPONSE TO ISSUES IN SUMMARY FORM²

The policy framework summarized below presents a suggested response to a series of interrelated issues briefly discussed above and drawn from our company's research over the past ten years. The framework should be looked at as a shopping list of options and factors that should be considered by stakeholders in formulating a national remote

² The author's company provides consulting services in data policy to countries and agencies world-wide. This framework and the background material has been drawn from a number of consulting assignments performed by the company and its staff over the past ten years.

sensing data policy. While some elements such as confidentiality and security are widely accepted, others are far more contentious. This framework as it stands is offered for discussion: it does not represent an accepted policy in any one jurisdiction, but rather is an amalgam of what has been considered in a number of countries in which we have worked.

Confidentiality and Security

1. Security with respect to enemies of the state must be guaranteed.
2. Integrity of the data must be guaranteed.
3. Security of order information must be guaranteed.

Cost Recovery and Pricing Policy

1. Pricing policy must be stated. The pricing may vary by different types of users, and with different systems. Options include: “Free” vs. cost of filling user request (COFUR), vs. cost recovery at some level for govt. subsidized systems.

Commercialization

1. Given that industrial development is often a goal of space agencies and governments, the ideal approach is to balance public and private sector roles based on the level of commercial maturity in the specific jurisdiction.
2. The commercial model in RS will change to see suppliers providing information, not just satellite data. This issue tends to be contentious.

Reception, Bulk Purchase and One-Stop Access

1. Governments must commit to receive or otherwise obtain satellite remote sensing data in the future to support their needs.
2. Bulk purchasing has been a feature of successful satellite RS programs.
3. A central clearing house or single point of access for satellite remote sensing is suggested to reduce confusion, delays, and improve access to data.
4. One central government agency may acquire spaceborne data from other national or commercial missions for non-commercial government and R&D use.

Archiving and Access to Archives

1. Given the need for data over time for time-series studies, all data should be archived for a minimum of 15 years in an active archive and, at minimum, in an unprocessed format. After the fifteen year period information should be maintained in an in-active but accessible archive for a period to be agreed upon by an expert multi-sectoral archive panel.
2. The policy should maximize early availability of and access to archived data within the limitations of national security, foreign policy, international obligations and commercial interests.

Order Desk and Acquisition Priority

1. For those with spacecraft, the spacecraft scheduling acquisition priority is: spacecraft health and safety; national security; emergencies: image quality and calibration; time critical requests; non time critical request; and background mission requests.

Data Sharing Among User Categories and Research Missions

1. Sharing data between users and researchers is encouraged within the commercial restrictions that may exist with respect to the data and derived proprietary information.
2. All researchers obtaining data from our national mission must provide the results of their research to the country at the earliest possible date, whether or not the research is to be published.
3. Except for a period of exclusive data use up to one year from the launch of the instrument, during which data is be reserved to the principal investigators of the mission, data from science missions is available for R&D purposes only at the cost of reproduction and transmission.
4. Data has to be obtained directly from an authorized supplier and cannot be reproduced without permission unless made available openly electronically.
5. Processed data, and accompanying data for calibration and validation of the spaceborne data, either in-situ, airborne or otherwise, should be obtained from the owner of the copyright of these data. The government will encourage these owners to make their data freely available electronically whenever possible.

Reproduction and Dissemination for Public Good

1. Recognizing that public good is the major driver for national missions, reproduction and access for such applications is encouraged. One option would see data that are for the general good is freely available (on the Internet), while value-added products are available from industry on a for-profit basis.

Reproduction and dissemination for international aid

1. Subsidized access to national RS satellite data will be provided to help developing nations cope with resource and environmental management, disaster response and planning on a project-by-project request basis.

Standards

1. The country will contribute to the development and setting of international RS data standards and national data will meet international standards for formats, metadata, etc. that are compatible with those used in the geospatial field.

Ownership and Copyright

1. Copyright or licensing appear to be the competing options to protect ownership. In light of recent experience in geomatics, the issue of copyright and licensing requires further analysis. From our research, it would appear that there should be some consideration given and a legal analysis performed as to the best way to proceed in the future data policy with respect to protecting remote sensing imagery. Copyright or licensing appear to be the competing options.

Operational Data Use vs. Developmental Data Use

1. Data access policies in support of the development of new applications of remote sensing both commercial and for the public good are to be encouraged

Bulk Monitoring Use vs. Specialized Intensive One-time Use

1. Data policy should encourage bulk buyers, but at the same time, make it convenient for high value added applications to take root among users who would use only a few images. New ordering technologies and developing a value-added community will facilitate this policy.

9. CONCLUSION

The need for and importance of a coherent national remote sensing data policy and policy framework have been highlighted, along with the key players involved both from a national and international perspective. The principles that are likely to drive the development of a policy framework have been presented. Impediments to the use of remote sensing have been examined, leading to the conclusion that many of these are related to data policy. With this basis, a policy framework that deals with the major remote sensing data policy issues has been presented.

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Table 1
Principles Relating to Remote Sensing of the Earth from Outer Space¹

- RS activities will be carried out in the interests of all countries irrespective of their degree of economic, social or scientific and technological development.
- RS activities will be conducted according to international law, including the Charter of the UN, and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Celestial Bodies.
- Freedom of exploration and use of space on the basis of equality, respect for sovereignty, and without being detrimental to the sensed state.
- States carrying out remote sensing will promote international cooperation and make opportunities available for participation based on equitable and mutually acceptable terms.
- To maximize benefits states are encouraged to provide for the establishment of data collecting and storage stations and processing and interpretation facilities.
- States participating in remote sensing activities shall make available technical assistance to other interested states on mutually agreed terms.
- The UN and relevant agencies within the UN system shall promote international cooperation including technical assistance and coordination
- Remote sensing shall promote the protection of the Earth's natural environment.
- Remote sensing shall promote the protection of mankind from natural disasters.
- As soon as the primary and processed data concerning the territory under its jurisdiction are produced, the sensed state shall have access to them on a non-discriminatory basis and on reasonable cost terms. The sensed state shall have access to the available analyzed information on the same basis and terms, taking into special account the needs of developing countries.
- States carrying out remote sensing of the earth shall upon request of states whose territories have been sensed enter into consultations in order to make available opportunities for participation to enhance mutual benefits.
- States shall bear international responsibility for ensuring that activities carried out by governmental or non-governmental entities are done in accordance with the principles cited.
- Any disputes resulting from the application of these principles shall be resolved through established procedures.
- Data collection is permitted under international law.

¹**The wording in this table should not be cited for the wording of the Principles.**

Table 2
Principles Underlying the Remote Sensing Data Policy Question in Canada

International or External Drivers	Domestic Drivers: Government, Industry, Academe
<ul style="list-style-type: none"> • follow UN Principles (as detailed below). • non-discriminatory access on reasonable cost terms. • access to analyzed information. • respect for sovereignty. • opportunities for others (especially less developed countries) to participate. • promote protection of mankind from natural disasters. • international cooperation and access to data from other national or corporate remote sensing satellites. 	<ul style="list-style-type: none"> • promote international cooperation and make technical assistance available. • establish data collection, storage stations & processing/ interpretation facilities. • protect the Earth's environment. • ensure that internal (domestic) partners adhere to the UN Principles. • data access, satellite operations (CSA). • data reception, archiving, and information generation (OGDs). • quick, easy and affordable access to pre-processed remote sensing data. (including use of new technologies such as the Internet). • secure access to data. • access to standard national products. • support safety and security of Canadians. • balance public/private sector roles. • ensure public good use or social and economic benefits for all Canadians. • maintain and expand expertise with the involvement of the R&D community. • better integration of space-based data and information in other systems • create sustained demand through development, production, and promotion of integrated cost-effective information solutions. • partnerships and consensus building between federal, provincial/territorial, industry, and academe. • foster the development of a knowledge-based industry. • foster the growth of that industry. • ensure SMEs can participate in the Canadian Space program. • foster regional development by building on regional strengths. • maintain and expand on Canadian expertise in traditional niches. • privatize and commercialize commercially self-sustainable space activities. • leave to government the responsibility for commercially immature sectors. • build on innovative partnerships in Canada and internationally. • integrate space fully and completely into Government of Canada departments and agencies. • maintain and expand Canada's leadership in remote sensing to obtain the timely, relevant, and essential information for decision making.

Table 3 Impediments and User Concerns Relating to the Use of Remotely Sensed Data		
Data	Human and Other Resources	Information
<ul style="list-style-type: none"> • The cost of data too high for a large area – why can I not buy in bulk? • The cost of data is too high to do my test. • Access is too difficult. • The data are the wrong format to fit our data systems. • Data continuity is not assured – why change my systems to use it? • I want information, not pictures. • Licensing rules and royalties makes sharing data with others difficult/impossible. • Delivery is too slow for our needs. • I don't trust the security - our order and area of interest may be leaked. • There is no consistency in results year to year. • There are too many choices, who should we believe? • I don't want to search all over for the different data sets – is there a clearing house? • The spatial resolution available is inadequate. • I don't trust a foreign supplier. • I can't get data for my area of interest. • I won't buy important data from a competitor. • How can I be assured that my image will be acquired when I need it? • I want to own the rights to anything we do. • Our policy states that we must post the results on the Internet, their policy prevents that. • What is in the archive? • Who controls the archive? • How far back does the archive go? • My work is for the general good of the people of Canada (or province X, Y, or Z, or developing country A, B, or C) – why do I have to pay so much for the data? 	<ul style="list-style-type: none"> • We have no experience with this, I got my degree 25 yrs ago! • We have no trained staff and cannot afford a contractor • There is no champion in our organization • The data are too hard to use • There is no training available • I don't know anyone in the field • We lack the necessary technology. • We have no capital budget to buy the technology we need. • Existing methods cost less, why would we change to this? • Airborne data are as cheap and we have the supplier and technology in place. • The technology is too hard to use. 	<ul style="list-style-type: none"> • We lack awareness of the capability. • There are no manuals. • No-one else is using it in our industry, why should we work on the bleeding edge? • There are no believable economic studies on the value of this to us. • There are no applicable demonstrations available • RS gives us a competitive edge - we won't share information on how to use it with our competition. • We are skeptical of the promises made, just as we were the last time. • Isn't this all controlled by the US military? • We tried that software available free on the Internet – it didn't work, so that's it. • Didn't one of those space companies doing this work go bankrupt?