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# SATELLITE DATA DISSEMINATION POLICY AND INTERNATIONAL SECURITY

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## ABSTRACT

The role of satellite imagery today in the security environment is increasing more than ever. The development of the commercial remote sensing sector adds to the need for establishing international and national policy frameworks for the use of satellite data for peaceful purposes. This paper will discuss international data dissemination policy and other regulatory frameworks with respect to various national policies and international coordination efforts made so far. The role of satellite data in the IAEA strengthened safeguards system will be discussed, identifying legal and policy issues in the use of satellite imagery in the field of international safeguards. Having analysed the various uses of satellite data from a military, civil and commercial perspective, the paper will argue the case for an international data dissemination policy. Such a policy should facilitate the use of satellite data by international and national organizations and other entities, in order to enhance international peace and security. The challenge lies in the art of institutionalization of the different levels of regulating space activities, with the aim of promotion of international common goals.

## 1. Introduction

The use of high-resolution[1] satellite imagery for surveillance purposes has been one of the prime applications of remote sensing capabilities[2]. Nevertheless, the data from such technologies has often been deemed as sensitive to national security and therefore, is not usually released into the public domain. Having said this, these surveillance technologies are usually separated from the civil Earth observation missions and the commercial systems that are supposedly 'open' to the public. The technical convergence of these traditionally divided domains, as well as the recent international requirement for treaty verification[3] has lead to a turning point in the role of Earth observation data in the international security regime.

Whereas in earlier times, the principal function of treaties was to record bilateral political settlements and arrangements, today, the main focus of treaty practice has moved to multilateral regulatory agreements, for example, in the field of environment, human rights, free trade or international security, addressing complex problems that require cooperative action among states[4]. These problems often have a trans-national and trans-generational nature. It is a curious fact that the emergence of such problems—surrounding what we call "common interest"—coincides with the dawn of the space era, when the human race became able

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to see the Earth from space for their own. With the technological developments, as well as the availability of commercial satellite imagery with quality comparable to military satellites, satellite imagery has come into use for supporting such multilateral efforts in the last few decades, especially in the field of environment and international security.

Over the last few years, the term 'international security' has come to be defined by a new set of threats such as the proliferation of weapons of mass destruction, terrorism, regional security etc. It should be noted here that although these are noted as the key threats affecting international security today, other more 'disguised' threats also exist, such as the movement of large numbers of refugees, the scarcity of clean water resources and the impact of natural disasters. These additional issues also have a subsequent knock-on effect on international security. The discussions on "international security" in this paper, however, will be primarily limited to the context of supporting the non-proliferation of nuclear weapons, in the framework of the IAEA safeguards.

What is the role of satellite data in the international safeguards system? What are the impacts of national legal and policy institutions, and is there a need for an international institution or policy in this regard? The purpose of this paper is to answer these questions, and to propose a future scheme for the use of civil earth observation satellite data in international security. The role of satellite data in the IAEA strengthened safeguards programme will be discussed. Subsequently, legal and policy issues affecting the use of satellite imagery in the field of international safeguards will be identified. Having analysed the uses of satellite data from a military, civil and commercial perspective, the paper will argue the case for an international data dissemination policy and the need for discussing the different levels – from legal to political, formal organizations to informal institutions, degree of centralization, actors and goals- of such a regulatory framework, in order to meet the requirement of verifying treaty compliance to accomplish international common goals.

The reader must note that the authors do not intend to provide a detailed description of the international data dissemination policy itself; rather the purpose is to highlight the need for discussion in regards to the formulation of such a policy. Furthermore, as this paper is a cooperative work by researchers of different academic backgrounds, the aim is also to propose a way of thinking that combines technical, legal and political expertise.

## 2. Background

### 2.1 History and Technology

Prior to the utilization of earth observation satellites, the highest pictures of the Earth's surface were obtained using capabilities such as the Explorer II balloon in 1935. This was followed several decades later by the use of the United States, Lockheed Martin built, U2 spy planes, which flew at high altitudes in order to captures pictures of particular regions including the USSR. Unfortunately, on 1 May 1960, the vulnerability of such measures were demonstrated when a U2 plane was shot down by the USSR. This incident accentuated the potential advantages of earth observation satellites, thus causing the US to accelerate the development of its CORONA program.

On 14 August 1959, an image of the Earth was transmitted from space for the first time. Of course, as the development of the US reconnaissance satellites continued the USSR was also conducting its own research under the Zenit Program into this particular area. From 1964 onwards, the former Soviet Union launched a series of spy satellites under the guise of the 'Kosmos' programme.

The Landsat satellite (originally named ERTS-1) launched on 23 July1972 was the first satellite used to sell Earth observation imagery. This move opened an entirely new market, which saw the launch of the French SPOT satellites, offering imagery with a 10m resolution. This was followed by the former

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USSR (5m resolution), Canada (RADARSAT-1 – 9m (fine mode) and 25m (coarse mode), India (IRS series – less than 5m resolution and the Cartosat series – less than 1m resolution), Israel (EROS series – EROS-B currently offers 0.7m resolution) and Germany (TerraSAR-X with 1-2m resolution). There is also the Quickbird satellite, which offers a resolution of 0.6m.

## 2.2 The Role of Satellite Earth Observation Data Today - Civil

The capabilities and applications of Earth observation satellites have increased dramatically in recent years. Whereas the public awareness of the applications of Earth observation satellites tends to focus on meteorology, in reality, this is only one aspect of the planned Earth observation satellite missions in the world. The other areas apply to a diverse range of research, operational and commercial activities, for example: atmospheric observations such as aerosols, humidity, temperature, wind, cloud, precipitation, ozone etc; land observations including landscape topography, soil moisture, vegetation, surface temperature, and acquire imagery for multiple purposes; ocean observations including ocean color, ocean topography, ocean surface winds, surface temperature, ocean waves etc.; snow and ice observation; and gravity and magnetic fields observation[5]. Various users including researchers and operational users in national and international organizations and international research programmes use these observations. The data could be applied to meteorology, Earth science research, mapping, infrastructure planning, agriculture, forestry, fishery, disaster management, surveillance and other fields. Table 1 shows currently operated civil and commercial high-resolution satellite missions.

| Country | Mission | Launch | Resolution (m) (panchromatic) | Resolution(m) (Multispectral) | Resolution(m) (SAR) |
|---|---|---|---|---|---|
| Brazil & China | CBERS | 10.2003 | | 20 | |
| Canada | Radarsat | 11/1995 | | | 8 |
| Europe | Envisat | 03/2001 | | | 10 |
| France | SPOT-5 | 05/2004 | 2.5 | 10 | |
| India | IRS-1C, 1D<br>IRS-P6 (Resourcesat)<br>TES | 12/1995, 09/1997<br>10/2003<br>10/2001 | 5.8<br>5.8<br>1 | 23.6 | |
| Israel | EROS-1 | 12/2000 | 2 | | |
| Japan | ALOS | 01/2007 | 2.5 | 10 | |
| Republic of Korea | KOMPSAT-1<br>KOMPSAT-2 | 12/1999<br>07/2006 | 6.6<br>1 | <br>4 | |
| Russia | Resurs-01 | 07/1999 | 2 | 30 | |
| Republic of China (Taiwan) | Formosat-2 | 05/2004 | 2 | 8 | |
| USA | Landsat-7<br>Ikonos-2<br>QuickBird-2<br>Orbview-3<br>EO-1 | 04/1999<br>09/1999<br>10/2001<br>06/2003<br>11/2000 | 15<br>0.8-1<br>0.61<br>1<br>10 | 30<br>2.44<br>4<br>20(9 bands)<br>30(220bands) | |

Table 1: Currently Operated Civil (including commercial) High Resolution Satellite Missions

## 2.3 The Role of Satellite Earth Observation Data Today - Military

Military Earth observation satellites are used for a wide array for applications. Civil Earth observation satellites are utilized by organizations such as the IAEA in order to verify that member countries are complying with the regulations of the Nuclear non-Proliferation Treaty (NPT). In the next chapter, a closer examination will be given into this case. However, countries also utilize their own military satellites in order to ensure compliance independently for national security purposes.

Another area within which military earth observation satellites are utilized is the detection of various types of missile launch sites and other such military infrastructures. If an image analyst is able to discern particular characteristics portrayed within the satellite images of such sites, it is possible that an intelligent estimate of the military capability of

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a country could be determined[6].

As mentioned earlier, military observation satellites also provide an indispensable component during combat operations. Satellite imagery is a critical component that provides the necessary intelligence needed for the coordination of command, control and communications.

## 3. The NPT Regime and Satellite Imagery

### 3.1 Verification of Treaty Compliance

International treaties and agreements, especially in the field of non-proliferation and arms control, often call for continuous verification measures. "Verification" in this sense can be defined as follows: "a process in which data are collected, collated and analysed in order to make an informed judgment as to whether a party is complying with its obligations. Such obligations may derive from many sources, among the most important of which are multilateral treaties and/or agreements (including the Charter of the United Nations itself), bilateral treaties and/or agreements, decisions of competent multilateral organs (including the General Assembly and the Security Council) and/or unilateral commitments undertaken by a party or parties which they then seek to have verified." [7] The term verification is used extensively in treaties on arms control, such as "international verification of compliance with it" (CTBT)[8], or in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[9], non-nuclear weapon State Parties undertake to accept safeguards "for the exclusive purpose of verification of the fulfilment of its obligations assumed under this Treaty".

### 3.2 International Frameworks Concerning Nuclear Non-proliferation

International frameworks for non-proliferation are outlined in table 2. The NPT is a foundation of the international nuclear non-proliferation regime. It provides incentives and reassurance to states willing to renounce nuclear weapons. Under this treaty, Nuclear Weapon States (namely, US, Russia, UK, France and China) undertake to prevent proliferation of nuclear weapons to Non-nuclear Weapon States (Art. I), while recognizing the right to the peaceful uses of nuclear energy, along with the obligation to undertake such activities under IAEA safeguards (Art. II, III, IV & V). Each State undertakes also to pursue negotiations in good faith on cessation of nuclear arms race and nuclear disarmament (Art. VI).

Treaties/Conventions

| NPT | CTBT | FMCT(*1) | NWFZ(*2) treaties |
|---|---|---|---|
| Effective since Mar. 1970 | Not in force | Negotiation to be initiated | Treaty of Tlatelalco; Rarotonga; Bankok; Pelindaba |

*1: Fissle Material Cut-Off Treaty
*2: Nuclear Weapon Free Zone

Other frameworks

| IAEA Safeguards Agreement (bi-lateral) | IAEA Additional Protocol (bi-lateral) | International cooperation for non-proliferation | Bi-lateral Atomic Energy Cooperation Agreements |
|---|---|---|---|
| Obligation under NPT Art. 3 | Protocol to Safeguards Agt, to strengthen safeguards system | UNGA Res., G8 Summit etc. | |

Table 2: International Frameworks for Nuclear Non-proliferation

### 3.3 The IAEA Strengthened Safeguards System and Satellite Imagery as "Open Source Information"

In bilateral arms control agreement frameworks as well as in IAEA safeguards, satellite imagery has been used as National Technical Means. However, the use and process in which satellite imagery is used changes with the IAEA strengthened safeguards system. In the 1990s, with the experience of the secretive nuclear development by Iraq that lead to the conclusion that the IAEA safeguards system was not always sufficiently effective in detecting undeclared nuclear material and atomic activities, the IAEA decided to take measures to strengthen its safeguards. In 1993, based on the recommendations by the Standing Advisory Group on Safeguards Implementation (SAGSI), the IAEA was tasked to produce and test effective and efficient safeguards measures,

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which was called "Programme 93+2"[10]. Through this programme, the IAEA obtained the function to gather information from wider sources and an analytical measure of such information, with the aim to assure the absence of undeclared nuclear and/or atomic activities. These measures are to be later formalized as the Additional Protocol[11].

Whereas under the comprehensive safeguards agreements, the assessment of non-diversion of nuclear material was made for each nuclear facility, under the strengthened safeguards, the evaluation has been broadened to the State-level[12]. The evaluation process has changed significantly as well. All information available to the IAEA is considered in the process, State declarations, information from verification activities, visits or complementary access, from open source, third party or satellite imagery, to draw the conclusion that (1) no indication of the diversion of nuclear material placed under safeguards; and (2) no indication of undeclared nuclear material or activities. It was impossible to assess (2) under the former safeguards mechanism. Information categorized as "open source information" include publications, databases and related literature, NGO reports, media and news reports, Internet sources, and commercial satellite imagery.

In February 1993, when the case of the Democratic People's Republic of Korea (DPRK) atomic energy development was suspected, satellite imagery was shown to the Board of Governors as evidence on the grave inconsistency between information of the State's report and the IAEA's inspections. As a result of this incident, it is said that satellite imagery was recognized as a necessary information source for IAEA safeguards.

With the continuing enhancement and availability of commercial satellite imagery, it has become a regular tool for IAEA safeguards activities. The IAEA is not a satellite operator furthermore, in the past the IAEA also did not contain its own expertise on satellite imagery analysis. Subsequently, the IAEA asked its Member States for support on this task, called "Commercial Satellite Imagery Analysis and Photo Interpretation Support", accepted by 7 Member States (Canada, France, Germany, Russia, Sweden, UK, US and Japan). Starting from experimental use, a satellite imagery laboratory was set up at the IAEA in 2002, and was integrated into the open source organization. In 2004/2005, regular budget funds were provided for the laboratory, in order to allow for the purchase of imagery without extra-budgetary funds.[13].

Nevertheless, several challenges still exist[14]. The first one concerns technical aspects such as improving spatial and time resolution, as well as developing an "all weather, day & night" site monitoring capabilities and to detect/identify underground structures by using radar techniques[15]. The second and third involve legal and policy issues. One is the issue of "shutter control", as seen in the case of US intervention to satellite imagery dissemination during the Afghanistan Crisis and the Gulf War. The other challenge involves independency and reliability of data. With the aim of supporting treaty compliance verification, it is important that the information – even if it is commercially operated - is independent from any State's national interest, and that it is reliable as base information to assess the presence/absence of nuclear or atomic activities. For such discussions, it is necessary to look into the national legal and policy frameworks, which we will attempt in the following chapter.

## 4. National Data Policies

### 4.1 US

The statute which currently governs US commercial remote sensing activities is under the Land Remote Sensing Policy Act of 1992[16]. The law provided for continued government procurement and support of remote sensing systems, including *Landsat 7* and its successor, if necessary.[17] The Policy Act requires that all domestic, privately-owned remote sensing systems be licensed, and gives licensing authority to the Secretary of Commerce, who consults with the Secretaries of Defence and State to ensure that national security and foreign policy concerns regarding individual systems are addressed[18]. In March 1994, The Presidential Decision Directive 23 (PDD 23)[19] was issued, the first formal policy on licensing

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of commercial remote sensing. While the policy allows commercial companies to sell data to other countries, it translates the language of the 1992 Act on conditions that allows the US Government access to limit data collection and/or distribution during periods when national security, international obligations and/or foreign policies may be compromised.

In April 2003, the US Commercial Remote Sensing Policy was released. Its goal is "to advance and protect U.S. national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities, and by sustaining and enhancing the U.S. remote sensing industry." And in doing so, the US Government will "(r)ely to the maximum practical extent on U.S. commercial remote sensing space capabilities for filling imagery and geospatial needs for military, intelligence, foreign policy, homeland security, and civil users"[20] The 2003 policy does not emphasize the ."limitation of data collection and/or distribution" but states that the US Government "may condition the operation of U.S. commercial remote sensing space systems to ensure appropriate measures are implemented to protect U.S. national security and foreign policy interests". It is observed that this reflects the fact that even during major military operations, the US Government averted taking formal "shutter control" measures, instead, taking measures such as gaining exclusive access to high-resolution commercial imagery[21].Although there remains questions as to the substantial effect to the use of satellite imagery as "open source information" for treaty compliance verification, it may well be assessed that the US government is intending to foster a stronger commercial industry by lifting the ambiguous risks of "shutter control" and by guiding the industry by emphasizing that the development of commercial remote sensing industry would meet US national interests.

4.2 Europe

Although within European legislation on space activities there is no provision on the dissemination of remote sensing data, specific data policies are defined at the level of policy guidelines. The European Space Agency (ESA) data policy for *Envisat*[22] respects the widest availability of data to all interested users each of whom has free access to the data on an open and non-discriminatory basis, in conformity with the United Nations Principles Relating to Remote Sensing from Outer Space [hereinafter "UN Principles"][23], and in practice, through contracts concluded for those who submit data requests, it is recognized by the user that the full title of data is held by ESA.

The French distribution policy for space-based Earth observation data states that the basic principle is the distribution of Earth observation data should produce a return on the investment, Thus it implies "control" of the data, and the legal mechanisms relating to "reservation" (copyright and other forms of intellectual property) must allow control of un-enhanced and processed data for the benefit of the satellite operator. The UN Principles of non-discriminatory access to data are also reaffirmed. However, there may be restrictions on the dissemination of and access to data for national security reasons[24].

4.3 Canada

The Remote Sensing Systems Act[25] which, was enacted in 2005 aims at protecting Canada's national security, national defence and foreign policy interests, while supporting continued leadership in the provision of satellite remote sensing data and services[26]. The Act provides that "(n)o person shall operate a remote sensing space system in any manner, directly or indirectly, except under the authority of a licence", establishing a licensing regime for remote sensing space systems and provides for restrictions on the distribution of data gathered by these systems. Under Articles 14 and 15, The Act gives special powers to the Government of Canada to order priority access or the interruption of service when it is deemed necessary to protect national security, defence or international relations interests and to observe international obligations.

4.4 Asia

In Japan, the Law Concerning the Japan Aerospace Exploration Agency[27] governs

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JAXA's activities. The Law requires JAXA's activities to be only for peaceful purposes (Art. 4), based on the Diet resolution of 1969[28].A new "Basic Law of Space Activities"[29] has been submitted to the House of Representatives on 20 June 2007. The objective of the new legislation is to review the R&D oriented space development policy to establish a balanced space policy with three pillars: "comprehensive security", "promotion of industry" and "research and development". It is intended to override the Diet resolution in 1969 on "exclusively peaceful purposes", by which Japan's space activities have been practically limited to "non-military" activities[30]. The changes in the "peaceful-purposes" interpretation would certainly affect future Earth observation mission planning, especially for defence purposes. Japanese governmental Earth observation satellite data has been commercially available through private data distributors (except for the Information Gathering Satellite).

Although India does not yet have a national policy in regards to the dissemination of remote sensing data, it fully supported the development of the 1986 UN Principles Relating to Remote Sensing of the Earth from Space. Furthermore, it is interesting to note that in the past, India's former President, Dr. APJ Abdul Kalam expressed concern over the imagery that is available via the Google Earth software[31]. He noted that areas sensitive to national security (for example the Army Headquarters and Parliament House) could clearly be seen on the Google site. Since then, Google Earth has agreed to 'blur' the areas that are deemed sensitive to India's national security. Many other countries have also followed suit.

4.5 Israel

Israel has a well-established space industry and is considered to be one of the leaders in the development of small satellite technology. In regards to remote sensing, there are two programmes: Ofeq (military) and EROS (commercial). Israel's data policy consists of a clear partition between dedicated military and commercial ventures[32]. This policy is similar to that of the USA and France. It is also important to note that although there appears to be a clear line of division between the use of military and commercial satellite imagery, the commercial satellites may be used during times that are deemed vital to national security.

Israel has also expressed concern in regards to the availability and dissemination of commercial satellite observation data. After the USA's adoption of the Land Remote Sensing Policy Act in 1992, Saudi Arabia, through a company named EIRAD, looked to establish an agreement with the USA in regards to OrbImage[33]. More specifically, Saudi Arabia was looking to acquire rights to the images covering the Middle East region. Israel could not agree with this, expressing concerns that access by Saudi Arabia to such high-resolution imagery would threaten Israel's national security. After much negotiation, the US Senate finally passed an amendment to the 1997 Defense Authorization Act, which prohibited the release of detailed satellite imagery (resolutions below 2m) relating to Israel[34].

4.6 Summary

The examination of national policy indicates the following points: Firstly, while many countries state that their remote sensing activities should be in conformity with the UN Principles, respective State practices, as well as levels of interpretation into domestic law vary significantly. Secondly, although it is understood that in order for a State to maintain "authorization and continuing supervision"[35] over remote sensing commercial activities, the most effective way to achieve this is to have a licensing scheme, this still does not yet exist in many countries. Only the US has an elaborately defined licensing scheme, and Canada is also setting up a new licensing framework Thirdly, States' practice and legislative instruments clearly show concerns as to the dissemination of sensitive commercial high-resolution data. In many cases, States have executed their political power in order to restrict the open dissemination of such data. Thus, the challenges in commercial satellite data use, as "open source information" for IAEA safeguards are evident also when seen from the national policy side.

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## 5. International Dissemination Policy – Is There a Need?

5.1 Issues under International Space Law

International law that regulates States' activities in outer space consists of a set of treaty/conventions and Principles (General Assembly Resolutions). The Outer Space Treaty[36] (OST) and the UN Principles are closely related to the discussions within this paper.

Although it could be argued whether or not the IAEA's use of satellite data is deemed as a "space activity" in the strictest sense, given the active role of the IAEA in acquiring satellite images through satellite operators, and with the IAEA being a member of the United Nations, it is understood that the IAEA would be "at least morally bound and politically well-advised to ensure that the satellite data and images it orders are obtained and handled in full conformity with international space law."[37] Therefore, it could be rightfully argued that the use of satellite images for determining or verifying compliance with, or breach of, nuclear non-proliferation or safeguards obligations is a "peaceful (non-aggressive)" activity under the OST. Therefore, the acquisition, processing and use of Earth observation data for IAEA safeguards purposes are allowed under the OST.

The UN Principles, not being a legally binding instrument, should be regarded more as a guideline to the activities by IAEA. One should note that its definition only covers, "the sensing of the Earth's surface from space… for the purposes of improving natural resources management, land use and the protection of the environment." It is sometimes argued that this does not entail certain missions for surveillance purposes. However, as the current plan of the IAEA is to acquire commercial source data of an open nature, it is likely that in most cases it would fall under the definitions of the UN Principles.

In the UN Principles it is provided that the sensed State should have access to primary and processed data concerning its territory as soon as they are produced, "on a non-discriminatory basis and on reasonable cost terms", and to available analysed information, on the same basis and terms[38]. Although some argue that the IAEA may act in conformity with this provision, it is on the other hand emphasized that such analytical information must be protected, and regarded as confidential as any other detailed safeguards information[39]. It is easily understood that such information would be, at least during a certain critical period, strictly confidential, including the fact that the area has been of interest to the IAEA at all. The same applies to the use of commercial imagery by national agencies, which has extensively become the case in the recent years, with the convergence of imaging capabilities by commercial satellites and military reconnaissance satellites. Thus it is no longer a valid argument that the UN principles only apply to certain satellite missions by definition. As seen in the case of Afghanistan, it is possible sometimes to practically make a detour around this matter, and moreover, without means of notification, the sensed state would practically have no means to know that images over its territory have been taken or purchased at all. We must say that at the point the compromise was made to eliminate the "prior consent" provision during the negotiation of the UN Principles, States have left the matter open to such future developments.

The conclusion of analysis regarding the OST and UN Principles are that the IAEA's procurement and use of data for the purposes of safeguards would be in conformity with at least the legally binding provisions of the OST. Questions still remain with the controversial sections of the UN Principles, though this is not the issue with the IAEA alone, but where a wide variety of State practice exists. National laws and policies of States, as seen in the previous sections, however, may restrict the transfer or impose conditions to the procurement or use of data by the Agency for safeguards purposes.

5.2 Institutional Options and Perspectives

In the recent decades there have been several initiatives to coordinate the various Earth

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observation programs and policies, such as the WMO Global World Weather Watch (WWW)[40] and the Global Earth Observation System of Systems (GEOSS). These international bodies have made efforts in harmonizing the data policies. It is a general agreement, at least within the respective forum, that Earth science data should be made readily available for global change research.[41] GEOSS, in its Ten-Year Implementation Plan, states that there will be "full and open exchange of data, metadata, and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation[42]". With these efforts, the international community is gathering existing efforts with a vision to develop an integrated systematic observation system that would respond to the requirements of international law. Whether this vision of States is realizable depends on the establishment of reliable and independent institutional frameworks on the global, international and national level.

When applied to IAEA safeguards activities, the above observation still stands, though the effort of the international community has concentrated on earth science or environmental issues rather than security, so that there is no internationally harmonised data dissemination policy for such purposes. This is only natural considering the sensitive nature of the issue. However, with the recent developments of the IAEA strengthened safeguards programme and the growing commercial sector, it is possible that in the near future States may agree upon a set of principles – an 'International Data Dissemination Policy' – that provide a smoother path for satellite data use by the IAEA, as part of the international framework for nuclear non-proliferation, or in a broader context.

Furthermore, it is argued that many benefits can be achieved from the utilization of commercial satellite imagery; not only do such capabilities offer a means towards arms control treaty verification, but they also have the potential to contribute to other areas of security, for example: peace-keeping operations and humanitarian assistance (i.e. the monitoring of refugee movement). It is thought that an International Satellite Monitoring Agency (ISMA)[43], similar to that suggested by France in 1978, could be established to ensure the implementation of the International Data Dissemination Policy, as well as monitor crisis areas and provide high-resolution satellite imagery data in regards to other issues affecting international security.

Here, we have an issue on multiple levels in regulating space activities and realising international common interests, whether that be international security, non-proliferation or environmental protection. The conceptual framework is illustrated as in Figure 1.

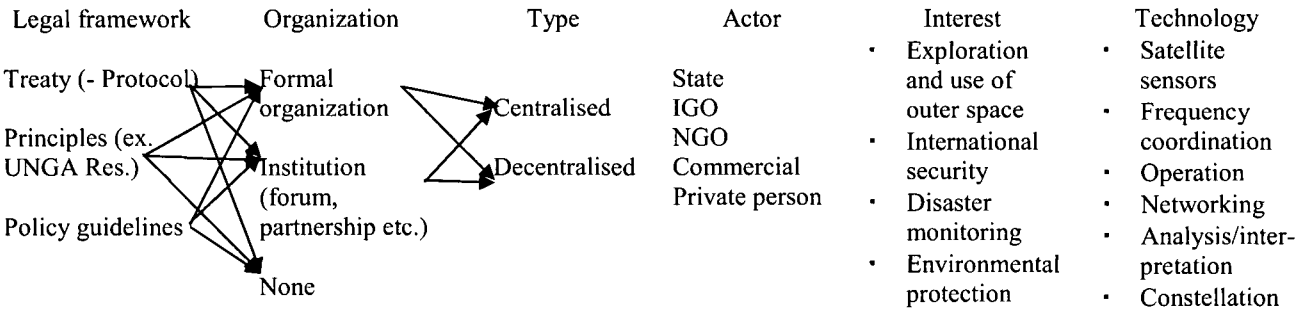


Figure 1: Different Levels in Regulating Space Activities

In order to fulfil the requirements of IAEA safeguards, or any other requirement for the realization of an international common interest, such multiple levels should be elaborately discussed, taking into account the surrounding political as well as technological situations. In this case, the following options may be considered: a) creation of an ISMA; b) agreeing on a set of international data dissemination principles; and c) no need of additional international regulation (i.e. status quo). Each option would involve multiple levels as

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suggested above. At least from the past experience of the proposal of creating an ISMA, it seems that there are much political difficulties surrounding the creation of a centralised international agency. On the other hand, the current development avoiding any modifications or conflict with the existing legal, political and institutional framework seems to be working well for the time being with the IAEA safeguards. However, as discussed earlier in this paper, there are potential risks and unconformities with the present national and international frameworks. An optimal solution, at least in the short term, may therefore lie somewhere in between b) and c), though further continuing discussion is required. In the long run, it may be possible that a centralised monitoring agency or perhaps, an institution in the form of a network of treaty verification measures would be formalised. The challenge lies in the art of institutionalization of these different levels of regulation space activities, with the aim of promotion of international common goals.

## 6. Conclusion – Defining the Levels of an International Data Dissemination Policy

Today – taking into account the rapid development of technologies within the space sector, any individual would be hard pressed to argue that the legal frameworks that exist today provide suitable control of these technologies. In short, the legal frameworks that do exist are very much 'behind the times'.

With focus on the IAEA safeguards system in the NPT regime, the use of satellite imagery for treaty compliance verification has become a routine requirement. However, there are challenges including technical issues as well as the problem of potential "shutter control" and reliability of the data. States' practices vary widely in regards to domestic legislation and/or licensing schemes. Several countries have voiced concern over the dissemination of high-resolution satellite imagery. As a result of this, in some cases, countries have formed bilateral agreements in order to ensure that high-resolution imagery of their respective countries is not made available to the wider public. However, as more and more countries gain remote sensing capabilities, there is now a growing need for discussion at an institutional level in regards to the dissemination of high-resolution commercial satellite imagery.

An examination into international space law showed that the IAEA's procurement and use of data for the purposes of safeguards would be in conformity with at least the legally binding provisions of the OST. Questions still remain with the controversial sections of the UN Principles, though this is not the issue with the IAEA alone, but where a wide variety of State practice exists. Furthermore, different levels of international data dissemination policy were considered, leading to the initial conclusion that the challenge lies in the art of institutionalization of the different levels of regulating space activities, with the aim of promotion of international common goals.

It is important now that the issues of data dissemination policy, as well as the existing information gap between technical experts, policy-makers and diplomats, are discussed in order to appreciate the inherent advantages and efficiency offered by such capabilities.

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[1] 'High resolution' within the context of this paper is defined as approximately 0.6m (i.e. for civil earth observation satellites). The reader should note that if this term were to be applied to military earth observations satellites, then high-resolution would be defined as approximately 0.1m.

[2] a) A satellite image is made up of many dots or 'pixels'. The 'resolution' of a satellite can be defined as the size of the area covered by one dot, or 'pixel' within the image. That is to say, if the resolution of the satellite is 5m, then the area covered within one pixel will be 5m x 5m. Therefore, objects smaller than 5m may not be easily distinguishable in a 5m resolution image. This is more specifically known as the 'spatial resolution'.
b) The 'spectral' resolution of an image is also important as it distinguishes different types of surface (e.g. water and vegetation). This is determined by the reflectance and/or emittance of the feature over a variety of wavelengths. Therefore, the higher the spectral resolution, the more detail that can be discerned.
c) 'Temporal' resolution is defined as the length of time a specific area is imaged. One satellite or multiple satellites can carry this task out. Nowadays, certain organizations (be they civilian or government) require images of a specific area to be captured on a regular basis.

[3] There are a number of studies on this issue, including: Birnie, P.W. and Boyle, A.E., International Law & the Environment, New York: Oxford University Press, 2002, pp.205-209; and Avenhaus, Rudolf et al., *Verifying Treaty Compliance:*

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*Limiting Weapons of Mass Destruction and Monitoring Kyoto Protocol Provisions*, Berlin-Heidelberg: Springer, 2006.

[4] Chayes, Abram and Chayes, Antonia Handler, *The New Sovereignty*, Cambridge: Harvard University Press, 1995, p.1.

[5] See Committee on Earth Observation Satellites, *Earth Observation Handbook*, 2002.

[6] Jasani, Bhupendra (Ed.), *Outer Space: A source of conflict or cooperation?*, Japan: The United Nations University, 1991.

[7] *Verification In All Its Aspects: Including the Role of the United Nations in the Field of Verification*, UN Doc. A/50/377, 1995.

[8] Comprehensive Nuclear Test Ban Treaty, Doc. A/50/1027, 1996, Art.II.

[9] Treaty on the Non-Proliferation of Nuclear Weapons, 729 UNTS 161, Art. III.1.

[10] IAEA, *Strengthening the Effectiveness and Improving the Secretariat's Programme for Assessment, Development and Testing of SAGSI's Recommendations on the Implementation of Safeguards*, GOV/2689, 1993, and *Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System: A Report by the Director General*, 21 February 1995 ("Programme 93+2"), GOV 2784, 1995.

[11] IAEA, *Model Protocol Additional to the Agreements between States and the International Atomic Energy Agency for the Application of Safeguards*, INFCIRC/540, 1997.

[12] For details on this passage see: Schriefer, Dirk, "The International Level", in Avenhaus, Rudolf et al., *Verifying Treaty Compliance: Limiting Weapons of Mass Destruction and Monitoring Kyoto Protocol Provisions*, Berlin-Heidelberg: Springer, 2006, pp. 435-453.

[13] Ibid., pp. 446-447.

[14] For this discussion also see: Jasani, Bhupendra, "Civil Reconnaissance Satellites", in Ibid., pp. 323-334.

[15] IAEA, SGIT-02 "Commercial Satellite Imagery", in *IAEA Department of Safeguards R&D Programme* 2006-2007, p.82.

[16] Land Remote Sensing Policy Act, Pub. L. 102-555, 15 U.S.C. §§5601 - 5642 (2000) [hereinafter, Policy Act].

[17] Ibid., §§ 5612, 5641.

[18] Ibid., §5657.

[19] U.S. Presidential Decision Directive 23, *Foreign Access To Remote Sensing Space Capabilities*, March 10, 1994.

[20] US Commercial Remote Sensing Policy, Fact Sheet, April 25, 2003.

[21] See Williamson, Ray A. and Baker, John C., *Current US remote sensing policies: opportunities and challenges*, Space Policy 20, 2004, pp.109-116.

22 European Space Agency, *ESA Envisat Data Policy*. ESA/PB-EO (97). rev. 3. Paris, 19 February 1998.

[23] Principles Relating to Remote Sensing of the Earth from Space, UN Doc. A/RES/41/65, annex.

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[25]Canada, An Act governing the operation of remote sensing space systems, 2005, c.45.

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[33] Ibid.

[34] Ibid.

[35] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, UN Doc. A/RES 2222 (XXI), annex., 610 UNTS 205; 6 ILM (1967), 386, Art. VI.

[36] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, UN Doc. A/RES 2222 (XXI), annex., 610 UNTS 205; 6 ILM (1967), 386.

[37] Loosch, R., "Acceptability of the Use of Satellite Imagery for Agency Safeguards Process", in Jasani, Bhupendra and Stein Gotthard eds., Commercial Satellite Imagery: A tactic in nuclear weapon deterrence, Berlin: Springer; Chichester: Praxis Publ., 2002, p. 274.

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