

REMOTE SENSING

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1. ABSTRACT

Satellite remote sensing has a particularly important role: many initiatives are now operating and others, with more advanced technological possibilities, are planned, often being the result of international co-operation.

In this context it is necessary to establish an appropriate regulation of these activities, as the interests at stake are considerably divergent. Industrialised countries are in fact able to play an active role in the development of space activities, while developing countries, not holding the necessary technology, more or less passively witness such activities.

The most controversial point is the interpretation of the principle of sovereignty, from which both parties move to reach opposite results. In favour of the industrialised countries one can invoke the principles of exploration and use on a non discriminatory basis, laid down by the Outer Space Treaty and also by the Universal Declaration of Human Rights, without mentioning the social and economic opportunities deriving from the development of activities bringing considerable benefits to mankind. It is equally true, though, that other principles exist, asserted to the point of sustain their common law status, such as the principle of permanent sovereignty on natural resources and the principle of non interference in the internal affairs of other States, which are the foundation on which the claims of the sensed States are based.

Taking into special consideration the UN Gen. Ass. Resolution 41/65 of 1986 on the "Principles Relating to Remote Sensing of the Earth from the Outer Space", my paper would illustrate how the international co-operation is pushed on to realise, in concrete manner, all those principles that, at that time, were only programmatic. At moment commercialisation and protection of Remote Sensing data are some of the most interesting arguments in the field of Outer space law.

So the Resolution does not refer to military remote sensing, we will try, in the second part of paper, to demonstrate the legitimacy of remote sensing for military activities.

2. THE UN PRINCIPLES ON REMOTE SENSING OF THE EARTH FROM OUTER SPACE

2.a Conflict between the Principle of Freedom of Outer Space Use and the Principle of sovereignty of the States

Sovereignty, the identifying element of any State entity, presents itself in different forms. The breadth of the concept allows different interpretations according to the aspect being favoured¹.

Developing countries assert that sovereignty on resources² extends to the information regarding the latter³. Although remote sensing takes place in outer space, the data gathered concerns portions of the Earth's surface where the principle of non interference in the internal affairs and the wider principle of sovereignty of a single State are put into evidence; according to the sensed State, the State itself should give its prior consent to the activity.

The need for prior consent has always been contested by industrialised countries capable of carrying out remote sensing activities according to the principle of freedom of exploration and use on a non discriminatory basis for all the States laid down by the Outer Space Treaty⁴.

The technical advancement and the benefits gained by all the States through remote sensing have lead developing countries to relax their initial opposition. Their demands have changed from the request of prior consent to the right of priority access for the sensed State to information regarding territory under its jurisdiction. Furthermore, the State should be free to decide if and within which limits, access should be granted to third party States.

The United Nations Resolution 41/65 of 1986⁵ on the principles regulating remote sensing activity did not accept such demands. Considering the purposes of remote sensing to improve "natural resources management, land use and the protection of environment" (princ. 1,a), it can be said that it is common interest of all States to know the amount of resources totally available, and also the information useful for a more rational land use and for protection of environment. Dissemination of data to third party States is definitely appropriate and should not be conditional on the approval of the sensed State.

The United Nations resolution has become a sort of compromise, indicating a "code of conduct" to follow when using the satellites and when disseminating the obtained data⁶. The efforts of the United Nations have focused primarily on allowing that as many subjects as possible benefit from the advantage of remote sensing, determining access to data on a non discriminatory basis and at reasonable cost terms.

2.b Commercialisation of data

The use of the data and the packaging of the relevant products require great investments by the industries and the latter are not willing to make these investments if a legal protection of the products and a technological follow-up for at least ten years is not assured.

Principle XII, does not exclude the commercialisation of data. The States financing these programmes, either directly or through international organisations, want to at least benefit of a return of investments.

Before mentioning any kind of protection, it is therefore necessary to distinguish between primary and processed data, according to UN terminology. **Primary data** is made up of electromagnetic waves refracted by the earth's globe, sensed by satellites, transformed into numeric signals and returned to the ground, while **processed data** means the products resulting from processing (through geometric or radiometric corrections). **Analysed information** means the information resulting from the interpretation of processed data, imputes, of data and knowledge from other sources(cartographic, geological, aerometrical,

naval etc).⁷

The most frequent form of protection of the remote sensing data, protecting from improper appropriation, reproduction and distribution, is the right of intellectual property. The Bern Convention of 1886 and its subsequent modifications would allow protection through copyright. However, the assimilation of the technical organisation of a computer archive, consisting in a data base, to a literary work has been rather criticised. The Convention mentions "a collection of works" and not a "collection of data" and wishes to protect originality, the creation of the work, the fruit of the intervention of a human mind. With an extensive interpretation which considers the technical evolution that the "works" have suffered, one could think that this kind of protection could be applied also to a certain number of data bases with a high documentary added value (processed data and analysed information) where it is possible to find human intervention and originality, but this is hardly applicable to computer products which are the fruit of an automated process, such as the primary data⁸.

An interesting solution to the problem could be offered by the already mentioned Directive of the European Parliament and Council of 11 March 1996 concerning the legal protection of a data base⁹.

Copyright is based on the principle that a piece of work requires fixation, whereas primary data are in most cases broadcast without being fixed.

According to literary and artistic property, the only thing which could be protected is the visual form, but at satellite level the product of the operation is only a flux of signals and not an image. In fact, the data emitted by the satellite are only natural waves transformed by an automatic means and therefore not subject to copyright because they are pre-existent to the satellite intervention and they are not a subsequent creation. The emitted data can only be the raw matter of a computer creation (a data base), but they cannot be protected.

The processing is not technically possible without the co-operation of the organisation which manages the satellite. The operation to be legally controlled is therefore the processing of the data. The data, to be usable, must be corrected with the use of other data which, according to the terminology of the Directive, have the same nature of a logic system or programme. The processing therefore passes under the legal control of the organisation managing the satellite which alone dominates the programme.

The original quality of the programme cannot be denied because the intellectual contribution for its creation is evident. Intellectual property is therefore granted to whoever is entitled to the rights of the programme, that is to say the organisation managing the satellite.

The States are certainly free to extend the protection also to the data not answering the characteristics established by the Convention with the risk, however, that they do not make use of the obligation of protection and of the mechanisms of reciprocity in the countries of the Union.

The law of United States does not imply a protection of the remote sensing data by use of copyright, which would have created a legal protection *erga omnes* and a free exploitation by its owner, but through the use of the confidential trade secret procedure. The

information is a confidential trade secret of EOSAT and its reproduction would cause a misappropriation of the trade secret itself. The American legislator, fearing that the holders of the data could make illicit profits, preferred to chose this form of protection¹⁰.

In France, on the contrary to what happened in the United States, no law regulates the legal regime of the activities of the SPOT remote sensing satellites. The law of July 3rd 1985 on the "logiciels" protected by copyright is applied analogically also to the collection of the remote sensing data. The private commercial company SPOT IMAGE has a licence for the distribution, on a world basis, of the data coming from the SPOT satellites whose copyrights belong to the Centre National d'Etudes Spatiales (CNES).

In the name and in favour of the States participating in the ERS programs the European Space Agency has the right of property of the two satellites ERS1 and ERS2 of which the matriculation was ensured.

The distribution of data is carried out on a non-discriminatory basis and without overlooking the rules of international competition. In order to ensure the protection of the satellite's data against any unauthorised reproduction and distribution the Agency shall keep the full property of the satellite data including the rights of intellectual property. The formula chosen is that of copyright even though the criticisms to the system, especially for the primary data.

To come back to the UN Principles we have more to underline that the Principle XII, without excluding the commercialisation of data, establishes that the sensed State has access to primary and processed data. The principle refers only to the analysed information in the possession of the States, excluding that in the possession of private entities. The observing entity may freely dispose of the data in its possession in observance of the freedom of disseminating and receiving information "regardless of frontiers", especially if it is in the interest of the whole community¹¹. In actual fact, the exclusion of sensed States from access to analysed information in the hands of private entities (whose participation in remote sensing activities is becoming more and more relevant) has weekend the importance of the resolution.

Without limiting private enterprise (the motor of the economic system) through interferences on the part of the State system, it would be necessary that the data be made available to the sensed States on mutually acceptable price terms, that is to say at production cost or with a formula similar to the clause of the more favoured nation.

In keeping with the purposes of remote sensing laid down by the above mentioned principle 1, it would have been necessary to have placed a few limitations on space resolution. When resolution exceeds 10 m. an already remarkably low limit, it cannot be affirmed that the purpose of Earth observation is the improvement of "natural resources management, land use and protection of environment", but a control of human activities. To obviate this inconsistency, satellites equipped with sensors having a space resolution higher than 10 m should be expressly left out of the field of application of the whole discipline. The sensed State would otherwise have to be granted the right of priority access to this kind of data and the freedom of deciding if and to which other entities to transmit this information. Specification of space resolution is highly necessary considering the launching of the so called Mediosat, satellites managed by the media heaving very high resolution values (5 or 3 metres).

The regulation of liability, which presents innovative elements for space law compared to international law, is briefly dealt with in principle XIV. While the first sentence of this principle explains the particular liability system dealt with in the Outer Space Treaty and in Convention on Liability of 1972, the next sentence establishes the applicability of the norms of international law on deriving activities not taking place in outer space. From the interpretative statements it is clear that industrialised countries oppose a particular liability system, suggested in the Brazilian proposition, for the dissemination of data similar to the provision for space activities. It is particularly difficult to answer any obligation deriving from behaviour of private entities in view of the prospect of privatising remote sensing activities and of the knowledge that more and more sophisticated sensors, with a resolution over 10 m. allow observation of human activities.

2.c Principles on the Protection of Environment

Principles X and XI will be studied thoroughly because they could induce a special system for the dissemination and use of data for the protection of environment¹².

The protection of environment is one of the most urgent problems of the modern world, both for the developing and the industrialised countries. It has serious and complex aspects, on one hand because at times the pollution phenomenon reaches catastrophic proportions or often exceeds the sphere of sovereignty of each State involving the sovereignty of other countries or common areas, and on the other hand because a higher authority is missing from the international point of view for the prevention, control and removal of its causes.

In order to be protected the environment must be studied, its deterioration identified and its remedies discovered. The lack of balance existing on Earth is due either to natural causes or to the irrational use of its resources by mankind¹³. Remote sensing can intervene and give an important contribution to be completed with actions on Earth to establish the state of environment. By giving many and precise details it allows a faster and more effective, and at times less expensive, intervention¹⁴. Therefore the link between the two branches is stressed.

The use of remote sensing has become extremely important for many countries which have developed more and more sophisticated satellite programs.

The acknowledgement of the necessity of preserving the State of our environment, be it oceanic, continental or atmospheric, has caused a growing need for global observation.

The legal problem we are interested in is to see how the satellite data, especially the data concerning the protection of the Earth's environment, may be largely distributed and used for the benefit of all the States in accordance with the Outer Space Treaty and with the draft resolution of the Spring meeting of 1996¹⁵.

With remote sensing the States will pursue the purpose of improving natural resources management, land use and the protection of the environment (principle 1,a). The offset of the principle, which is remarkably controversial, is found in principle II where it is stated that remote sensing activities shall be carried out for the benefit and in the interest of all

countries and in principle V where the States, carrying out remote sensing activities, are asked to promote international co-operation. If a wider distribution to all countries of the remote sensing data concerning environmental protection were to be carried out these aims would be substantially already reached. Unfortunately the dispositions of the resolution of the principles do not help very much in this sense.

Principle X establishes that remote sensing shall promote the protection of the Earth's natural environment. For this purpose States participating in remote sensing activities that have identified information in their possession that is capable of averting any phenomenon harmful to the Earth's environment shall disclose such information to the States concerned.

Principle XII indicates, rather generically, that all States must have access to the data on a non-discriminatory basis and on reasonable cost terms. The principles do not impose any obligation to gratuity or mutual exchange of data. They do not mention questions concerning the international commercialisation of the data, the notion of public service, the tariff regulations and the intellectual property. The rules have been imposed by practise by the single States or by the ESA or they are included in some national regulation.

The consultation with a State whose territory is sensed in order to make available opportunities for participation and enhance mutual benefits to be derived therefrom (principle XIII) is not compulsory for the State carrying out the remote sensing.

The promotion of international co-operation, including technical assistance and co-ordination in the area of remote sensing (principle VIII) is entrusted to the United Nations and the relevant agencies within the UN system and to the initiative of each State¹⁶.

An opening towards a help policy is offered by the second part of principle XII where it is stated that when giving access to the observed States to the primary data and the processed data concerning the territory under their jurisdiction, the State participating in remote sensing activities must take into particular account the needs and interests of the developing countries. In this case the reasonable cost terms must be particularly favourable¹⁷.

2.d A functional aerospace environment system

The freedom of access to information on environmental matters had already been ensured, in the Community, by the Directive 330 of the Council dated June 7th 1990 with the purpose of "guaranteeing freedom of access to information concerning environment in possession of public authorities and the diffusion of the same"¹⁸. The information on environment coming from remote sensing may be included in the information of the public authorities, also included in the data base, concerning the state of the environment and the activities or measures damaging it. This information must be given to any requesting natural or artificial person without the latter having to prove their interest.

The existence of these provisions seems to confirm the theory on the creation of an "functional aerospace environmental system"¹⁹. The novelty of this formulation consists in denying the necessity of a distinction between air space and outer space, affirming the singleness of aerospace : "sovereignty is a weak barrier against... the degradation of the Earth's environment"²⁰. The necessity of protecting environment has inspired the suggestion

for the setting up of an international authority specialised in this field (World Environment Authority)²¹.

At regional level, the **European Environment Agency** was instituted in the framework of EEC with the Council regulation n. 1210/90 of May 7 1990²². The purpose stated in Article I is to provide the Community and members States with objective and reliable information, comparable on a European level, making it possible to take the necessary measures for the protection of environment. The Agency provides for the gathering, the processing and the analysing of the data. Information must be integrated into international programs of environment monitoring and must be widely disseminated. The "thematic operative centres"; are institutions entrusted with special duties for the Agency in a particular geographical area. All data supplied to the Agency, except classified information, may be published and made available to the public.

The Agency is provided with corporate existence (according to article 7) to guarantee the maximum freedom of management. It has a board of directors made up of a representative of each member State and two representatives of the commission.

Article 19 establishes that the Agency must be "open to Countries not being members of the European Community who share the interests of the Community and the purposes of the Agency". In this context it is to be hoped that an appropriate co-operation policy will be followed regarding the developing countries by providing them at least with data and necessary information for the protection of environment.

Between the international initiatives to create co-ordinating Organisations is to mention the **Committee on Earth Observation Satellites (C.E.O.S.)**, created in 1984 as a result of the international Economic Summit of Industrialised Nations and serves as the focal point for international co-ordination of space-related, Earth observation activities. It is a consultative organisation striving for information exchange, co-ordination and consensus on policy issues.

Findings and recommendations of C.E.O.S. are acted upon at the discretion of each member. C.E.O.S. deliberations and recommendations help members to come to agreement on issues and to ensure appropriate co-ordination among national programs and across the spectrum of space based Earth observation missions and data management activities.

Members are those national and international government agencies with funding and program responsibilities for a satellite Earth observation program currently operating or in the late, stages system development.

The C.E.O.S. plenary meets once year to pursue co-ordination and to receive progress reports from and provide direction to its technical working groups, which each meet up to three times a year.

The C.E.O.S. Working Group on Data plays a very active role in standardising data formats world-wide, working toward an international interoperable catalogue system, developing a lexicon and data dictionary, and

identifying data sets to test a proposed international network for electronic data transmission.

Among the suggestions made by the States to CEOS to adopt an appropriate policy for the commercialisation of data, the American one appears to be most interesting. EOS (NASA Earth Observing System) suggests different agreements for three kind of users. Access to data at a cost no higher than a marginal reproduction cost will be given to researching users, including the other EOS partners in Europe, Canada and Japan, which NASA will choose according to "professional reliability".

Data will also be made available at no more than the marginal cost of reproduction and distribution for operational and environmental monitoring use by affiliated entities providing public service such as weather and sea state forecasting. Commercial arrangements will be established to serve users not affiliated with any of the participating agencies and users interested in commercial endeavours ²³.

Similar comment has led France to consider typically two categories of data: Earth observation data, collected primarily for research in Earth sciences, are disseminated at no cost or cost of reproduction, as general rule; Earth observation data, collected primarily for monitoring and surveying applications historically for well established industry. These data have a commercial value and maximising revenue, as the general rule.

An other international entity is the **Earth Observation World Information Centre (EOWIC)**, proposed to support the international effort to exchange information and data relevant to the Global Change problem. Rather, it will act as an interfacing agency between the operational scientific centres and the general user or potential user. A non profit organisation, strongly supported by the host country as regards financing of the development and maintenance of the infrastructure whilst controlled by a truly international scientific committee and staffed by international personnel, could be envisaged.

The EOWIC will provide the general public, both scientific and application oriented, with all information necessary to access and exploit the various centres and networks established to archive and exchange data relevant to the study and monitoring of Global Change ²⁴.

In general we must to observe that the attention of the public opinion and of politicians has been awakened by revealing signals concerning a possible deterioration of the Earth's environment. Therefore on a national and international level more and more programs are developed for the safeguard of environment and the stabilisation of climate. The interest is no longer of each person but of all mankind and therefore initiatives for the co-ordination of national and international programs of Earth observation have increased. The researchers working in this field must be advantaged for the use of many and precise elements such as remote sensing can offer.

Many European governments and the ESA have shown attention to this problem and they have adopted a policy of distribution of the data which acknowledges the necessity of covering part of their financial investment in the Earth observation systems and also recognises the necessity to maximise the return of the investments in a non monetary sense. Because the main purpose of the public investment in Earth observation is to maximise the public benefit a wider use of the data is one of the ways to reach this aim. For this reason the purpose of the policy of those States and of the ESA tends to establish preferential categories for some users because of the social value of the research. Usually, a special treatment consisting in giving the data free of cost or at reproduction cost, is offered to the research community and to those operational organisations operating for public benefit and on a non commercial basis. This category at present basically includes meteorological services is now ready to encompass other organisations due to the growing interest in environmental monitoring.

On the contrary of what happens in other branches of space applications, such as meteorology and telecommunications, the community of users of satellite observation does not have an organised structure. The observation of Earth must be the privileged field for international co-operation in order to share the costs of the space systems and to avoid duplications and also to reach a larger exchange of the data concerning the Earth's environment and to strengthen the programs, for the benefit of developing countries, for a better management of the resources and their environment.

These aims are pursued by international organisations, among which the most important is the CEOS²⁵.

The need to centralise in regional or international organisations the co-ordination of these space activities, which may be specifically for public benefit, is increasing²⁶. The same above mentioned Draft resolution of the United Nations of Spring 1996 suggests in art. 8 that COPUOS should become "a forum for the exchange of information on national and international activities in the field of co-operation for the exploration and use of outer space".

2.d Principle on the protection of mankind from natural disasters

Principle XI indicates that remote sensing shall promote the protection of mankind from natural disasters. The States participating in remote sensing activities shall transmit data and information in their possession to the States affected by natural disasters or likely to be affected by impending natural disasters. No mention is made of the conditions for disclosing such information; however, because both cases involve information concerning environmental protection and therefore relevant to a public heritage it would be logical for the information to be disclosed free of cost²⁷.

The problem is closely connected to the more general problem concerning a wider and easier diffusion of the data concerning environmental protection²⁸. The satellite data can be useful for the researches of the Earth science which must be

taken into consideration in a correct policy of the States for the construction of urban settlements and for the protection of environment from pollution which can lead to disastrous consequences, especially in **geological risk areas**. The *geological risk* is the combination of geological danger and of the potential human vulnerability of a territory, in relation to the predictable events of geological danger, their intensity and frequency and their relevant interference with human activities²⁹.

Therefore, geological risk is closely connected to human activities and it can be reduced by acting not so much on the geological phenomena, which are hardly controllable, but most of all through mankind's careful and rational use of the territory.

An increasing awareness of the need for a common effort to face the serious problems caused by natural disasters has led the General Assembly of the United Nations to declare, the Nineties (1990-2000) "**The International Decade for Natural Disaster Reduction**" (IDNDR)³⁰.

Among the main aims of this resolution, which created the International Decade, we find the aim "to reduce throughout concerted international actions, especially in developing countries, loss of life, property damage and social and economic disruption caused by natural disasters" and also "to improve the capacity of each country to mitigate the effects of natural disasters" by especially supporting developing countries and fostering "scientific and engineering endeavours aimed at closing critical gaps in knowledge in order to reduce loss of life and property" and to "develop measures for assessment, prediction, prevention and mitigation of natural disasters through programs of technical assistance and technology transfer"³¹.

In order to reach these aims it is necessary to intensify the study of natural disasters that include accurate prediction of the event that may cause or contribute to the cause of disaster and a rapid assessment of the location and extent of damage for quicker and more effective help interventions. This study, which is conducted on Earth by geologists and experts and, in the system of international co-operation of the UN. program, by those entrusted with the management of disasters, can benefit and is benefiting from new terrestrial and space technologies, including Earth Observation Systems, as well as mobile and fixed satellite communication systems³².

It must immediately be stressed that **Remote Sensing satellite systems** are not useful alone for the prevention of the disaster, because they are not able to predict natural phenomena such as the ones above mentioned, which are sudden and unpredictable. Only the meteorological ones can predict climatic variations which could lead to disastrous events, but these forecasts are only at a short time distance and the intervention time to avoid the happening of the disaster is not always enough. However, the satellite images are useful for the Earth science experts and if they help to give elements for an appropriate use by mankind of the land and of the environment. Space technology can in fact give important

cartography information for the preparation of hazard related maps, such as vulnerability maps and land use or land cover maps, the key to avoid many disastrous effects of natural events. These maps can show the cultural concentrations, such as houses, in the earthquake zones, the flood plains or the landslide hazard areas. The role of Remote Sensing satellites becomes relevant in the management of catastrophes, because it allows a rapid observation of the involved area and the transmission in real time of the data for a monitoring of the natural disasters, for the mitigation of their effects and for an accurate assessment of losses. At present ALMAZ, ERS 1 and 2, JERS, LANDSAT, MOS and SPOT are used to observe, map and monitor features and phenomena on the Earth's surface. The recent launch of the ERS satellites with synthetic aperture radar allows Remote Sensing to penetrate the clouds.

Space Shuttle *Endeavour*'s astronauts fired up their radar and began, the February 12, 2000, to map more than 70 percent of the Earth's surface to create the ultimate map of planet's peaks and valleys. An antenna in the cargo bay beams radar signals at the Earth. The signals bouncing back are received by both that antenna and the antenna 60 meters away at the tip of the mast. By combining the two sets of images, scientists hope to compile 3-D snapshots of Earth' terrain with unprecedented accuracy and clarity. The results will be used by the Defence Department for security purposes, as well as by environmentalists, airlines and emergency relief groups.

The Rio Declaration, which sprung from the UN. Conference on Environment and Development in June 1992, with the participation of 183 Heads of State, enunciated 27 general principles on environment and development³³. With reference to environmental disasters the Declaration contains principles which have a greater legal significance compared to most of the other principles which have a mainly political or "soft law" content. The Declaration stresses the obligation to inform and co-operate which has become a general rule of international law.

From May 23rd to May 27th 1994 the World Conference on Natural Disaster Reduction³⁴ took place in Yokohama (Japan), within the program of the International Decade for Natural Disaster Reduction proclaimed by the UN. The aim of the conference was to analyse the results so far reached on a national, regional and international level for the prevention and management of disasters.

The attention of the United Nations had already turned to the fight against natural disasters in the Development Program (UNDOP) instituted in 1965 with resolution n. 2029 XX of the General Assembly.

The Department for Humanitarian Affairs (DHA), a specialised office of the Secretary General of the United Nations responsible for all disaster-related matters is the most specific organisation. One of the main purposes of this office is to mobilise, direct and co-ordinate external assistance provided by the United Nations system in response to disasters. The DHA helps to prevent potential catastrophes by studying and forecasting them. The Department acts in co-ordination with other international organisations, most of which belong to the

United Nations. Finally, the DHA participates in the International Emergency Readiness and Response Information System (IERRIS), a system uniting a growing number of international organisations for crisis management³⁵.

Since 1987 the European Council has been carrying out an open Inter-governmental Agreement concerning the management of natural and technological risks: the **EUR-OPA Major Hazards Agreement**.

The partial open agreement concerning prevention, protection and the rescue organisation against major natural and technological risks was adopted on March 20th 1987 by the Committee of Ministers of the Council of Europe³⁶. The Agreement has the advantage of reuniting the representatives of the European countries and those of the Mediterranean area.

In May 1994 the Executive Secretary of the Agreement requested the ESA, in co-operation with the Russian Minister of Civil Defence and Emergency Situations (EMERCOM), to conduct a study on the possibility of improving the risk prevention and the organisation of rescue with the aid of space technology. The study had the double aim of analysing the necessities in case of seismic or chemical risks, stressing the potential interest of space technologies for the prevention and management of such risks, and of filing an inventory of the available satellite resources in western Europe and in the Russian Federation to face these necessities.

The study first of all reported that space technologies, especially those used for Remote Sensing, meteorology, navigation and telecommunications, can have an important role in the observation and management of the major risks. For example, the ERS and SPOT satellites could give detailed, filed and actualised cartography data necessary in the event of natural catastrophes; the METEOSAT system can give useful meteorological forecast data indispensable in the event of a major catastrophe and furthermore it can organise a telecommunication network to support rescue, especially when the network on Earth is damaged³⁷. Secondly, the study reported that the space technologies cannot replace, but only complete the terrestrial or air-borne equipment. Finally, the use of satellite systems must be placed in the decisional process of each State.

During the Convention on space technology contributions in Ispra on July 2nd 1996, the Committee of the permanent correspondents of the EUR-OPA Major Hazards gave order to the Executive Secretary of the Agreement to introduce a proposal to the competent organs for the realisation of a European system of space information on major risks. The co-operation should take place among the European Commission, the European Space Agency, the competent Ministers of the States parties, the National Space Agencies and the operators of the branch. The system should allow the availability of the data useful for the management of catastrophes and should inform about the potential offered by the space systems. The system should operate for prevention and alarm, for the management of emergency situations, for the post-crisis assessment and for the elaboration of rehabilitation actions. Russia has offered the possibility of using the

Russian space means, including the MIR space station, to contribute to the European system. Finally, it was stressed that the financing of the project is based on the voluntary contributions of the States parties, of the involved European institutions and of other partners who wish to participate.

The principle of international co-operation has led various International Intergovernmental Organisations to commit themselves to specific studies on Earth's environment. The World Climate Research program has been promoted by the World Meteorological Organisation (OMM); the United Nations have created a program for environment (PNUE), UNESCO has carried out various initiatives and the Forum of Space Agencies (SAF) has included the Mission to Planet Earth project in its program. This leads us to think that, at least in the branch of environmental studies, the policy of the States is leading towards international co-operation.

2.e Legal nature of UN Principles

Resolution 41/65 was accepted without vote according to the consensus procedure³⁸. The nature of the United Nations resolutions is not binding by itself except for the aspects that respect common law. The resolutions are to be considered expression of "opinio iuris ac necessitatis"; only in the case when they expressly establish that their violation is equivalent to the violation of the instituting charter or of international law, can it be deduced that they have the value of agreements even in simplified form³⁹. This provision does not appear in resolution 41/65. In actual fact, the principles IV and XIV underline that the obligations deriving from the resolution are not based on the latter, but on different legal instruments already in existence: Outer Space Treaty and international law. The non binding nature of the principle must therefore be maintained, because common law status cannot be granted to recently formulated principles⁴⁰.

The resolution, moreover, makes no mention of the possible violations of the principles. Some of the regulations it implies, though, (equal rights for the States, auto determination of the people, non interference) and some of the ones it recalls (permanent sovereignty on resources), are part of common law and for this reason they are imperative. In this respect the resolution is merely a **recognitive act**, its **recommendation nature** being confirmed, the obligation not being the effect of the purviews but of the international system.

One last observation is to be made on the compulsory value of the United Nations Resolution of the principles on remote sensing. In actual fact it has a recommendation value even though, having been adopted by "consensus", it expresses the legal opinion of all the community. Should the following study on the policy adopted by the States and by the ESA for the diffusion of the remote sensing data show an increasing attitude favouring scientific research for the Earth's environment it could be claimed that a customary norm is being established. The States are realising that the protection of the Earth's environment is compulsory and that it involves all mankind, and therefore any behaviour in favour

of research (distribution of data free of cost or on extremely advantageous cost terms) is to be seconded.

While at the beginning of the space activities the States were more inclined to entrust the regulation of the matter to international law, this attitude has deeply changed in time. The UN. are unable to lead to the stipulation of agreements; at the most, some principles in resolutions have been produced by the General Assembly. The States do not wish to give up their exclusive competence on the subject and, at most, in order not to slow down the space activities further, they prefer to regulate the situations with specific agreements between the parties.

3. LEGITIMACY OF REMOTE SENSING FOR MILITARY ACTIVITIES

Among the first technical applications of remote sensing, we find military applications, begun in the first Sixties with the launching in outer space of the USA Satellites Discover 13 and Samos II, capable of taking the first photographs of Soviet territory⁴¹.

Resolution 41/65 of the United Nations dictates some of the principles on remote sensing, defined as the observation from outer space of the Earth's surface to improve natural resources management, land use and the protection of environment. It does not refer to military remote sensing, even though its exclusion was the cause of debate, in the UNCOPUOS, among the States. The casual acquisition of military information by civilian satellites must be treated according to the resolution for all other kinds of information.

The activity of military surveillance and reconnaissance satellites is now generally considered lawful by the States.

On a political-strategic level it is necessary to be able to observe the areas of interest with continuity, in order to have a constantly updated picture of the elements which could constitute a potential risk and in order to allow swift evaluation and decision processes on the opportuneness and amount of the intervention of the military organisation. Furthermore, the areas of positioning of ballistic missiles must be controlled, in order to activate contrasting measures if necessary.

As for remote sensing, it must be stressed that the satellite is the only means for the acquisition at any time of information on any point of the globe, because it can fly freely and legally over it, due to the fact that international law does not impose any flight limitation.

Remote sensing has an important role in the field of intelligence, because it is a flexible instrument for reconnaissance and surveillance in areas of interest. The more and more frequent external interventions lead to the necessity to make use of high resolution and definition satellite images of such areas; to be integrated with other knowledge for a more effective planning and conduct of operations.

The Armed Forces must operate, in most cases, in areas with no local infrastructures and therefore, the satellite could be the only means to ensure connections with the Home country and between the units on the field. On an operational and tactical level, reconnaissance and surveillance satellites must not only supply information for decisional activity and to verify the results of the intervention, but they must also swiftly signal an alarm to ensure the safety of the formations engaged. The space component has successfully managed political and military crisis situations, as proven during the war in the Persian Gulf.

The principle of the pacific purposes of space activities is stressed in various points of the Outer Space Treaty but the most important regulation, in which this principle appears, is without any doubt, the one in article IV which establishes that "States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction". It includes the contents of the two United Nations Resolutions (res. 1884-XVIII of October 1963 and res. 1962-XVIII of December 1963) and the Moscow Treaty of 1963, treaty banning the nuclear weapons tests in the atmosphere, in outer space and under water.

The problem is the identification of the weapons the ban refers to. Article IV gives no indication regarding what should be considered a nuclear weapon or a mass destruction weapon.

The second part of art. IV adds: "The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited."

While the second comma of article IV considers the regime of the Moon and of the other celestial bodies under this specific point of view, to the point of being unable to avoid contrasting opinions and conflicting interpretation, no other regulations of the Treaty expressly establishes the lawfulness or the unlawfulness of the instalment of such system in outer space. It is common opinion that very few military activities are really forbidden by the provisions of the Treaty; one of the principles on which this assumption is based is that whatever is not expressly forbidden, must be intended as lawful (16). This thesis is not unanimously accepted in doctrine.

As clear as the ordinary meaning of the term "peaceful" may seem, its interpretation from the legal point of view is rather controversial, also due to the fact that a clear definition of this term in the Treaty and in the whole space order is missing. Two main doctrine currents seem to be in conflict on this theme: according to the first, all those non aggressive military activities undertaken for purely defensive purposes are to be considered peaceful⁴². The opposite thesis equals peaceful space activities to non military ones. According to this last interpretation, even the plain use of surveillance satellites placed in orbit by military

personnel or for military purposes must be considered illegal, being non pacific⁴³. There is an intermediate position that, according to which, the Outer Space Treaty establishes a principle of partial demilitarisation of outer space, and of total demilitarisation for the moon and other celestial bodies ⁴⁴.

The partial banning of military activities in outer space may be deduced not from the merely programmatic and not legally binding nature of the above mentioned principles, included in the Preamble and in the first articles of the Treaty, but from the fact that such principles are to be interpreted in the context of the Treaty. The banning in article IV of the installation in outer space of mass destruction weapons being established, all military activities not expressly forbidden should be allowed. The international practice follows such conclusions resulting from the analysis in the preliminary works of the predominant will of the States. The USA have always been advocates of the use of outer space for non aggressive military activities; USSR and non-aligned countries had instead sustained the ban on any military activity in outer space until half way through the Sixties. The subsequent capacity of disposing of space systems able to undertake remote sensing, has induced socialist countries in the early Seventies to adapt an interpretation according to the use of outer space for non aggressive military purposes is not precluded by the Treaty of 1967.

The Convention on the prohibition of the use of environmental modification techniques for military or other hostile purposes was established by initiative of the Conference on Disarmament Committee of the United Nations. Opened to signature by the General Assembly on may 18th 1977, the Convention came into force on October 5th 1978⁴⁵.

On July 31st 1991 USA and URSS signed the Strategic Arms Reduction Treaty (START) in Moscow ⁴⁶, the last step in the commitments of the two powers in the field of armament control. In actual fact this agreement introduces for the first time noticeable cuts on arsenals, not limiting itself to stopping their increase. On June 16th 1992 the two nations USA and Russia signed a major agreement in the History of disarmament: USA and Russia will destroy all multiple warhead missiles; the step from mutual assured destruction to minimum nuclear deterrence seems quite close.

3.a Legitimacy of Remote Sensing for security and military surveillance

Now, military remote sensing being a mainly defensive activity and the Treaty itself establishing the freedom of exploration and use of outer space, we can only confirm its lawfulness⁴⁷. The bilateral SALT agreements between USA and USSR establish and in fact legitimate the use of the above mentioned satellites for verification.

Article XII of the ABM (Antiballistic Missile System) Treaty and article V of the temporary agreement included in the bilateral agreement SALT I between USA and USSR in 1972, and article XV of SALT II drawn up by the same powers

in 1979, explicitly foresee the appeal of each party to National Technical Means as instruments for the verification of the accordance of the works of the counterpart with the commitments undertaken with those agreements. Even without listing the lawful technical means, the parties have agreed that these also include photographic and remote sensing satellites. The use of these instruments must be in accordance with the generally known principles of international law, but each party agrees not to impeach the control exercised by the other, and not to deliberately make use of measures capable of impugning such control.

Article XII of the 1987 Washington Treaty between USA and USSR for the de destruction of ballistic missiles more or less follows SALT's dispositions in reference to the technical means. In addition, measures of co-operation are established among States parties for a period of three years, starting from the coming into force of the Treaty, for the observation, through the satellites, of the bases in which mobile ballistic missiles with a range in excess of 5500 km are placed. Similar verification systems are also foreseen in the 1991 START which definitely legitimates remote sensing among National Technical Means.

At present the main source of support for Defence in the field of observation is represented by the HELIOS system, the result of a co-operation among France, Italy and Spain. More precisely, France already had some studies in course for the definition of the project when the two countries, Italy and France, stipulated on September 25th 1987 a co-operation agreement to develop and realise the French project together and to use the resulting system jointly. Subsequently, in 1988, Spain joined the programme. The quotas of participation in the programme, and therefore for the utilisation of the system are respectively: 79% for France, 14.1% for Italy and 6% for Spain. The first satellite was launched on July 7th 1995. The Command and Control Centre of the earth segment of HELIOS is situated here in Toulouse.

The delay with which the images are at disposal varies from a minimum of 12 hours to a maximum of 3-4 days due to a series of concurrent factors, among which the joint use of the system with two other users.

The estimated operational life is five years per satellite and twenty years for each earth segment. Therefore, the next satellite should be launched after the year 2000, in respect of the good functioning of HELIOS. In the event of damage occurring in HELIOS 1A, the substitute with the same characteristics could be launched within 12 months.

On this basis, a completion of the programme could be sought in the realisation of a further satellite supplied with SAR, according to the pattern used in the last two years to find a quadrilateral agreement (France, Germany, Italy, Spain).

Some elements which hinder the start of the joint programme must be considered. France has long since begun a civilian and military synergy in the field of remote sensing, leading to the alternate launches of civilian satellites (SPOT

1,2,3) and military satellites, developed in parallel on the bases of the same "carriage". As for the future, France intends to maintain a close co-ordination between the SPOT and HELIOS series. Furthermore, France has expressed, as mentioned, the intention of having a bi-satellite optic military system. On the contrary, not much interest has been expressed for a SAR satellite which is, on the other hand, subordinate to the aim of HELIOS 2.

Germany has justified the reflection pause on the project with budget restrictions, but it is possible that the position taken is consequent to the intentions expressed by the French.

A last observation is to be made on some new political and economical questions which noticeably influence the behaviour of the international community. New factors moderate military influence in outer space: the arrival of non super-powers that can play a balancing role, the consciousness of the growing importance of the safeguarding of environment which can be carried out in outer space and which has involved in the "Mission for Planet Earth" even the American agency NASA; the virtual ending of the cold war, and, last but not least, the reaction against the cost of military expenditures which stimulates industries to use their technologies for more efficient civilian realisations. In this context, co-operation among States is now much more felt, and, returning to our subject, it is appropriate to refer to a few proposals brought out by some nations regarding the creation of multilateral control systems through the use of satellites, for the verification of the respect of the disarmament treaties and for the surveillance of any eventual areas of crisis or conflict in the whole planet.

The creation of an international satellite control Agency encounters a whole series of legal and political problems. It is extremely difficult, if not impossible, to limit the collecting of data according to the international treaties, without access to different kinds of information. The problem of the zones to be monitored, the access to data and information, their not always unequivocal interpretation which causes differences and controversies, and the impossibility of organising efficient if not through the Security Council of the UN, with the possibility of a veto by permanent members, all represent difficulties to be solved, regarding the functioning of a similar entity, on which no proposal has yet thrown any light.

The future availability of civilian systems, supplied with high observation capacities provided with high capability of information observation, telecommunication, collection and dissemination, confirms the validity of a choice leading to their use to cover some of the necessities of the Defence, limiting the necessary investments to the development and management of the satellites for exclusive military use. On the other hand, the combination of civilian and military programmes, when possible, is a must which is strongly striven for by all countries, for obvious economic reasons, but also to maintain and develop the national technological level. The United States themselves have long since been moving in this direction⁴⁸. The last example of this connection, between military and civilian exploitation of data, is the Earth's mapping mission realised with the space shuttle

Endeavour.

In conclusion the placing of arms in outer space could then be justified as a defensive purpose, and it is here, in our opinion, that the weak point of the whole regulation lies, because this means that it is the use made of the weapon that is lawful or unlawful, and not the weapon itself, as would be appropriate.

From this point of view, the right to legitimate defence seems to have created a pretext for the countries and in particular for the space powers to justify a future massive militarization of outer space. If such a solution appears as the most accordant with the political and historical context of the years in which the Space Treaty was adopted, nowadays, with the radical change in such a context, and with the total subversion of the opposing block in international relationships, it is necessary to cancel such ambiguities and to clearly establish what is lawful and what is not. It is in any case necessary to consider some of the principles established in the Treaty of the 1967: the call for international co-operation and the carrying out of space activities in the interest of all the countries and as a prerogative of all mankind.

The peaceful character of those military activities not concerned with the placing of arms in outer space, but which are carried out for national security reasons, is not to be questioned.

From an international point of view there has been a substantial recognition of its lawfulness through the implicit inclusion of remote sensing satellites in the National Technical Means as verification instruments in the framework of the SALT and START treaties.

From a political point of view, the fall of the soviet empire, while freeing many peoples from the enslavement to totalitarian regimes, has inevitably created regional conflicts and instability factors in different parts of the world. The creation of international (even regional) surveillance organisations, while allowing a greater participation of all countries in the control of the world's order, from the point of view of the respect of the treaties, of surveillance on eventual crisis areas, of resolution of international controversies, seems to constitute a good deterrent instrument against and eventual subversive action by some States, favouring the reaching of stable and long-lasting new international equilibrium.

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²U.N. res. 19803, XVII, dec. 14, 1962: Charter of economic rights and duties of States, U.N. res. 3281, XXIX, dec. 12, 1974, art. 2 para 1

³See Argentinean proposal U.N. doc. A/AC, 105/C. 2/L.73, 1970; the Argentinean-Brazilian proposal, U.N.doc.A/AC 105/C.I/L.47, 1974 Mexico bill, U.N. doc. A/AC.105/288.13, 1981 and Colombia bill U.N. doc. A/AC.105/288.12; Brazilian proposal U.N. doc. WG/RS, 1982, WP/11

⁴ Art. 1, Treaty on the Principles governing the Activities of States in Exploring the Moon and Other Celestial Bodies, Jan. 27, 1967, U.N.T.S. 205 (effective Oct. 10, 1967), in United Nations Treaties and Principles on Outer Space, New York 1997, A/AC. 105/572/Rev.2: art. 1,2: "Outer space...shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality in accordance with international law"; art. 1,3: "There shall be freedom of scientific investigation in outer space."; art. 3: "States Parties to the Treaty shall carry on activities in exploration and use of outer space..., in accordance with international law including the Charter of United Nations..." ; see GOROVE International legal aspects of Earth resources satellites, in Proc. of the 15th Colloquium on the law of Outer Space 1972, p. 14; MUELLER-REINTANZ, The relationship between sovereignty and freedom in outer space using the example of remote sensing, I Wiss. Zeit-schrift der MLU Halle 1985, p. 42

⁵ Principles Relating Remote Sensing of the Earth from Space: U.N. General Ass. A/RES/41/65, Jan. 39. 22, 1987 in UN Treaties cit., note 4, p.4

⁶ SWAAIN-DEVRIES, Regulating remote sensing of the Earth from Outer Space taking into account the present trend of privatisation of this activity in Proc. of the 30th Colloquium on the law of Outer Space 1987, p. 411; *ibidem* SYBESMA-KNOL, Negotiating the United Nations principle on Remote Sensing of the Earth from space: the role of observes, p.394; COURTEIX, Le droit de l'espace, Texts réunis et commentés, Documents d'etudes, n. 3,04, ed. 1990, p. 41.

⁷ DESAUSSURE, Remote sensing, the interaction and international law, Proc. Of the 30th Colloquium on the law of Outer Space, 1987, p. 296; *ibidem* KOPAL, Principles relating to remote sensing of the Earth from outer space; a significant outcome of international cooperation in the progressive development of space law, p. 322.

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⁹Directive 96/9/CE of European Parliament and Council on the Legal Protection of Data Base, 11 march 1996, in O.J., L77/20, 27 march 1996; Initial Proposal: COM(92), 24 final, 393, 13 may 1992, in OJ , C156, 23 june 1992, p. 4, modified proposal: COM(93) 464 final, 4 oct. 1993, in OJ, C 308, 15 nov. 1993, p. 1

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