A TECHNICAL AND LEGAL INTRODUCTION : FUNCTIONS, STATUS, NATIONALITY OF SATELLITES

BY

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As you can see from the programme, I have been asked to give a technical and legal introduction on the subject of this colloquium, which is « Telecommunications Satellites and International Law ».

Although I'm sure that most of you are very familiar with both the technical and the legal aspects of international telecommunications, it is certainly useful for our discussions today to refresh our memories.

1. SPACE COMMUNICATION

Communication can be defined as a process by which information is exchanged between individuals through a common system of symbols, signs, or behaviour. Mankind has always tried to improve its means of communication in order to achieve a faster and more reliable exchange of information, but also, mankind is continuously searching to find new ways of communicating or to find new partners to communicate with. The search for extraterrestrial intelligence is but one exemple of this endeavour. The improvement in communications is closely linked with the development of civilization.

The telegraph, electrical communication using wires, brought mankind into the industrial era, whilst radio communication helped to inaugurate the space age. Without radio communication, the exploration and the exploitation of outer space would be impossible : there would be no guidance or control of space objects, no tracking, no command or telemetry and no reception of data. Space telecommunication is in fact the latest development in the human endeavour to exchange information.

Telecommunications, needless to say, is part of our daily lives and its importance for the economic, scientific, and military activities of nations is vital. Telecommunications by satellites has become an integral part of the communications infrastructure of the nations in the world.

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For countries with remote areas or areas with a difficult access, communication satellites are often the prime means of communications, whereas for developing countries, which do not possess a ground infrastructure for communications, the satellite offers the possibility to immediately benefit from a complete communication system. This modern technology does not prevent the use of ancient forms of communications as is witnessed by the Swiss Government still having, within its military budget, an allocation to keep up a regiment of pigeons, as a redundant system in case its telecommunication system would be totally destroyed.

How can one define a communication satellite ? It is in fact a microwave relay in outer space, which receives a signal transmitted from an earth station, the so-called *uplink,* amplifies this signal, and retransmits it to a receiving earth station, the so-called *downlink.* The electronic device on board of the telecommunications satellite, which actually performs this task is called a *transponder.* A typical telecommunications satellite has between 12 and 14 such transponders.

Telecommunications traffic is transmitted through electromagnetic signals or radio-waves, from an earth station to the satellite. Of course satellites may communicate between themselves. In this context it is interesting to note that a lot of research is being performed on optical intersatellite links, which would greatly enhance the capacity of the information flow between satellites.

The size of earth stations, which perform the uplink to the satellite, has considerably diminished through formidable technical developments. Uplinks can now be made from very small stations, put on ships, trucks, or airplanes, and, dependent on the increased power of future satellites, it will be technically feasible to communicate with a satellite through transmitters as small as a wrist-watch.

2. RADIO-SPECTRUM

The next subject to be touched upon in this technical introduction is the phenomenon of radio, which is an arbitrarily defined portion of the entire electromagnetic spectrum, which comprises also frequencies linked to other portions of this electromagnetic spectrum such as infrared, ultra-violet, x-ray, and gamma-ray.

This spectrum is a form of oscillating electrical and magnetic energy, capable of traversing space without the benefit of physical interconnection. The rate of oscillation, or frequency, is expressed in cycles per second, or Hertz, a term named after the German physicist Heinrich Rudolph Hertz, who discovered the radio waves in 1886.

Within the scale of Hertz, the radio-spectrum ranges from 10 kilo Hertz to 3000 Giga Hertz. The radio-spectrum is considered as a « limited natural resource » because our technology does not master the use of the entire radio-spectrum and because natural and man-made limitations limit its use.

The natural limitations on the electromagnetic spectrum include attenuation due to gases in the atmosphere and absorption by water vapor and other constituants such as clouds, fog or precipitation. The man-made limitations are due to interference between radio systems using the radio frequencies in the same area at the same time.

3. THE GEOSTATIONARY ORBIT

A second « limited natural resource » is the geostationary orbit, which is defined as a circular earth orbit in the plane of the equator at an altitude of about 35.800 km above the earth's surface. At this altitude a satellite will orbit the earth in 23 hours and 56 minutes and is, therefore, synchronous with the rotation of the earth. Consequently, to an observer on earth the satellite will appear to be stationed at a fixed point in the sky. Such geostationary satellites continuously view 40 % of the surface of the earth and hence three geostationary satellites are capable of covering the entire surface of the earth.

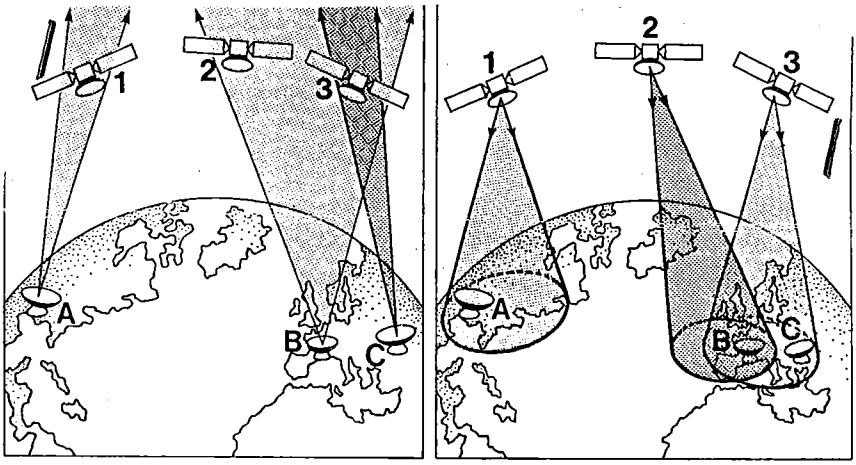
The geostationary orbit is therefore the ideal orbit for telecommunications satellites, but other satellites such as meteorological, earth-observation and space research satellites also make use of this unique orbit, so that a fear of overcrowding has been emerging.

Indeed at the end of 1984, 138 satellites, of which 80 telecommunications satellites, were operating in the geostationary orbit, and from the order books of launcher organizations, it can be deducted that about the same number of additional communications satellites will join them by the end of 1989. If one keeps in mind that modern communications satellites have a design life time of 10 years, it is obvious that the increase of the number of satellites in the geostationary orbit may create problems with regard to orbital positions and radio frequency interference.

Taking into account the fact that the station-keeping system of satellites can maintain a position in orbit to an accuracy of plus or minus 0.1 degree, the potential number of orbital positions, available in the geostationary orbit, is theoretically 1800, but in practice much lower, in the present state of technical development.

As far as frequency congestion is concerned, it is true that prior to the 1980's, most communications satellites operated in 4-6 Ghz, because the technology for this frequency range was proven the cheapest to operate and the least susceptible to rain attenuation. Since 1980, however, the improve-

ment in technology has allowed the use of higher frequency ranges with the same advantages as the 4-6 Ghz range, so that the problem of frequency congestion is less dramatic than expected before.



Because of the risk of radioelectric interference, only a limited number of geostationary satellites can be placed in orbit. This interference might also affect the ascending as well as the descending links.

Left: stations A and C are transmitting a straight beam towards satellites 1 and 3. In contrast, station B is radiating a very wide beam, which causes interference in satellite 3. In order to overcome this, it is essential either to place 3 and 2 further apart, or to narrow the beam transmitted by 3 (by using a more directional aerial).

Right: being too close together, satellites 2 and 3 will interrupt the reception of station B. To permit B to operate normally, it is essential either to improve the directivity of aerials 2 and 3, or to increase the distance between these two satellites in such a way as to enable each to transmit towards its own aerial without signals overlapping.

4. THE LEGAL FRAMEWORK FOR SATELLITE COMMUNICATION

Turning now to the legal framework for satellite communications, the first major source of international law applicable to space communications is International Space Law. The United Nations, through its Committee on the Peaceful Uses of Outer Space (UNCOPUOS) has played a key role in the creation of International Space Law.

To date five important treaties govern the activities in outer space :

- The « Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space », also called the « Outer Space Treaty », of 1967.
- The « Treaty on the Rescue and Return of Astronauts and the Return of Objects Launched into Outer Space », of 1968.
- The « Convention on International Liability for Damage caused by Space Objects », of 1972.
- The « Convention on Registration of Objects Launched into Outer Space », of 1974.

and - The « Agreement governing Activities of States on the Moon and other Celestial Bodies », of 1979.

The main principles of space law, which form the basis for these treaties, were adopted in 1963 by the General Assembly of the United Nations in the Declaration on legal principles governing activities of States in the exploration and use of outer space. They are :

1. The activities in outer space shall be carried out for the benefit and the interest of all mankind.
2. All States have the right to explore and to use outer space and celestial bodies on a basis of equality and in accordance with international law.
3. Outer space and celestial bodies will not be subject to national appropriation by claims of sovereignty, by occupation or by any other means.
4. The activities shall be carried out in accordance with the Charter of the United Nations, and with international law, in the interest of international peace and security and for promoting international co-operation and understanding.
5. States will bear international responsibility for their activities in outer space, whether carried out by governmental agencies or non-governmental entities. For the latter the responsible State must deliver an authorization and shall exercise a continuing supervision. When activities are carried out by international organizations, the responsibility will be borne by the latter and by the States participating in it.
6. States will be guided by the principle of cooperation and mutual assistance. They shall have due regard for the corresponding interests of other States. If a State believes that there is one of its activities or experiments which could harmfully interfere with activities of other States, it shall undertake appropriate consultations before proceeding with its initiatives.
7. States shall retain jurisdiction and control over their space objects and personnel. These objects or their component parts found beyond the limits of the State of registry, shall be returned.
8. The launching State or States procuring facilities for launchings are internationally liable for damage to a foreign State or to its natural or juridical persons.
9. Astronauts shall be regarded as envoys of mankind in outer space. States shall render to them all possible assistance in case of accident, distress or emergency landing on foreign territory or on the high seas. Astronauts shall be promptly and safely returned to the State of registry.

The second major source of international law applicable to Space communications stems from the Convention of the International Telecommunication Union, which is a specialized agency of the United Nations since its affiliation with the United Nations in 1947.

Originally, the purpose of the ITU was to set international telecommunications standards. Today the action of the ITU is much broader as it has to maintain and extend international co-operation between all members of the Union for the improvement and rational use of telecommunications of all kinds, as well as to promote and to offer technical assistance to developing countries in the field of telecommunications.

In order to establish and maintain an efficient world-wide telecommunication system the ITU Convention stipulates that the Union shall : « effect allocation of the radio frequency spectrums and registration of radio

frequency assignments in order to avoid harmful interference between radio-stations of different countries and coordinate efforts to eliminate harmful interference between radio stations of different countries and improve the use made of the radio frequency spectrum ».

The law-making process of international space communication occurs in Plenipotentiary and Administrative Conferences of the ITU, which are supported by the Administrative Council. Indeed the Plenipotentiary Conference, which is the supreme organ of the ITU, has not only regulatory but also constitutional authority, i.e. the authority to modify the ITU Convention.

The Current Convention is the one enacted at the Plenipotentiary Conference of 1982 held in Nairobi. The administrative conferences of the ITU, which can be world conferences or regional conferences, produce the *Radio Regulations* which are annexed to the ITU Convention, and are binding upon all members of the ITU.

Apart from these periodical organs, as they are meeting at more or less long intervals, mention should be made of the permanent organs of the ITU, i.e. :

— The General Secretariat

— The International Frequency Registration Board (IFRB)

— The International Radio Consultative Committee (CCIR)

and — The International Telegraph and Telephone Consultative Committee (CCITT).

The International Frequency Registration Board is in charge of the interpretation of the Radio Regulations and their application to specific uses of radio frequencies that are notified to the IFRB for recording in the *Master International Frequency Register*.

The duties of the IFRB are stipulated in the ITU Convention as follows :

To effect an orderly recording and registration of frequency assignments made by different countries as stipulated in the Radio Regulations with a view to ensuring formal international recognition.

To effect an orderly recording of the positions assigned by countries to geostationary satellites.

To furnish advice to Members with a view to maximizing the number of radio channels and with a view to the equitable, effective and economical use of the geostationary satellite orbit, taking into account the needs of Members requiring assistance, the specific needs of developing countries, as well as the special geographical situation of particular countries.

And to perform any additional duties related to the assignment and use of frequencies and the geostationary satellite orbit.

The International Radio Consultative Committee for its part is responsible for studies of technical and operating questions relating specifically to radio communication without any limit of frequency range, and to issue recommandations on them.

The ITU was the first entity to issue regulations for telecommunications with regard to outer space at the Administrative Radio Conference in Geneva in 1959. Since that date, it has continuously been dealing with the regulation of Space telecommunications and despite the many problems, mainly of a political nature, its work can be regarded as essential as it established the basic principles of telecommunications law :

— The non-discriminatory and equitable access to the Geostationary Orbit and the radio-frequencies linked with its use.

— The right to international protection from harmful interference if defined uses of the frequency spectrum are in conformity with the ITU Convention and Regulations.

In order to complete the picture of international law regarding telecommunications, mention should also be made of the *organizations* which operate and exploit telecommunications satellites. Some of these organizations are of a universal character, others were established on a regional basis. One of the oldest and most important is the International Telecommunications Satellite Organization or *INTELSAT*, which aims at providing telecommunications services, on a commercial basis, to all areas of the world.

The International Maritime Satellite Organization or *INMARSAT*, which is in charge of making available a space segment to improve maritime communications, but which lately expressed its interest in extending its mandate from maritime communications only to all mobile telecommunications, such as planes and trucks.

As far as the regional organizations are concerned, mention should be made of the European Communication Satellite System or ECS, developed by the European Space Agency and operated by EUTELSAT ; ARABSAT for the Arabian countries, and INTERSPUTNIK for Eastern Europe and the Soviet Union.

5. THE LEGAL ISSUES

1. *The Geostationary Orbit and the Radio Frequency Spectrum*

As mentioned earlier, the GSO is a limited natural resource and the fear of overcrowding has made it the subject of legal disputes.

In 1976, the Governments of Brasil, Colombia, the Congo Republic, Ecuador, Indonesia, Kenya, Uganda and Zaire, all States situated on the

equator, made the *Bogota Declaration,* which claims a right of sovereignty over the part of the geostationary orbit situated above their territories. This claim was based on legal and technical considerations. The equatorial States declared that the GSO is a physical fact arising from the nature of our planet, because its existence depends exclusively on the relation to gravitational phenomena caused by the earth.

It is also a material resource and as such protected by the right of nations to the permanent sovereignty over their resources, a right recognized by international law.

Consequently, the Bogota Declaration stated that the placing of satellites in a fixed position in an equatorial State's geostationary orbit segment requires an authorization from the underlying State, and the operation of the satellites shall be governed by the national law of that State. Finally, the absence of a legal delimitation of outer space makes it impossible to support the thesis that the GSO is an integral part of outer space.

The Bogota Declaration has been practically unanimously condemned as being in contradiction with the Outer Space Treaty, in particular with the articles thereof dealing with the prohibition of all claims of sovereignty or appropriation of outer space, and with the principle of freedom of exploitation and use.

The issue of the GSO has been discussed at length in the legal subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space, but also at ITU Conferences the need to regulate access to the GSO has been a constant preoccupation.

The 1971 World Administrative Radio Conference for space telecommunications recognized the GSO and the Radio Frequency Spectrum as limited natural resources which should be most effectively and economically used.

The 1973 Malaga-Torremolinos Plenipotentiary Conference incorporated this resolve into the ITU Convention, making the principle of non-discriminatory and equitable access to the spectrum-orbit resource a part of international communication law.

The constant request of developing countries to ensure this equitable access to the GSO and the Radio Frequency Spectrum has triggered an evolution from the first-come, first-serve principle to the *ARC Allotment Plan* suggested at the 1985 World Administrative Radio Conference on the use of the Geostationary-satellite orbit and the planning of the space services utilizing it.

The Arc Allotment Plan is a compromise between the first-come first-serve principle and the *a priori* planning requested by developing countries, in that the Plan involves the allocation of an arc segment rather than a specific orbital location. It should, however, be noted that the development

of improved technology has extended the capacity of the GSO to accommodate communications satellites. Nevertheless the legal battle concerning the GSO is still continuing.

2. *The Issue of Direct Broadcasting Satellites*

Another subject of legal dispute is the issue of Direct Broadcasting Satellites.

DBS is defined as a radio communication service in which signals transmitted or retransmitted by space stations are intended for direct reception by the general public.

The question of the legal regime applicable to DBS has been discussed at the UN Committee for the Peaceful Uses of Outer Space, and its legal sub-committee, during 15 years.

When trying to elaborate on DBS, the legal sub-committee of UNCOPUOS has been confronted with 2 antinomic principles namely : the principle of the free flow information and the principle of national sovereignty.

Unable to arrive at a satisfactory solution, the members of UNCOPUOS have abandoned the idea of elaborating an international treaty, and have sought to obtain a consensus on a number of principles governing DBS. The consensus on these principles could not be obtained because a fundamental disagreement existed on the principle of prior consent receiving States.

The ITU for its part has established in 1977 regulations for the technical and administrative aspects of DBS. It assigned the 12 Ghz band to DBS and stipulated *inter alia* that « in devising the characteristics of a space station in the broadcasting satellite service, all technical means shall be used to reduce to the maximum extent practicable, its radiation over the territory of other countries unless an agreement has been previously reached with such countries.

On the legal front, however, the discussions on DBS stalled and finally the United Nations' General Assembly adopted in December 1982 a resolution which included in its annex « Principles governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting ».

For the first time in the history of space law, this document was not adopted by consensus but by a majority vote and consequently its legal value lacks the expression of the general will of the International Community.

As a result of this lack of consensus it is probable that rules of conduct regarding DBS will have to be adopted on a regional basis.

6. CONCLUSION

The increased technological development of telecommunications has a continued impact on the law-making process. The evolution of space regulation in the ITU is but one typical example of this statement.

The formidable impact of telecommunications on our society through the advent of new telecommunications services such as mobile telecommunications, video conferencing, data dissimination, distance learning and business communications, calls for permanent adaptations of existing laws. As an example : the European Commission is now also heavily involved in regulating the market for telecommunications.

You will all recall the « Green Book », issued by the *European Community* in June 1987, which contains proposals for the further development on an integrated European market in telecommunications and a liberalization of satellite communications.

In July of this year, the Commission has adopted a communication on space, intended for the European Council and the Parliament.

This communication deals *inter alia* with the role of the Community in telecommunications, and contains an analysis of the competitiveness of European industry. In there it is stated that, although European industry is technically on a par with its competitors, the competitive position is still very weak.

One of the major obstacles is the fragmentation of the European market and the monopoly situation of the European PTT's which do not allow optimal use of space communication services.

The Communication stresses the need to reach common positions on the modification of the regulatory environment for the telecommunications satellites in Europe ; its objective is in particular the complete and gradual opening of the terminal market to competition and the definition of common European positions within various international bodies.

The interest of the *private sector* to operate or lease telecommunications systems requires also the development of legal regimes to deal with the new environment of modern telecommunications. For example, if a private company wishes to lease transponder capacity from a satellite operator, it will conclude a transponder lease contract which includes preemptory rights clauses.

This term « preemption » is in fact an old legal term which has been revived to deal with the protection of the rights of transponder lessees.

The term « preemption » originates from the seventeenth century, when it was given to the prerogative right by which the royal purveyor might buy up goods for the use of the royal household at an appraised price, in

preference to other prospective buyers and without the consent of the owner of those goods.

In transponder law contracts it means that in case of a problem in a satellite lease transponder, the operator is entitled to claim a preemptible transponder in favour of a lessee with preferential rights. The lessee of a preemptible transponder is preempted from use of this transponder. In order to be sure that the transponder of a lessee is protected against breakdowns, a lessee should lease a non-preemptible or restorable transponder. The difference in treatment between lessees is due to the fact that public services have to be guaranteed. The price of a non-preemptible transponder is of course much higher than the price of a preemptible transponder.

I hope that with this technical and legal introduction the scene has been set for fruitful discussions today.

I thank you !