

NATIONAL SOVEREIGNTY AND REMOTE SENSING  
OF EARTH RESOURCES BY SATELLITES

By

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Remote sensing of earth resources by satellites is about to become an important field of space flight and space technology applications. There is no doubt that teledetection of terrestrial resources from outer space will open up, in the next few years, new perspectives of mankind's knowledge about its natural environmental conditions both on the continents and under the surface of the ocean. Particular importance has been attached to the new surveying techniques by developing countries which highly depend upon the exploitation of their natural resources as a condition of their economic development.<sup>1</sup> The present article attempts to review the problems involved with this novel phenomenon in four sections: (I) scientific and technical aspects of earth resources surveying by satellites, (II) the consideration of the problem by the United Nations, (III) earth resources surveying by satellites under existing international law, and (IV) a needed regulation de lege ferenda.

I. Scientific and Technical Aspects of Earth Resources Surveying by Satellites

What does the term "Remote Sensing of the Earth from Space" mean? The United Nations Working Group on Remote Sensing of the Earth by Satellites provided in its Draft Report on the work of its second session of February 8, 1973, the following definition:<sup>2</sup>

For the purpose of this report, in the context of environmental and earth resources studies, remote sensing of the earth from outer space is defined as a methodology to assist in characterizing the nature and/or condition of features or phenomena on, above or below the earth's surface by means of observations and measurements from space platforms. Specifically, at present, such methods depend upon the emission and reflection of electromagnetic radiation.

A similar definition was provided in the Working Group's Progress Report on Remote Sensing of the Earth by Satellites of February 14, 1973.<sup>3</sup>

Although the Working Group pointed out that earth sensing by satellites had not yet reached an operational stage by now, i.e., the stage of becoming "a system resulting from the commitment to supply a space remote sensing service on a continuous and permanent basis, coupled with a commitment by interested users to use such a service on the same basis,"<sup>4</sup> but is still in its experimental phase, it is certainly not premature to outline today's potentially useful applications of the new space technology. The Working Group, which showed itself reluctant to single out, on the basis of existing experience, which are the generally most valuable uses of remote sensing of the earth from outer space, has, however, drawn up a list of certain successful, already demonstrated practical uses which include the following points:<sup>5</sup>

- (a) Discrimination of crop and forest species to the degree that crop types are separable;
- (b) Surface soil color patterns;
- (c) Observation of geological factor patterns that do not appear on existing maps;

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- (d) Unique possibility of synoptic geological coverage of large areas and possibility of tracing on a regional basis geological structures associated with mineralization;
- (e) Up-to-date production of land use mapping;
- (f) Demonstration of the real possibility of producing through space images highly accurate cartographic maps of a country at a scale of 1 : 250,000;
- (g) Possibility of detection of subterranean water resources by their effects on surface vegetation and to perform surface area water measurements and monitoring;
- (h) Possibility of obtaining valuable information about the ocean although still incomplete for practical operational use.

Other authors undertake to systematize certain actual and potential satellite uses for the monitoring of earth resources. Attorney Brooks, e.g., distinguishes applications for agriculture and forestry, geography and cartography, geology and mining (like for terrain mapping, the discovery of new energy supplies, the prediction of natural disasters such as landslides or volcanic eruptions), oceanography uses (like for the exploration of marine resources, sediments, plankton or fishing areas), hydrology uses (like for land irrigation or drainage, moisture measurements, flood and drought predictions), and transportation, navigation, and urban planning applications.<sup>6</sup>

It should be noted on this occasion that remote sensing systems can technically work in several ways:<sup>7</sup>

- (a) Conventional optic cameras are most widely used in imaging the earth's surface. They are also useful for earth resources siting. Optic cameras operate in the visible bands of the electromagnetic spectrum. From an altitude of 500,000 ft., altitude of low-orbiting geo-satellites, a camera with a focal distance of 150 mm. covers a visual field of some 170,000 ft. square and has a ground resolution of some 33 ft. (values given for a film of 50 mm. and a resolution of  $R = 100$ ); from an altitude of 2,500,000 ft., such camera, under the same conditions, covers an area of some 830,000 ft. square and provides a ground resolution of some 170 ft.<sup>8</sup>
- (b) Infrared and, similarly, multispectral line scanners are imaging like conventional visible light cameras but survey, contrary to those, heat signals, i.e., thermal energy in the infrared bands of the electromagnetic spectrum. The heat signals are technically converted into an electron flux which generates visible light on a photographic film. As scanners, thus, provide a "thermal map of the ground," they are highly useful in measuring water surface temperatures or heat discharged from power plants, or in detecting aircraft and spacecraft launches.
- (c) Radiometers, contrary to visible light cameras and infrared scanners, are non-imaging. They measure the incident radiant energy of the long-wave end of the spectrum, comparably to radiotelescopes on the ground. As their resolution is minimal, they are only useful in covering large homogeneous areas, like for the detection of particular pollutants in the atmosphere or oil slicks on water surfaces.
- (d) Radar monitoring, technically well known from airflight control operations, is also a technique helpful for resources surveys such as oil or mining field detections.
- (e) Spectrometers and spectrographs, for decades used in astronomical and aerological spectral analysis, are, like radiometers, non-imaging. They scan certain light frequencies which are emitted or absorbed respectively by radiant or dark bodies. In anti-pollution technology they can be used to measure gas, especially exhaust gas concentration ratios.
- (f) Finally, LASER (Light Amplification by Stimulated Emission of Radiation) beams, short-time high energy coherent light pulses emitted from sensing satellites, can, after back-scattering from the atmosphere, furnish certain data the analysis of which allows to determine possible pollutants in the atmosphere.

To provide an illustrative survey of today's technical and scientific progress achieved in earth monitoring by satellites, the United States 1972 aeronautical and space program may suitably be cited:<sup>9</sup>

The most important single applications program event of last year occurred on July 23, 1972, when the first Earth Resources Technology Satellite (ERTS-1) was successfully launched into accurate polar orbit. ERTS-1, which crosses the equator plane about 10 a.m. each day and flies over the same area of the globe every 18 days for repetitive coverage, is equipped with a monitoring payload consisting of a television scanning system (Return Beam Vidicon--RBV system) and a multispectral scanning system (Multispectral Scanner--MSS system) to furnish independent ground pictures covering 115 miles by 115 miles square of the earth's surface. The objective of its mission is to obtain multispectral earth resources imagery for 330 selected investigations into certain areas such as agriculture, forestry, geology, geography, oceanography, ecology and environmental quality.<sup>10</sup>

To handle the large quantity of data transmitted by ERTS-1, a major new processing facility was required which, located at the Goddard Space Flight Center, became operational early in 1972; today it is processing some 13,000 scenes per week. Several other agencies are taking part in the utilization of the earth resources data obtained by the satellite.

The Department of the Interior is conducting an Earth Resources Observation System (EROS) Program which is to apply aircraft and spacecraft-gathered data to Department-of-the-Interior functions concerning natural and cultural resources. The launching of ERTS-1 has permitted, for the first time, to proceed to a mutually complimentary three part collection system by satellite, aircraft, and ground stations. In order to consolidate remote-sensing data collection and encourage multidiscipline interpretation and cooperative investigations, regional research activities are being conducted by this Department in certain test sites, to wit the Central Atlantic, Arizona, the Pacific Islands and the Gulf Coast Region.<sup>11</sup>

The Bonneville Power Administration is also a participant with the EROS program; the Bureau of Indian Affairs utilizes earth resources data in order to make a soil inventory of Indian land in South Dakota; the Bureau of Mines is investigating into earth fracture systems; the Bureau of Sport Fisheries and Wildlife is engaging in measuring biological parameters in the State of Alaska; the Department of Agriculture makes use of ERTS-collected data for vegetation, soil, soil erosion, defoliation, water resources, insect infestation and crop irrigation research; the Geological Survey undertakes to correct geometric and photometric errors in a television display system.<sup>12</sup>

International cooperation with the United States earth resources observation program is similarly well underway. Within the framework of the EROS program a three week course on applications of remote sensing systems to earth resources analysis and management was arranged for experts from developing countries in the fields of geology, water resources, topographic mapping, forestry, agriculture, oceanography and land use planning. Likewise, within the framework of the EROS program, the Inter-American Geodetic Survey (IAGS) began to serve as a remote sensing training center for Latin American countries.<sup>13</sup>

## II. The Consideration of the Problem by the United Nations

The United Nations has been dealing with the question of earth resources survey satellites since 1969. In its Resolution 2600 (XXIV), entitled "International Co-Operation in

the Peaceful Uses of Outer Space," of December 16, 1969, the General Assembly invited United Nations Member States with experience in the field of remote earth resources surveying "to make such experience available to other Member States which do not have such experience and encourage them to become familiar with this field" (Par. 1). In the same resolution it called upon States "to join in exploring the various aspects involved in the analysis of data obtained through earth resources surveying techniques, their dissemination and application so as to maximize the benefit, to be obtained therefrom, taking into account the particular interests and needs of developing countries" (Par. 2).

At the request of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), the Secretariat established in 1970 a selective bibliography on remote sensing<sup>14</sup> and prepared a note on the cost and execution of the program of publication on earth resources surveying by satellites.<sup>15</sup> In the same year, on June 26, 1970, the Delegation of Argentina submitted to the Legal Sub-Committee of the UNCOPUOS a first Draft International Agreement on Activities Carried out through Remote-Sensing Satellite Surveys of Earth Resources.<sup>16</sup>

The Argentine Draft International Agreement took into account the principle of permanent sovereignty of States over their natural resources, as expressed in several United Nations resolutions, and emphasized the importance of identification and uses of human and natural resources as "the principle economic assets of any country" (Preamble). It strongly felt the need for "close international co-operation for the benefit of all mankind" in the applications of the techniques of remote sensing satellite inventory and study of earth resources (Art. 1). Until remote sensing satellite surveys of earth resources have been placed on an international footing, surveying activities of States should be based "on the principle of equality between States and of the honorable fulfillment of international commitments, as well as the other cooperation between States" (Art. 5).

The basic practical guidelines in the area of space-originating surveys are, with respect to national sovereignty, the following:

"The exploitation of the natural resources of each State in its territory and in its jurisdictional waters shall be governed solely by national laws and regulations" (Art. 8). On the other hand, "(s)urveys of natural resources and their findings with respect to the sea beyond State jurisdiction or the ocean floor and subsoil beyond the limits of national jurisdiction" shall be transmitted to a Data Bank (Art. 6), which shall be responsible for the functions of planning, consultation, information, inventorying and coordination of remote sensing activities by satellites in their operational phase and which shall, for this purpose, disseminate, as appropriate, the findings and practical results obtained from earth resources surveys by satellites. Special reference shall be made to the interests and needs of the developing countries (Art. 3). If, finally, the surveys involve "the national territory and jurisdictional waters of one or more States, the facts and findings shall be promptly communicated to the State or States concerned and transmitted to the data bank." (Art. 6).

In its Resolution 2733 (C) (XXV) of December 16, 1970 ("International Co-Operation in the Peaceful Uses of Outer Space"), the General Assembly invited the Scientific and Technical Sub-Committee of the UNCOPUOS to set up, within its framework, a working group on earth resources surveying with special reference to satellites. This working group,

entitled "Working Group on Remote Sensing of the Earth by Satellites" was constituted at the meeting of the UNCOPUOS Scientific and Technical Sub-Committee of July 13, 1971, and assumed its functions during the 14th session of the UNCOPUOS.<sup>17</sup>

The Scientific and Technical Sub-Committee, after close examination of studies and reports on the scope and importance of remote sensing activities,<sup>18</sup> recognized in its Draft Report of the work of its eighth session of July 15, 1971, "that the potential benefits from such technology can be extremely meaningful to the economic development of countries, in particular the developing countries, and to the preservation of the environment" and declared that "(t)he objective will be to promote the optimum utilization of this space application including the monitoring of the total earth environment for the benefit of individual States and of the international community, taking into account, as may be relevant, the sovereign rights of the States."<sup>19</sup>

In this Draft Report, the Scientific and Technical Sub-Committee requested the newly created Working Group to review the scientific and technological developments concerning sensors and methods for the collection, processing and interpretation with regard to the following purposes:

- (1) to assess their potential;
- (2) to consider whether there are operational system capabilities which might be of special value to meet international regional and global requirements;
- (3) to make recommendations for possible development, provision and operation of data collection and utilization systems in the United Nations or other international framework, taking into account the economic, social and legal implications for the international community.

In order to suitably exercise its functions, the Working Group was requested by the Sub-Committee to cooperate closely with the UNCOPUOS Legal Sub-Committee, appropriate United Nations specialized agencies, and other relevant international organizations, notably to solicit their respective views. Member States of the United Nations, in return, were invited to submit pertinent information concerning their national and cooperative activities in this field to the Working Group.<sup>20</sup>

The General Assembly welcomed and endorsed the report of the Scientific and Technical Sub-Committee in its Resolution 2778 (XXVI), entitled "Convening of the Working Group on Remote Sensing of the Earth by Satellites" of November 29, 1971, and requested the UNCOPUOS and its Technical Sub-Committee "to bring about the early initiation of the Working Group's substantive work and to keep the General Assembly informed on the progress of its work" (Par. 4). The Secretary-General was invited to provide the Working Group with his comments on this subject. (Par. 3).

The year 1972 was marked by the growing activity of relevant United Nations organs and specialized organizations in the area of earth resources surveying by satellites. On April 10, 1972, the Legal Sub-Committee put on the agenda of its eleventh session inter alia "Matters relating to activities carried out through remote sensing satellite surveys of earth resources."<sup>21</sup> The United Nations Food and Agricultural Organization (FAO) was also engaging in scrutinizing the effects of resources surveying for nutritional requirements. Its report thereon was reviewed by the Scientific and Technical Sub-Committee at its ninth session.<sup>22</sup>

In accordance with the terms of General Assembly Resolution 2778 (XXVI), the Working

Group held a first preparatory session in May 1972. The session revealed large divergencies of the political views and interests of the several States represented: Whereas some delegations considered that the mandate of the Working Group, besides scientific and technical problems, covered legal, social, and organizational aspects, others underlined the desirability of considerations of political and legal consequences of earth monitoring by satellites within the framework of the Legal Sub-Committee. Some other delegations stressed the need for establishing an early exchange of views with the Legal Sub-Committee as regards the legal implications of sensing activities. As a common denominator, it was inferred that the Working Group should deal primarily with the technical and economic aspects of remote sensing, thus leaving it over to the Legal Sub-Committee to benefit from the findings of the Working Group as a preliminary working basis to express its views on the subject.<sup>23</sup>

The query of legal implications of remote sensing of the earth by satellites was again discussed at some length during the second session of the Working Group. The opinions expressed by delegates ranged from the desirability of requesting studies of legal subjects on a wide array to the suggestion of leaving the study of legal problems untackled until technical and organizational achievements had reached a more advanced state of development.<sup>24</sup> On this occasion, a considerate number of proposals, options and principles with regard to a broad and systematic review of legal implications were suggested for further consideration.<sup>25</sup>

Particular attention should be paid to a Preliminary Draft of Legal Principles to be Applied by States Utilizing Space Technology in Exploring the Resources of the Earth formulated by the delegation of the Soviet Union.<sup>26</sup>

In conformity with the 1967 Outer Space Treaty the Soviet Draft recognizes that "activities connected with the exploration of the natural resources of the earth by means of space technology shall be conducted in conformity with the principles of international law, including the United Nations Charter, and in the interests of peace and progress for all peoples" (par. 1), and that States conducting such activities "shall undertake to respect the sovereignty of other States and, in particular, their inalienable right to control their own natural resources as well as information concerning such resources" (par. 2).

As to information obtained about the natural resources of other States, the State having obtained such information shall be required to transmit it to the State concerned "under mutually acceptable conditions" (par. 4). It shall, however, not be entitled to make such information public or transmit it to a third State or international organization without the express consent of the State to which these natural resources belong, nor shall it be entitled to utilize such information in any other manner to the detriment of the latter State (par. 5). An "internationalization" of earth resources data by their transmission to an international organization or data bank, as it is envisaged for certain type of data in the Argentine Draft International Agreement of June 26, 1970, is not provided in the Soviet Draft.

### III. Earth Resources Surveying by Satellites Under Existing International Law

Although remote sensing of earth resources by satellites is a rather novel field of space activity, it is not conducted in a legal vacuum. There is no doubt that, already at

the present stage, certain basic principles of international law can be considered applicable. Notably the 1967 Outer Space Treaty, praised by some authors as the "Magna Charta" of outer space and the celestial bodies, applies in various respects:<sup>27</sup>

The principles of the launching States' responsibility and liability for their national activities in outer space (arts. 6 and 7) include earth resources survey satellites as well as any other artificial space objects; launching States retain jurisdiction and control over such satellites and the personnel thereof while in outer space or on a celestial body; ownership rights of such satellites are not affected by their presence in outer space or on a celestial body or by their return to the earth (Art. 8).<sup>28</sup> Equally, the provisions of the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space<sup>29</sup> and of the detailed 1972 Convention on International Liability for Damage Caused by the Launching of Objects into Outer Space<sup>30</sup> fully apply to earth resources surveys by satellites.

Further, it stands to reason that the legal imperative of carrying out space exploration and use activities with due regard to the bonum commune humanitatis also refers to earth resources sensing from outer space, as it does to any other space-oriented or space-originating activity. Art. 1, par. 1 of the Outer Space Treaty unmistakably indicates that the exploration and use of outer space generally "shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind."

The main query which arises in this context is admittedly whether remote sensing of earth resources by satellites is a lawful activity under existing international law. The issue of lawfulness can be approached from three different aspects which are:

- (a) Does earth resources sensing by satellites come under the scope of the freedom of space exploration rule, as enounced in Art. 1 of the Outer Space Treaty?
- (b) Does earth resources sensing by satellites constitute peaceful uses of outer space in the meaning of Art. 4 of the Outer Space Treaty?
- (c) Is earth resources sensing by satellites compatible with the respect for States' sovereignty over their natural resources, principle repeatedly recognized in United Nations resolutions?

#### Ad (a): The Rule of Freedom of Space Exploration

Art. 1, pars. 2 and 3 of the Outer Space Treaty proclaim this basic rule textually as follows: "Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and . . . there shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies. . . ."

Despite the fact that the earth and its atmospheric environment cannot be regarded, under the nomenclature used in the Treaty, as a part of outer space or a celestial body, the spatium liberum rule is unanimously considered by authors as covering both space-oriented and space-originating activities. Thus, Gorove rightly argues that this line of reasoning finds support in the clear wording of the Treaty which speaks of scientific investigation "in" outer space rather than scientific investigation "of" outer space.<sup>31</sup>

Galloway logically distinguishes four different types of space law norms, all four being covered by the scope of the Outer Space Treaty provisions: (a) law which applies

solely to outer space; (b) law which applies to the earth, airspace and outer space as an environment; (c) law which applies to functions performed in outer space and occasionally including airspace; (d) law which applies essentially to activities performed on the earth as a consequence of the exploration and particularly the uses of outer space. In adopting Galloway's distinction, earth resources surveying activities by satellites would come under the fourth category of international space law.<sup>32</sup> Although they are entirely earth-oriented, they are, however, space exploration activities in the full meaning of Art. 1 of the Treaty.

Ad (b): The Imperative of Peaceful Uses of Outer Space

Art. 4, par. 2 of the Outer Space Treaty provides basically that "(t)he Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes." This rule is lacunar and even misleading in a double sense: Firstly, while speaking of the Moon and other celestial bodies, it is silent about the legal status of outer space as such; secondly, it does not make clear what "peaceful" means, thus leaving a battleground for more or less biased interpretations.

Although the genesis of the Treaty indicates that it was not fortuitous that no reference was made to outer space in the peaceful uses clause,<sup>33</sup> no proper interpretation will go as far as to declare, *argumento e contrario*, non-peaceful uses lawful and permitted in empty outer space. The international doctrine, in application of the General Treaty Law Principles worked out by the International Law Commission, notably that "(a) treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose" (Art. 27, par. 1), has always unanimously contended that the peaceful uses rule indifferently applies to space and celestial bodies therein.<sup>34</sup>

As regards the meaning of the term "peaceful," there is much confusion in theory and practice: Whereas the Soviet doctrine and practice contend the strict synonymy of "peaceful uses" and "non-military uses," despite the fact that Art. 4, par. 2 expressly does not ban the use of military personnel for peaceful purposes, Meyer understands "peaceful" in the context of international space law as synonymous with "non-aggressive," as the term is used in general international law.<sup>35</sup> Markov argues that the Outer Space Treaty introduced a new international law rule of higher quality which prohibits all military actions in outer space without exception. He bases his postulate on Art. 1 of the Treaty which calls for the exploration and uses of outer space in the interests and for the benefit of all mankind, thus forbidding activities which are of use exclusively for the benefit of individual States or groups of States.<sup>36</sup>

Whether adopting the Soviet understanding of "peaceful" or supporting Meyer's or Markov's interpretation of the term, it appears that, under no reasonable construction of the peaceful uses clause, remote sensing of earth resources by satellites can be regarded as unlawful and in violation of international peace and security, so long at least as it does not cause substantial damage to the sensed country or produce harmful effects on human health or life.<sup>37</sup>

Ad (c): The Principle of State Sovereignty Over Natural Resources

Earth resources sensing by satellites cannot only be approached from the international law of outer space, but also be viewed and evaluated in the light of States' national sovereignty over their land and water territories, well-established principle of public

international law which, according to an ample number of United Nations resolutions, includes State sovereignty over the natural wealth and resources located within the territorial boundaries of States. Speaking in more practical terms, remote sensing of earth resources can be highly prejudicial to the economic progress and welfare of the countries concerned, in particular the developing countries which are largely dependent upon the economical exploitation of their mineral and biological resources.<sup>38</sup>

The United Nations General Assembly has first been tackling the problem in its Resolution 523 (VI) of January 12, 1952, entitled "Integrated Economic Development and Commercial Agreements," in the preamble of which it held that the under-developed countries had "the right to determine freely the use of their natural resources and that they must utilize such resources in order to be in a better position to further the realization of their plans of economic development in accordance with their national interests, and to further the expansion of the world economy. . . ." Further, the General Assembly recommended that Members of the United Nations, within the framework of their general economic policy, should "consider the possibility of facilitating through commercial agreements . . . the development of natural resources which can be utilized for the domestic needs of the under-developed countries and also for the needs of international trade. . . ."

Similar views were expressed in Resolution 626 (VII) of December 21, 1952, entitled "Right to Exploit Freely Natural Wealth and Resources," in which the General Assembly recommended United Nations Member States "to refrain from acts, direct or indirect, designed to impede the exercise of the sovereignty of any State over its natural resources" (par. 2).

The pregnant and often-cited formula "Permanent Sovereignty over Natural Resources" was first used in Resolution 1720 (XVI) of December 1961, entitled "Permanent Sovereignty over Natural Resources," in which the General Assembly expressed its desire "to promote the strengthening of permanent sovereignty of peoples and nations over their natural wealth and resources." It appeared again in four further United Nations Resolutions, namely 1803 (XVII) of December 14, 1962, 2158 (XXI) of November 25, 1966, 2692 (XXIV) of December 11, 1970, and 3016 (XXVII) of December 18, 1972, which were likewise entitled "Permanent Sovereignty over Natural Resources."

Particularly noteworthy is Resolution 1803 (XVII) in which the General Assembly emphasized its recognition of the "inalienable right of all States freely to dispose of their natural wealth and resources in accordance with their national interests" and declared that "(t)he free and beneficial exercise of the sovereignty of peoples and nations over their natural resources must be furthered by the mutual respect of States based on their sovereign equality" and that a "(v)iolation of the rights of peoples and nations to sovereignty over their natural wealth and resources is contrary to the spirit and principles of the Charter of the United Nations and hinders the development of international cooperation and the maintenance of peace" (pars. 5 and 7).

It is not entirely clear what "sovereignty over natural resources" virtually means. Manifestly, the term has a sense different from that in which "sovereignty" is used in classical international law. The traditional concept of sovereignty as the right of States to complete self-commitment and self-determination (developed by Kelsen, Jellinek et al.) proves to be as little applicable to this notion as the time-honored Roman law distinction between *imperium* and *dominium*. Sovereignty over natural resources would, on the contrary,

become largely meaningless if it were only applied to "imperial," i.e., public law rights, but left private law property of natural resources out of consideration. On the other hand, this principle, strongly advocated by developing countries, is no charter for uncompensated expropriations of foreign nationals who hold property of natural resources in such States.

To speak with the words of the delegate of Sweden to the United Nations, "sovereignty over natural resources is a political notion which is not incompatible with the fact that the property of the resources or the right to exploit them belongs to foreigners."<sup>39</sup> Thus, the internationalist Fischer arrives at the conclusion that the principle of State sovereignty over natural resources is a political doctrine rather than a rule of existing international law; it is still an "idée-force" born of the developing countries' aspirations to achieve economic liberation and independence.<sup>40</sup> His conclusion may be borne out by the fact that General Assembly resolutions generally produce no binding legal effect, but are, for the most part, non-committal declarations of principles or intentions.<sup>41</sup>

It has been rightly stated that neither the Outer Space Treaty and its sequential legislation nor the declarations of the principle of State sovereignty over natural resources render it unlawful to sense the territories of other countries and to gather information about their natural resources without the consent of the countries concerned. As there is no positive rule in international law, either in treaty law, including the Charter of the United Nations, or in international custom, which would prohibit such activity, earth sensing by satellites has, under the Lotus rule,<sup>42</sup> to be considered lawful and permitted.<sup>43</sup>

A limit should, however, be drawn between mere information-gathering about another State's territory and natural resources, on the one hand, and the subsequent use of the information obtained to the political or economic detriment of the country concerned, on the other, like for purchasing, or allowing its nationals to purchase, resources-bearing land below value. To cite Attorney Brooks: "In such case an injury is being done to a State directly on its own territory involving a tangible, specific resolution. This is something more than mere information gathering that may be used indirectly to the advantage of the collecting State. Additionally, the secretive and hurtful nature of the act would seem to fall below even minimum standards of "promoting international cooperation and understanding."<sup>44</sup>

#### IV. A Needed Regulation de lege ferenda

Existing law, in particular the 1967 Outer Space Treaty, provides certain basic guidelines for the conduct of earth resources surveying by satellites but is too vague to cover the wide array of legal, political and economic problems involved with remote monitoring systems which can be expected to outgrow their experimental phase in the next few years. The need for comprehensive legislation de lege ferenda stands to reason. Statements of government officials from various countries have expressed dissatisfaction with the existing regulation as well as the writings of renowned space lawyers.<sup>45</sup>

Among the issues arising in this context, two occupy a pivotal position in the discussion on present and future law-making requirements:

- (a) Who shall acquire the rights to data gathered in the territory of another State or on the sea beyond the boundaries of national jurisdiction?
- (b) Should an international agency be established to coordinate remote sensing activities and to disseminate relevant data?

Ad (a): The Rights to Satellite Gathered Data

The question as to who shall be entitled to satellite collected information, if the sensing and the sensed States are not identical or if the information pertains to the high seas, presents itself in a twofold aspect, affirmative and prohibitive. The affirmative aspect would be whether the sensing State should be obliged to transmit such information to the State concerned, an international organization, or the general public; the prohibitive aspect, in return, would be whether the sensing State should be entitled to pass the information to third States, international organizations or the general public without the express or implied consent of the State or States sensed.

International treaty law as well as international custom is silent about both sub-questions. The Outer Space Treaty calls in its Art. 11 "in order to promote international cooperation in the peaceful exploration and use of outer space," upon States conducting activities in outer space to "agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities."

The wording of this provision is clear: It does not impose upon States the duty to disclose detail information but leaves it to their discretion to determine, in accordance with the guiding principle of world-wide cooperation and having due regard to the betterment of mankind, to what extent data communication is (technically) feasible and (politically) practicable. It does, however, not admit of interring a general obligation to disclose satellite gathered data. As it has been rightly stated, there is no rule in existing order pending international law which would bind States having collected information about the natural resources of another State to transmit such information to that State, except, possibly, in emergency situations, like for the avoidance of major disasters on humanitarian considerations.<sup>46</sup> Likewise, it must be emphasized that there is no prohibition, to be derived either from the Outer Space Treaty or the principle of national sovereignty over natural wealth and resources, to make such information available to third States, international organizations or the general public.

The above-mentioned Soviet Preliminary Draft of Legal Principles provides that "(a) State which engages in exploration of the natural resources of the earth by means of space technology and, in the course of such activities, obtains information concerning the natural resources of another State shall be required to transmit such information to the latter State under mutually acceptable conditions" (par. 4), but the State having obtained such information "shall not be entitled to make such information public or transmit it to a third State or international organization without the express consent of the State to which these natural resources belong" (par. 5). No reference is made to information collected about the natural resources of the sensing State itself or of the sea beyond the limits of national jurisdiction, thus prompting the clear inference that such information, at the sensing State's discretion, may be, but must not be disclosed to third States or international organizations.

The Argentine Draft International Agreement goes farther: The legitimate interest of the international community in the dissemination of relevant information is given priority over the individual States' interest in deriving benefit from their national activities. "Surveys of natural resources and their findings with respect to the sea beyond State jurisdiction or of the ocean floor and subsoil beyond the limits of national jurisdiction

shall be transmitted to the data bank. If the surveys involve the national territory and jurisdictional waters of one or more State, the facts and findings shall be promptly communicated to the State or States concerned and (emphasis author's) transmitted to the data bank." (Art. 6).

The Argentine lawyer Barboza, finally, while essentially consenting to the Argentine Draft International Agreement, recognizes the exclusive rights of sensed States to the data collected about their national land and water territories, including their natural resources, and, therefore, demands a prohibition to disclose such information to third States or international organizations, like a relevant data bank.<sup>47</sup>

Following essentially Barboza's findings, the following principles are proposed for suitable regulation de lege ferenda:

- If and insofar the information obtained relates to the territory of the sensing State, it shall belong entirely to that State, and there is no conflict between the interest of the sensing State in deriving benefit from its sensing activities and the sovereign rights of the sensed State over its natural wealth and resources.
- If and insofar the information obtained relates to the sea beyond the limits of national jurisdiction, the principle of mare liberum shall be preeminent upon the interests of the sensing State, and the information shall, consequently, be disseminated to the international community, possibly through an appropriate international organization.
- If and insofar the information obtained relates to the territory or territorial waters of another State, the fundamental international law principle of full and exclusive sovereignty of States over their territory and territorial waters, principle which implies sovereign rights over natural wealth and resources, shall require the disclosure of such information to the State concerned. Its dissemination to third States or international organizations, however, shall be regarded as a violation of international law.

#### Ad (b): The Establishment of an International Agency

Opinions on the desirability of such agency, its precise functions and competences, and organizational structure are largely divergent. Fiorio strictly denies, at least for the time being, its usefulness, arguing that some of the objections and legal difficulties would persist even under United Nations data management, let alone the fact that, as it is, the United Nations does not have the capability of handling the enormous flood of relevant data.<sup>48</sup> Contrariwise, the establishment of a data bank for the planning, consultation, information, inventorying and coordination of remote sensing activities by satellites is suggested by the Draft International Agreement worked out by Argentina (Art. 3). The International Council of Scientific Unions, Scientific Committee on Problems of the Environment (SCOPE), recommended in a Report on Global Environmental Monitoring (1971) the creation of a global earth monitoring system consisting of a Central Monitoring Coordinating Unit to be established by international agreement to delineate and review programs and provide data handling and dissemination with the scientific assistance of the International Council of Scientific Unions.<sup>49</sup>

Coddig and Beheshti stress the requirement of constituting an International Agency for Earth Resources Experiments which should basically be patterned after the model of existing technical organizations such as the International Telecommunications Union or the International Atomic Energy Agency. The Agency should be set up as "an intergovernmental, technoscientific, non-profit making agency" (Art. 1 of the detailed 18 article Draft

Agreement prepared by the authors), open for membership to all States (Art. 7). Its functions should be "to promote the development and use of space laboratories to explore and inventory the resources of the earth (Art. 2 (1)(a)), "to negotiate with interested governments . . . for time aboard their space laboratories for use by the Agency" (Art. 2(2)(a)), and "to coordinate the planning and designs of experiments to be carried out by space laboratories under contract to the Agency" (Art. 2(2)(b)).

Among the guiding principles of the new intergovernmental body, proposed by Coddington and Beheshti, which should act with an Assembly, a Council, a Technical Commission and a General Secretariat as organs (Art. 11), should rank the maxim that "(a)ll members shall have the right to benefit from the use of space laboratories contracted by the Agency to explore and inventory their natural resources (Art. 3(1)).<sup>50</sup>

It is undeniable that, possibly in a near future, both administrative planning and coordination of sensing activities and data management on a world-wide basis, such as processing, storage, retrieval and dissemination, will become an imperative necessity. Bilateral or multilateral agreements as such cannot come up to the need for institutionalized administrative coordination. Especially developing countries may express their misgivings about their possibly being discriminated against by agreements with technologically advanced nations.

It would, however, seem to be premature, at the present stage of development, to give final consideration to particular questions of organizational concern. Whether an agency for remote sensing of earth resources by satellites should be constituted as an independent body with legal personality or as an organ within the framework of the United Nations or one of its specialized organizations, and what its precise functions and organizational structure should be, is a question to be left to the future requirements of sensing activities from outer space once they will have entered into their operational phase. The United Nations, notably through its Committee on the Peaceful Uses of Outer Space and its Working Group on Remote Sensing of the Earth by Satellites, could be the appropriate international entity to provide a focal point for pertinent consideration,<sup>51</sup> as it has proved to be a workable center for international cooperation in the peaceful uses of outer space.

#### Footnotes

<sup>1</sup>Marco G. Marcoff, "L'étude des ressources terrestres par des objets spatiaux et le droit international," Revue Générale de l' Air et de l' Espace, vol. 35, 1972, no. 4, pp. 343 et seq., at 343.

<sup>2</sup>Draft Report of the Working Group on Remote Sensing of the Earth by Satellites on the work of its second session, U.N. Doc. A/AC. 105/C.1/WG.4/L.4 of February 8, 1973, par. 6, p. 2.

<sup>3</sup>Progress Report of the Working Group on Remote Sensing of the Earth by Satellites on the work of its second session, U.N. Doc. A/AC.105/111 of February 14, 1973, par. 6, p. 2.

<sup>4</sup>Definition provided by the Progress Report, op. cit., par. 15, p. 4.

<sup>5</sup>Draft Report, op. cit., par. 10, p. 3; see also Progress Report, op. cit., par. 11.

<sup>6</sup>Eugene Brooks, "Technological and Legal Aspects of Environmental Monitoring," Journal of Space Law, vol. 1, 1973, pp. 6 et seq., at 19-20. For further surveys of actual or potential future uses of teledetection techniques concerning natural resources see: Franco Florio, "International Implications of Earth Resources by Satellites," Journal of Space Law, vol. 1,

1973, pp. 1 et seq., at 3-4; Jaffe/Summers, "The Earth Resources Survey Program Jells," Journal of Astronautics and Aeronautics, vol. 9, April 1971, pp. 24 et seq.; Eugene Brooks, New Developments of Earth Satellite Law, Proceedings of the 13th Colloquium on the Law of Outer Space of the International Institute of Space Law, Constance 1970, pp. 337 et seq., at 338-339; Pierre Touzelet, "L'évaluation des ressources terrestres au moyen de satellites," Revue de Défense Nationale, vol. 25, no. 11, 1969, pp. 187<sup>4</sup> et seq.

<sup>7</sup>Eugene Brooks, Technological and Legal Aspects of Environmental Monitoring, op. cit., at 11-13.

<sup>8</sup>See table in Revue Générale de l'Air et de l'Espace, vol. 35, 1972, no. 4, p. 348; see also Manfred Dausen, Die Grenze zwischen Luftraum und Weltraum als Gegenständen rechtlicher Regelung (The Frontier between Airspace and Outer Space qua Subjects of Legal Regulation), Doctoral Dissertation, Wuerzburg 1969, pp. 130-131 with tables.

<sup>9</sup>The Aeronautical and Space Report of the President - 1972 Activities, Executive Office of the President - National Aeronautics and Space Council, Washington, D.C., 1973.

<sup>10</sup>The Aeronautical and Space Report of the President, op. cit., at 16; see also Brooks, Technological and Legal Aspects of Environmental Monitoring, op. cit., at 15.

<sup>11</sup>The Aeronautical and Space Report of the President, op. cit., at 53.

<sup>12</sup>Op. cit., at 53-58.

<sup>13</sup>Op. cit., at 57.

<sup>14</sup>U.N. Doc. A/AC. 105/L.56.

<sup>15</sup>U.N. Doc. COPUOS/XIIIth Session, CRP. 2.

<sup>16</sup>U.N. Doc. A/AC. 105/C.2/L.73.

<sup>17</sup>Draft Report of the Scientific and Technical Sub-Committee of the work of its eighth session, U.N. Doc. A/AC. 105/C.1/L.42, July 13, 1971, par. 15.

<sup>18</sup>The Use of Earth Survey Satellites in Monitoring the Changes in the Global Environment, U.N. Doc. A/AC. 105/C.1/VIII/CRP. 1; The Role of Earth Satellites in the Study of the Human Environment, U.N. Doc. A/AC. 105/C.1/VIII/CRP.2; Report of the United Nations Panel on Remote Sensing for Earth Resources Surveys, U.N. Doc. A/AC. 105/92; Annex to the Report of the United Nations Panel on Remote Sensing for Earth Resources Surveys, U.N. Doc. A/AC. 105/C.1/VIII/CRP.4.

<sup>19</sup>U.N. Doc. A/AC. 105/C.1/L.42, July 15, 1971, as amended U.N. Doc. A/AC. 105/C.1/L.42/Amend. 1.

<sup>20</sup>For discussion of the legal status of the Working Group see UNCOPUOS, 8th Session, Scientific and Technical Sub-Committee, Summary Record of the 18th Meeting, July 7, 1971, U.N. Doc. A/AC. 105/C.1/SR.81, pp. 27-31.

<sup>21</sup>U.N. Doc. A/AC. 105/C.2/11; see also Report of the Legal Sub-Committee on the work of its eleventh session (April 10 - May 5, 1972), U.N. Doc. A/AC. 105/101, May 11, 1972, par. 5, no. 4 (c), p. 3.

<sup>22</sup>Report of the Scientific and Technical Sub-Committee of the work of its ninth session, U.N. Doc. A/AC. 105/102, May 15, 1972, par. 8, p. 3.

<sup>23</sup>Report of the Scientific and Technical Sub-Committee of the work of its ninth session, U.N. Doc. A/AC. 105/102, May 15, 1972, Annex I, Summary of the Preparatory Session of the Working Group on Remote Sensing of the Earth by Satellites, May 1972, pp. 1-3. For further work of the Working Group see U.N. Doc. A/AC. 105/C.1/WG. 4/L. 3/Rev. 1; U.N. Doc. A/AC. 105/C.1/WG.4 CRP.7 (Working Paper prepared by the Secretary-General assessing United Nations documents and other pertinent data related to the subject of remote sensing of the earth by satellites); U.N. Doc. A/AC. 105/C.1/WG.4/CRP.8 (Working paper submitted by Sweden); U.N. Doc. A/AC. 105/C.1/WG.4/CRP.10 (Working paper submitted by Japan); U.N. Doc. A/AC. 105/C.1/WG.4/CRP.10 (Working paper prepared by the World Meteorological Organization (WMO)).

<sup>24</sup>Draft Report of the Working Group on Remote Sensing of the Earth by Satellites on the work of its second session, U.N. Doc. A/AC. 105/C.1/WG. 4/L.4/Add. 1, February 8, 1973, par. 41, p. 1; Progress Report of the Working Group on Remote Sensing of the Earth by Satellites on the work of its second session, U.N. Doc. A/AC. 105/111, February 14, 1973, pars. 45 and 47, p. 11.

<sup>25</sup>Progress Report, op. cit., pars. 50 and 51, p. 12.

<sup>26</sup>Progress Report, op. cit., par. 48, p. 11.

<sup>27</sup>See also Franco Florio, International Implications of Earth Resources Surveys by Satellites, op. cit., at 1; Eugene Brooks, New Developments of Earth Satellite Law, op. cit., at 341-342.

<sup>28</sup>Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, done January 27, 1967, in force October 10, 1967, text in U.N. GAOR Doc. A/Res. 2222 (XXI), December 19, 1966.

<sup>29</sup>Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched in Outer Space, done April 22, 1968, in force December 3, 1968, text in U.N. GAOR Doc. A/Res. 2345 (XXII), December 19, 1967.

<sup>30</sup>Convention on International Liability for Damage Caused by the Launching of Objects into Outer Space, done March 29, 1972, in force September 1, 1972, text in U.N. GAOR Doc. A/Res. 2777 (XXVI), November 29, 1971.

<sup>31</sup>Stephen Gorove, "Earth Resources Survey Satellites and the Outer Space Treaty," Journal of Space Law, vol. 1, 1973, pp. 80 et seq.

<sup>32</sup>Eilene Galloway, "Should the United Nations Draft a Treaty on Earth Resources Satellites? -- A Pro and Con Analysis," Journal of Space Law, vol. 1, 1973, pp. 72 et seq., at 78-79.

<sup>33</sup>A proposal to insert to words "outer space, including . . ." had been submitted to the UNCOPUOS by the delegations of Ceylon, Burma, India, Kenya, Mexico, Pakistan, and the United Arab Republic, but was rejected by a majority headed by the United States, U.N. Monthly Chronicle, January 1967, p. 40.

<sup>34</sup>Alex Meyer, "The Term 'Peaceful' in the Light of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Space Treaty)," Zeitschrift fuer Luftrecht und Weltraumrechtsfragen, vol. 17, 1968, pp. 111 et seq., at 111; Marko Markov, The Juridical Meaning of the Term "Peaceful" in the 1967 Space Treaty, Proceedings of the 11th Colloquium on the Law of Outer Space of the International Institute of Space Law, pp. 30 et seq.; Marco Marcoff (idem), "Sur l'interprétation juridique de l'article 4 du Traité régissant les activités spatiales des Etats," Revue Générale de l'Air et de l'Espace, vol. 31, 1968, no. 1, pp. 30 et seq., at 43; Julian Verplaetse, "Autour de l'article IV du Traité du droit cosmique du 27 janvier 1967," Revue Générale de l'Air et de l'Espace, vol. 31, 1968, no. 1, pp. 45 et seq., at 47; Manfred Dausen, "Die Grenze zwischen Luftraum und Weltraum als Gegenständen rechtlicher Regelung," op. cit., at 43-47; Manfred Dausen, "Der gegenwärtige Stand des Weltraumrechts (The Actual State of Outer Space Law)," Neue Juristische Wochenschrift, January 30, 1973, pp. 172 et seq., at 173.

<sup>35</sup>Alex Meyer, "The Term 'Peaceful' in the Light of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Space Treaty)," Zeitschrift fuer Luftrecht und Weltraumrechtsfragen, vol. 17, 1968, pp. 11 et seq., at 111.

<sup>36</sup>Markov, Marko, "The Juridical Meaning of the Term "Peaceful" in the 1967 Space Treaty, Proceedings of the 11th Colloquium on the Law of Outer Space of the International Institute of Space Law, pp. 30 et seq.

<sup>37</sup>See Stephen Gorove, Earth Resources Survey Satellites and the Outer Space Treaty, op. cit., at 83.

<sup>38</sup>See Julio Barboza, Los satélites equipados con sensores remotos y los recursos naturales, Proceedings of the 13th Colloquium on the Law of Outer Space of the International Institute of Space Law, Constance 1970, pp. 151 et seq., at 151.

<sup>40</sup>G. Fischer, La souveraineté sur les ressources naturelles, *Annuaire Français de Droit International* 1962, pp. 516 et seq., at 518-519.

<sup>41</sup>For the legal significance of General Assembly resolutions on outer space see: Manfred Dausen, Die Grenze Zwischen Luftraum and Weltraum als Gegenständen rechtlicher Regelung, op. cit., at 66-67 with notes; Manfred Dausen, Die Grenze des Staatsgebietes im Raum (The Frontier of Territory in Space), Berlin-Munich 1972, at 30 with notes; Manfred Dausen, "Bestehen und Inhalt von Weltraumgewohnheitsrecht -- Ein Beitrag zur Lehre von den Rechtsquellen des Weltraumrechts (Existence and Contents of Outer Space Customary Law -- A Contribution to the Doctrine of the Sources of Outer Space Law)," Zeitschrift fuer Luftrecht und Weltraumrechtsfragen, vol. 20, 1971, pp. 267 et seq., at 27<sup>4</sup> with notes.

<sup>42</sup>Case of the S.S. "Lotus", 1927, P.C.I.J., Series A, no. 10.

<sup>43</sup>Eugene Brooks, Technological and Legal Aspects of Environmental Monitoring, op. cit., at 34-36.

<sup>44</sup>Ibid., at 36.

<sup>45</sup>Eilene Galloway, "Should the United Nations Draft a Treaty on Earth Resources Satellites? -- A Pro and Con Analysis, op. cit., at 74-75; see Franco Fiorio, International Implications of Earth Resources Surveys by Satellites, op. cit., at 4; Julio Barboza, Los satélites equipados con sensores remotos y los recursos naturales, op. cit., at 152.

<sup>46</sup>Eugene Brooks, Technological and Legal Aspects of Environmental Monitoring, op. cit., at 35.

<sup>47</sup>Julio Barboza, op. cit., at 152.

<sup>48</sup>Franco Fiorio, International Implications of Earth Resources Surveys by Satellites, op. cit., at 3.

<sup>49</sup>International Council of Scientific Unions, Scientific Committee on Problems of the Environment, Global Environmental Monitoring, Stockholm 1971, pp. 64-65.

<sup>50</sup>George A. Coddington, Jr., and Mohammed Beheshti, "An International Agency for Earth Resources Experiments," Journal of Space Law, vol. 1, 1973, pp. 40 et seq., at 47 et seq.

<sup>51</sup>See Resolution 1721 (XVI) of December 20, 1961, which provides that "(t)he United Nations should provide a focal point for international cooperation in the peaceful exploration and use of outer space," International Co-Operation in the Peaceful Uses of Outer Space, U.N. GAOR Doc. A/Res. 1721 (XVI), December 20, 1961.