COMEST SUB-COMMISSION ON "THE ETHICS OF OUTER SPACE"

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REPORT

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I. INTRODUCTION

1. The main purpose of the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) is to promote values, which will permit better and broader international cooperation in science and technology and also in the social and cultural domains. According to its mandate, COMEST is to advise the decision-makers in the public or private sectors who have to make choices founded on ethical reflection. It has therefore turned its attention to space technologies, which are both promising and disturbing in that they mobilize considerable capital and touch upon power relationships between the nations. The conquest of space cannot be isolated from the risks, which it brings to humankind, integrity and human dignity. The ethics of space policy must lead to questioning of the motives underlying man's access to outer space and exploration of the universe, the degree of acceptability to public opinion and, last but not least, equity. The ethics of space policy must respond to the anxieties of public opinion through an objective, independent and transparent approach without emotional overtones.

2. Pursuant to the conclusions of the first session of the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) held in Oslo (Norway) in April 1999, the decision was taken to set up sub-commissions to enable COMEST members to meet in small groups between the statutory sessions. This would provide an opportunity to examine the conclusions of the expert groups in more detail. So it was that a sub-commission on the Ethics of Outer Space was created.

3. The proceedings of this meeting (list of participants in Annex 2) were based on the work of a group of experts co-ordinated by Prof. Alain Pompidou (France) and a seminar organized in September 1999 in co-operation with the European Space Agency (ESA). The latter meeting enabled specialists to share their ideas and experience on the subject, while also involving participants with a direct interest in space, the representatives of space agencies and of industry. The report on the "Ethics of space policy" presented to the Sub-Commission is the outcome of all this work.

4. Opening the meeting, Her Excellency Mrs Vigdís Finnbogadóttir, the Chairperson of COMEST, stated her satisfaction at the interest created in various circles by the fact that COMEST had decided to deal with the ethics of outer space, a field in which the ethical implications are as numerous as they are varied. The Chairperson stated that this Sub-Commission chaired by Prof. Jens Erik Fenstad (Norway) was the second of its kind to meet. The first Sub-Commission was responsible for the ethics of the use of fresh water resources, while the third would be

considering the ethics of energy at a later date. She pointed out that the task of the Sub-Commission was to define ethical principles which would be placed before COMEST for its approval at its second session (programme attached as Annex 1).

5. By way of introduction, after referring to the function of COMEST as an intellectual forum and the importance of the fields which it had decided to examine, Mr Jens Erik Fenstad highlighted the need to define ethical principles which might be translated into action. Any ethical discourse required guiding principles. However, the emphasis must be placed on practical matters and situations. On the ethical discourse, he emphasized the interest of promoting dialogue between scientific communities, the decision-makers and the general public, notably for analysis of the possible choices and assessment of the related risks. Since space was a new challenge to humankind, he pointed out that the recommendations made in the report on the "Ethics of space policy", regarded as a starting point, could be translated by COMEST into ethical guiding principles for the development and use of space technologies.

II. PRESENTATION OF THE REPORT ON THE "ETHICS OF OUTER SPACE"[1]

6. Introducing his presentation, Mr Alain Pompidou, the Sub-Commission's Rapporteur, pointed out that the ethical approach to space policy was founded on a concept, which envisaged space on several different levels:

- space as an area which raised ethical questions;
- space as a dimension;
- space as an instrument, and
- space as a perception.

This study must be accompanied by a communication strategy. To avoid all disinformation, a commitment must be given to avoid taking advantage of the credulity of individuals or whole populations.

Reference was made to the fact that ethical questioning conditioned the acceptability of space technologies. This was a permanent movement designed to clarify and guide law. Space activities needed a precise juridical framework, underpinned by an ethic defined and then clearly accepted by all the participants. The ethical questions must not be metaphysical but practical, designed in particular to guarantee free access to knowledge while safeguarding the protection of intellectual property. Better understanding and support by public opinion must also be assured.

1. See Annex 4.

On the subject of "space as a dimension", the need to regard space as part of the shared heritage of humankind was asserted. It would therefore be desirable for space to be proclaimed as a scientific territory at the disposal of all humankind. That being so, free access must be ensured. Moreover, the allocation of resources must be guided by the concept of equity.

Turning to "space as an instrument", the need to limit the pollution created by space activities, and more particularly by space debris, was asserted. In this connection, it was desirable for international measures, uniformly applicable to all users, to be taken in order to avoid any distortion of competition. The possibility of developing an international legal instrument providing a detailed definition of space debris must be envisaged. In parallel the importance of access to data, varying according to the specific nature of the data, was highlighted. In particular, a distinction between scientific data, environmental data and commercial data was proposed. On the subject of electronic surveillance, a balance must be struck between protection of the confidentiality of information exchanges and that of the individual and protection of public order and morality, while avoiding the circulation of subversive messages or the development of illicit activities. This must be done on a basis of respect for the protection of public freedoms and cultural differences. The vital need to avoid the standardization of cultures was reiterated, in particular by permitting the expression of minority cultures, while striking the necessary balance between the maintenance of existing cultural identities and the appearance of new identities created by planetary electronic forums.

"Space as perception" was considered from two angles: risk management and communication.

On the subject of risk management, supranational bodies must now be identified to propose rules of balanced risk management and ensure follow-up of the effective application of these rules. It was felt that risk management required the creation of an independent authority to protect security. Moreover, a policy of long-term development founded on a proportionate precautionary principle must be adopted. Risk management must be accompanied by a procedure for unlimited liability in cases where damage is caused by a space vehicle.

On the subject of communication, training to handle the challenges of space policy must be organized at the earliest opportunity. The quality of information and the level of understanding by public opinion must be assured to develop the most transparent possible form of communication. All the efforts of communication must lead to the development of a "space culture" based on a pedagogy of mediation which had now become imperative.

7. Welcoming the work done, the members of the Sub-Commission stressed a number of matters raised in the report which, in their view, warranted particular attention. Thus, on the problem posed by the proliferation of space debris, COMEST, in co-operation with the United Nations Committee on the Peaceful Use of Outer space (COPUOS), must look into this question in more detail to permit the drafting of new rules, notably in regard to the principle of responsibility applicable here and to the problem of the financing of potential solutions to reduce the volume of space debris. In general, it was felt that the principles and treaties applicable to outer space must be revised. In this regard, the difficulty of implementing them because of the lack of financial resources was raised. The need for a strong policy to be followed by the space agencies was mentioned. They should adopt an ethical approach. Some representatives stressed the importance of reconciling the use of communication and information techniques applied to space with respect for individual freedom and protection of private life. Moreover, an ethical approach was regarded as essential in processing certain information with a dual character, such as that gathered for national defence purposes, but which might also be used for purely economic ends. Referring to the principle of equity raised in the report, several members of the Sub-Commission laid emphasis on the importance of sharing the benefits induced by the use of space techniques between the space powers and the developing countries, with particular reference to the dissemination of data for the prevention of disasters. The question as to whether space resources were part of the common heritage of humankind was raised. In this regard, while taking account of the difficulty of defining strict rules on the matter, the suggestion was made that the experience acquired in the domain of the law of the sea could be drawn upon to assess the expediency of setting up a “High Authority” to organize the use of space for the benefit of humankind.

III. DISCUSSION

8. The members of the Sub-Commission, for their part, spoke in the discussions which focused on the subjects under review, defined on the basis of the conclusions of the report referred to earlier.

a) Decision-making process and definition of procedures for co-operation with the national space agencies

9. In his statement, Mr Franco Malerba asked why the space agencies should take account of the ethical principles applicable to space exploration. In this regard, he felt that it was in their own interest to consider the deep moral convictions, which, in the citizens’ perception, justified space exploration programmes and endowed these programmes with long-term sustainability. He pointed out that the space race had lost

its attraction today. In the 60s, everybody was aware of the stakes and everyone accepted the idea of competition to put man into orbit and make the moon an object of rivalry between two super-powers. Today, space no longer really hits the headlines; public budgets are stable or falling and the political objectives are not always clear to the general public. The fear seems to exist that another accident leading to the loss of human lives, as happened to the Challenger shuttle, might jeopardize the construction of the International Space Station. Today, the space agencies are justifying their programmes primarily through their scientific and technological merit. That attitude did not necessarily accord with the deep sentiment held by our citizens. On this point he mentioned the need for the security of citizens, which called for scrupulous risk management. It was therefore the task of the space agencies to evaluate the ethical dimension and the public perception of space programmes. They should consequently promote discussion of the ethical foundation and justification of space programmes and place an evaluation of "scientific merit" in the wider perspective of the "benefit to all humankind".

10. The ensuing discussion highlighted the desirability of a better definition of the field of action and limits specific to these agencies and industrialists, given the need to organize concertation between space agencies, especially in Europe, to permit a better shared understanding of concepts on the matters referred to previously. In the area of risk management, planetary protection should therefore be organized to avoid any contamination by the return of samples taken in outer space. While procedures existed in this field, they must be revised in a long-term approach based on consensus. The question arose as to whether criteria, rules, guidelines and certifications must be drawn up or the view simply taken that it was sufficient for the agencies to themselves decide the procedures applied by them, having due regard to the relevant ethical principles.

b) Role of ethics in decision-making strategies, such as technological feasibility and cost-benefit ratio

11. Mr Rao pointed out that space technology was a very powerful tool in the service of development because of its world reach and its ability to rapidly transform life styles, even in the most remote parts of the planet. It had proved capable, through appropriate choices, of fostering the rapid growth of the communication infrastructure, establishing closer links between people, improving literacy, protecting the environment, enhancing agricultural productivity, while at the same time helping to combat disasters and promoting the cause of integrated sustainable development. Every space project presupposed analysis before its implementation. This analysis must cover the needs of each country in relation to the programme priorities, the technological choices and the calendar for

implementation, the cost of the project and its financing, the induced development of human resources including training aspects, the environmental and social impact and the security of other countries. All this pointed to the importance of a transparent ethical approach to all decisions on the choice of a project or space programme. Referring to the marketing of space technology and in particular the sale of high resolution remote detection data, often offered at very high prices, he felt that ethics were a matter not only for the country of destination, but also for the supplier country. To an even greater extent than the sale of communication equipment, that of vital data obtained in particular by remote detection posed real ethical questions.

12. Some aspects of the presentation were regarded as a matter for the exercise of political authority rather than ethical debate. In drawing a demarcation between policy and ethics, the frontier was blurred and politicians must not be allowed to define the meaning of ethics. However, unanimity was reached on the idea of creating a mindset, which would encourage public information about events in space. The question of the interaction between space agencies and governments was recognized as a key element in the definition and elaboration of space programmes: the agencies certainly play a dynamic role in promoting and proposing space activities; nevertheless, they tend to promote space programmes for their own long-term survival. This leads us to believe that ethical aspects must be taken into account more than ever. In this regard, the organization of a public debate could have a positive impact on space programmes. The example of NASA was mentioned; because of the rules imposed upon it by the legislator, this agency informs the public of the budgetary aspects and potential risks of each one of its programmes. Moreover, awareness creation campaigns can be useful to obtain more financing.

c) Does outer space have any specific features as a protected and inalienable domain?

13. Mr Antonio Rodotà pointed out that, in the context of space activities, the absence of any claims to sovereignty had a juridical foundation. The fundamental principles governing space law included the principle of non-appropriation. He referred to the Space Treaty (1967) which had been drafted and adopted in a cold war climate and saw the United States of America and the USSR, for reasons both of prestige and of ideology, as rivals in the conquest of space. However, a geo-strategic compromise by which these two powers waived the right to appropriate outer space, including the moon and other celestial bodies, permitted the emergence of the present regime which is founded on three principles whose implementation has proved positive: non-appropriation; freedom of exploration and use (necessary for the development of space activities so as not to deprive the populations of the advantages resulting from their

implementation); utilization of space for the benefit of all humankind. He pointed out that, although the number of space powers had considerably increased since the drafting of the Space Treaty, it nevertheless remained limited. That fact had probably encouraged a number of equatorial States to claim sovereignty over the segment of the geo-stationary orbit situated above their respective territories. The regime created by the Space Treaty guaranteed respect for ethics in which the morality of principles accords with the morality of consequences. However, a situation must not be allowed to develop in which economic dogmatism may deprive some populations of the benefits brought by space technologies applied within the framework of the Space Treaty.

14. In the ensuing discussion, the emphasis was placed on the desirability of treating humankind, like the States, as a subject of international law. The principles applicable to outer space as a protected and inalienable domain do indeed have consequences for all humankind. Against the background of the principles of non-appropriation of outer space and benefits to all humankind figuring in the existing treaties, a review of these treaties might now be envisaged. If that were to be done, it might provide an opportunity to replace the term “privilege” used in the 1967 Treaty by the notion of shared heritage of humankind. The legitimate interest of all countries must be taken into account since technology does not solve all the problems. A more balanced and equitable path must therefore be chosen to regulate space activities.

d) What are the domains in which space technologies can be beneficial to all humankind?

15. Presenting the subject, Mr Cheick Modibo Diarra stated that programmes connected with space exploration were the principal source of most of the new technologies which are assuming increasing importance in our daily life. This was particularly true in the field of communications, transport safety, environmental monitoring, industrial productivity and manufacturing techniques. The large number (1,200) of products and derivative processes generated by the technologies needed for the NASA missions, and which contributed to varying degrees to the improvement of the economy and quality of life, have had a favourable impact. Many domains have been enriched, e.g. technologies of communication and information, use of GPS satellites for cartography; the medical domain (computer science and telecommunications enabling practitioners to connect up in a network and treat their patients more effectively); the use of remote detection equipment to protect the environment and manage natural resources; the development of robotics. Clearly, the progress of space technology and the benefits induced by it would find a still broader justification if they were equitably shared by all.

16. The discussion emphasized the importance of better information for the public. Scientists must learn to justify their activities. Attention was drawn to the fact that, since the end of the Second World War, the terms of the contract between science and society had changed, the interactivity of the scientific world with the public through an organized dialogue has permitted the emergence of reflection on ethical problems. The quality of this reflection was largely dependent on the way in which the dialogue was organized and the public educated, especially young people in whom a regrettable lack of interest in the scientific disciplines can be observed. In this regard the attraction of space for young people should be drawn upon to create an interest among them in the challenges created by the use of space technologies. Emphasis was placed on the need to stimulate a better perception of the positive aspects of space technologies to justify risk management. On this point, cultural differences were highlighted. Communication was not the same in the industrialized and developing countries. Although they shared a common base, the language to be employed must be adapted so as to guarantee synergy between the prospects opened up by space and the uses made of them. We must determine the extent to which the space agencies are capable of embarking upon a policy of communication and, if necessary, set up specialized media training institutes. In the latter field, a great deal of work remains to be done: only 8% of journalists have scientific training. Moreover it is desirable to make a clear distinction between the direct and indirect benefits of space. During the cold war there was no need to justify the interests of space programmes. That situation has changed today. An essential partnership must be developed between public opinion, agencies and the government authorities. An attempt must also be made to avoid a purely commercial policy and consider the opportunity cost (comparison between the indirect benefits and the contribution of direct investments in the discipline concerned, such as space exploration and medicine). Such an approach would be advantageous to the developing countries, which could therefore benefit from the contribution of space technologies.

e) Integrated global system for observation of the Earth: can space research contribute to a reduction in pollution of the planet through environmental surveillance?

17. Having regard to the enormous progress made by production techniques, Mr André Lebeau first called attention to the recent transition, at least in the developed countries, from a civilization of shortage to a civilization of abundance which generated two main problems: the depletion of non-renewable resources on which it draws and the management of waste. Assuming that the world economy can be transformed to make exclusive use of renewable resources or inexhaustible stocks, the interaction between man and the planet

engendered by waste would still remain and contribute to the progressive and irreversible degradation of the environment. The decisions needed to control the effects of global pollution are by nature hard political decisions, because in relation to the long-term anticipated benefits, they involve negative short-term aspects for some categories of economic users. Global management of the planetary environment would necessitate the broadest possible knowledge of this environment, more particularly of its weakest components: the atmosphere and the ocean. But there is no global and permanent earth watch system except for meteorology. In this context, when it comes to the global environment, space technology can play a central role because of two of its specific features: it permits measures covering the entire surface of the globe, regardless of the degree of accessibility of the zones concerned and it ensures great homogeneity of the measures because orbital movement enables the whole of the earth's surface to be covered by the same instrument. Three kinds of ethical conclusions can be drawn from this: one of the major objectives of the space programmes conducted by the States should be the creation of a permanent global system for the observation of the Earth's environment; the information acquired by this system and the advances of knowledge founded on this information should be made equally accessible to all the participants in the international debates on management of our planetary heritage; last but not least, the tasks of the design, deployment and exploitation of the global observation system should be shared through open international concertation between all the participants.

18. This presentation revealed the need to strike a balance between technological development and sustainable development of countries. On the matter of an integrated global surveillance system, international concertation has not made much progress so far. Given their importance for environmental management and disaster prevention, the data needed for modelling and supervision of the planetary environment should fall within the public domain to permit the broadest possible use by all the countries concerned, in particular the developing countries. However, such measures necessitate strengthening of the existing structures and perhaps even the creation of new bodies. A more rational approach to the management of resources would be desirable. To reduce pollution levels, a better relationship should perhaps be struck between public and commercial mechanisms. The use of data for environmental and forecasting purposes must be encouraged, even if the material concerned has been gathered for other applications. In the context of broader international cooperation, the importance of the role of the space agencies – which lie at the origin of the world dynamic in this field - was asserted. However, in the interest of closer international cooperation, better coordination of the public and commercial mechanisms and greater effectiveness, the space agencies must increase and diversify the number of their partners.

f) Management of risks created by the use of space technologies and space exploration: what is the limit of acceptability to the public and what is the cost that the States and the industrial sector are willing to bear?

19. Introducing this question, Mr Alain Pompidou felt that the motives behind the conquest of space were: the technological victory represented by manned flights; a broader scope of knowledge through exploration of the universe; the prevention of natural disasters, the surveillance of vegetation and that of the sea levels which were threatening the continents, by making use of observation satellites; the creation of closer ties between individuals and a commercial component with a high added value by placing communication and positioning satellites in orbit; and last but not least, the greater military power won by the space powers. All space activities were accompanied by a substantial real or potential risk which would sooner or later threaten the identity and autonomy of the individual and that of the nation states. Some risks were general and bound up with all space activities, ranging from the use of launchers to the placing of objects in orbit. This also held good for the proliferation of space debris, which may be regarded as a form of pollution that must be remedied as a matter of urgency. Other risks were inherent in every field of application of space technologies. These were risks specific to the exploration of the universe which may lead to contamination, notably when samples are brought back to earth; the success of manned flights with the constraints that astronauts are willing to accept; observation of the Earth and remote surveillance which, if they are used to good advantage, are bound to be beneficial to the population but may otherwise prove prejudicial to individual freedoms; the standardization of communication systems capable of prejudicing cultural diversity and, last but not least, the development of mafia or terrorist networks which present a real threat to democracy. The management of these risks poses certain difficulties of a political, technological and economic nature. It calls for an “ethic of responsibility” which requires adequate information, legal measures and political decisions at one and the same time. However, it cannot be developed without good information which is they key to acceptability to public opinion. The States, research institutes and industrialists must all contribute to the creation of media training centres to promote an effective “pedagogy of mediation”. International consultation must lead to the drafting of a code of good conduct and development of an ethic of responsibility.

20. The latter notion met with the attention of the participants who advocated its development. In this regard, the promotion of programmes to educate the public and train scientific journalists was essential to remedy the marginalization of a part of the population. To the extent that a major difference exists between the risks as calculated by engineers,

scientists and their perception by public opinion, the education and organization of the public debate are acquiring their full meaning. Moreover, the creation of training centres must be promoted, especially as the part played by space activities in the economy of the industrialized countries is growing. Nowadays, science is deified. We are witnessing an extraordinary emphasis on intellectual capability without the necessary convergence of professional expertise of all concerned in favour of the promotion of an ethic of responsibility. The human cost of space activities was examined. While it is generally accepted that the conquest of space must have a human cost, there is something irrational in taking the view that the loss of human life in space is unacceptable. The notion of zero risk in this field, as in every other application of scientific progress, cannot be adopted. This accordingly justifies the provision of information to the public who must be prepared to accept a possible accident even if, unlike the air transport field, life in the space exploration area has become in a sense sanctified.

g) Use of space technologies and access to data: should access procedures be based on equity and shared benefits?

21. After recalling the sustained efforts and considerable progress made by man in the field of space technologies in the last fifty years, Mr Lu Yongxiang presented the current status of the principles relating to space data at both national and international level and the resulting ethical questions. Most developing countries do not have access through their own resources to space technology or space data, although such data are crucial to their development. The present situation is reflected in the rapid growth of space activities with the spectacular development of earth observation data files. Since the entry into force in 1976 of the United Nations Convention on the registration of objects launched into outer space, some 3,977 space objects have been launched by the signatories. Moreover, the spatial and spectral resolution of the on-board detectors has been improved almost 100 times in 20 years. This progress creates an unprecedented capability to gather vital data from space. Confronted with this rapid growth of data associated with the progress of space technology, the use of such data has become a fundamental target for data suppliers and international bodies alike. The problem covers three essential dimensions: technical, political and ethical, involving moral principles of action, the notion of risk and recognition of the detected States founded on respect for all other human beings. In the particular field of space data, the difficulties and complexity represented by the creation of an ethical code acceptable to the largest possible number of people have not prevented the States from translating their ethical views into policies in which the full dimension of ethical study appears through the affirmation of the rights of the observed countries, the special attention

given to the developing countries and the notion of equity in access. However, it would be desirable to draw up an ethical code to harmonize the elaboration of policies in the area of data and corresponding practices; free access to low resolution data held on archive should be guaranteed in the cause of environmental protection; and a system of management via the Internet of space data with an environmental or health component should be set up.

22. The discussion emphasized the importance of access to data collected through the use of space technology. In the event of serious accidents or natural disasters it would be desirable for the space data gathered to be circulated immediately and without charge on the widest possible scale. However, account must be taken of the commercial aspect of this data. Having regard to the principle of equity, solutions should be studied to enable the developing countries to access this data; often they are unaware of the potential uses for the implementation of sustainable developing policies. Until measures to this effect have been generally introduced, the developing countries will remain underprivileged potential users. The problem posed by information obtained by one State about another was raised: is this a matter of ethics or one of politics? Since political issues touch upon the nature of relations between States, it was proposed that the data should classified, although all classification is difficult because of the inherent partitioning involved.

h) Promotion of the law of space: its application for better protection of intellectual property and respect of human rights

23. Mr Juan Manuel de Faramiñan Gilbert pointed out that the development of space activities and their constant evolution must be accompanied by progress of the law to fill the legal gaps that exist at present and to inhibit all kinds of abuse. In a field such as outer space, legal regulations must be drafted with the greatest precaution, given that advances in this field must serve as the basis for development of a whole new sphere of law. As to the lines on which space law must evolve, an important place should be accorded to intellectual property law. While this area is perfectly covered by law, the fact remains that the development of activities in outer space has opened up new paths which require intellectual property law to be reconsidered in depth. The example of scientific discoveries which will be made in the International Space Station (ISS) modules can be taken to illustrate the importance of the question of intellectual property rights. To apply these rights in the space station, the legal fiction of extraterritoriality is still used today. Allowance would have to be made for the State in which the space object is registered when a discovery takes place in one of the modules making up the station, as though this were an activity pursued on the territory of the State in which

the module is registered. Harmonization of existing legislation must go ahead with a view to effective coordination and cooperation between the public and private sectors, between States and companies. In the field of human rights too, the conquest of space has called attention to the legal gaps which need to be filled. Space exploration and research are developing in an environment. which should be designated as the common heritage of humankind. Similarly, the need for regulation of manned flights and inhabited space stations is now felt. The presence of human beings in outer space leads us to believe that it would be appropriate to draw up codes of conduct guaranteeing respect for human rights in space and preventing their violation or that of fundamental freedoms. At all events, if space law is to adapt to the rapid evolution of technology and space activities, innovative and flexible solutions will have to be envisaged on the basis of ethical principles.

24. The direct relationship between space objects and the State of registration was recognized, so enabling liability to be determined. Moreover, unlike the status of objects in space, no legal definition of a space station exist today. The international space station which is currently being built may be envisaged as a cluster of space objects. Determination of the intellectual property rights applicable to inventions made in this station will therefore be based by default on the nationality of the module. This solution presents the risk of seeing the duplication of experiments which might be performed in the different modules. The development of a universal ethic of space accompanying the definition of new legal norms must not be understood as a mere monitoring factor, but also as a factor to promote dynamism in space. Emphasis was placed on the need to obtain universal approval of the future ethical rules or principles. In general, while recognizing the need to recast the law in response to the progress of space technology, this must not be allowed to present a threat to international law by weakening the existing body of law.

i) Report on the activities of the United Nations Committee on the Peaceful Use of Outer Space (COPUOS)

25. Mrs Mazlan Othman, Director of United Nations Office for Space Affairs (OOSA), outlined the activities of the United Nations Committee on the Peaceful Use of Outer Space (COPUOS) falling within the field of action of COMEST, with particular reference to the management of space debris. She pointed out that COPUOS was examining the possibility of revising some existing texts, which deal inter alia with the use of sources of nuclear energy and the concept of the “launching State”. She invited the Sub-Commission to arrange to be represented at a colloquy on the “Human dimension in space science and its technological applications” which will be held in 2001.

26. International treaties certainly need to be updated. There were substantial gaps in space law. Allowance must be made for scientific and technological progress. However, in this regard, the need for a prudent attitude was reaffirmed. The treaties have certain foundations, which must not be called into question. In any work on the revision of legal norms, the dignity and security of human beings must remain the focus of attention.

IV. OUTLINE OF THE PROPOSED RECOMMENDATIONS

27. The purpose of COMEST is to permit an exchange of views and experience in order to assist the process of reflection on ethical aspects. It must facilitate:

- a better understanding by public opinion of scientific progress and technological challenges;
- the anticipation of risk situations;
- a sound balance between individual and collective protection with a view to recognition of human dignity and the principle of equity;
- due allowance for a proportionate precautionary principle based on objective data and on transparent expertise, seeking to assure the best possible conditions for sustainable development.

It is founded on the creation of a dialogue between the scientific community, political decision-makers and well-informed public opinion.

Its task is to draw up guidelines and norms with a view to the prevention of errors of interpretation.

In the field of the ethics of outer space, the COMEST Sub-Commission defines ethical principles applied to scientific knowledge of the Universe and to the development and use of space technologies.

After hearing the speakers and holding an in-depth dialogue, the participants adopted the following recommendations.

A. ETHICAL ISSUES RELEVANT TO SPACE

28. Applied to space policy, the specific features of the ethical approach reside in the fact that it establishes a relationship between human beings, the planet Earth and the entire Universe. Without engaging in a wide-ranging philosophical debate, the Sub-Commission will consider the facts logically and draw up norms as the outcome of ethical reflection. The intention is to safeguard human dignity and therefore to highlight the diversity of human societies. It also seeks to introduce a “proactive” and constructive, rather than limitative, approach in order to permit the harmonious progress of science and technology in the context of space activities.

- Ethical reflection must come before law and not the reverse, but a synergetic approach is indispensable in so far as ethics must take into consideration the already established law and in so far as law must be based on ethical rules.

- Ethical reflection must precede and guide the definition of national space policies. By assuring an equitable balance between ethical concerns and political decisions, the conditions can be created for prior consultation founded on dialogue with a view to enabling all the parties involved to subscribe to the recommendations emerging from the process of ethical reflection. The main aim of this approach is to safeguard a long-term vision for the sustainable development of space activities.
- Risk management involves the calculation and comparison of risks followed by choices.
- Ethical principles must be applied at every stage of the development of space vehicles in order to:
  - Safeguard free access to space and avoid as far as possible the release of debris through measures which apply equally to all concerned.
  - Take due account of existing means to guarantee:
    - economic security;
    - technological choices;
    - launch and control infrastructures on the ground;
    - training of staff and development of human resources;
    - the possibility of financing and resource allocation.
  - Make sure that projects are not over ambitious and that initial costs are not overrun.
  - Retain the principle of equity in access to resources needed for the use of space for observation and communication purposes.
  - Guarantee free access to knowledge, while safeguarding the protection of intellectual property.
- Take into account contrary opinions: difficulties must not be concealed and risk reduction procedures must be clearly defined using objective and transparent approaches.
- A tendency towards diversion through the pursuit by Agencies of their own interests must be avoided.

This, in order to define a genuine culture of space (which goes far and beyond the simple awareness of the public opinion).

B. SPACE AS A DIMENSION

29. Three principles have been recognized:
    - non-appropriation of space;
    - freedom of access;
    - seeking benefits for all humankind.

These principles lead to actions, such as:

1. Space must be regarded as the common heritage of all humankind and not as a mere "appendage"[2]; space must remain in the service of all humankind.
2. Space must be regarded as a "**scientific territory**"[3].
3. Freedom of access to space must be assured: quite apart from access as such to outer space, the question of access to space resources arises.

To the extent that space is seen as the shared heritage of humankind, legal procedures must be defined to permit the processing, in the medium to long term, of data obtained by the use of space technologies and the discovery of potential resources bound up with the specific nature of space objects and/or that of the different planets.

4. Access to geostationary orbits must be safeguarded and electromagnetic pollution avoided.
5. The proliferation of barriers seeking to curtail access to space must be prevented.
6. Space debris must be limited by measures which are applied in equal measure to all to prevent any distortion of competition in respect of launchers and satellites.
7. A detailed definition must be made of the notion of space debris.
8. In the case of manned flights, quite apart from the fact that the exploration of space by human beings pushes back the frontiers of human activity, the situation of human beings in a state of micro-gravity confronts them with extreme conditions because they are "ill-adapted" to survival in outer space.

   Is it appropriate to consider that manned flights will enable a new territory for humankind to be defined, confined in the first instance to orbital stations, but which might later lead to the settlement of human beings on other planets?

   While robots remain under human control, human beings propelled into outer space must benefit from the same rules, which govern human and animal experimentation on earth:

   - explicit and well-informed consent in the case of human beings;
   - specific rules for the protection of experimental animals.

2. See para. 14 and Mr Juan Manuel de Faramiñan Gilbert's contribution in annex 3.
3. See para. 6.

9. The problem of the search for forms of life comparable to, or different from, those existing on Earth must be considered. Appropriate measures must be taken to administer the return on Earth of samples taken from other planets (especially Mars).

10. As to the existing treaties, the Sub-Commission proposes two further points:

    - Should humankind be regarded as a subject of international law?
    - The drafting of a document concerning orbital stations (permanently manned civilian space stations). The Sub-Commission referred to the extension of criminal law to the behaviour of astronauts in manned stations.

    The existence of internal rules, a code of good conduct and the concept of responsibility of the commander figure in the provisions stipulated for the Intergovernmental Agreement. However, it would also seem appropriate to consider the procedure for requiring confidentiality on the part of crew members during and after any particular mission.

30. Having regard to the specific dimension created by the special features of outer space, international organizations must be encouraged to reflect on the creation of an **International High Authority**[4] for the use of outer space for the benefit of humankind, based on the model of the authority for the sea and ocean beds, but taking account also of the rules laid down in the Antarctic Treaty. Such an authority will have to define what constitutes scientific knowledge, requiring total freedom of information exchange, and what falls within the domain of industrial development for the purpose of commercial exploitation by ensuring mutual and reciprocal benefits in the service of all humankind.

C. SPACE AS AN INSTRUMENT

31. The volume of space data increases by one terabyte daily. This raises the problem of the ethical use of space that implies:

1. To avoid the technological illusion

- in the preparation of programmes;
- in resource allocation;
- in presentations to public opinion.

Space has become a “technological motor” at the origin of a partnership and synergy effects. Space policy must therefore be based on the concept of mutual and reciprocal benefits, which may prove

4. See para. 7 and Mr Franco Malerba’s contribution in annex 3.

contradictory with the notion of a return on investment. Hence the role of ethics in project choice and its long-term evaluation for economic security.

A distinction must be made between:

- direct benefits which are a function of the financial resources allocated by the States;
- indirect benefits (spin-off).

The opportunity cost in relation to what might have been obtained by means other than space technology has to be also evaluated.

2. To protect the environment

- by creating a permanent global system for observation of the earth 's environment, a global system of observation shared by all on the basis of open-ended worldwide concertation: early warning system;
- by implementing a planet management system on a horizon, which extends beyond market forecasts: hence the importance of monitoring damage to the natural environment on a planetary scale.

This demand gives rise to a strong recommendation to European Space Agency (ESA) and the other space agencies.

3. To safeguard data acquisition and protection

3.1. Access to data

The fact that the hierachization and segmentation of data relating to space activities are difficult must be borne in mind. As a preliminary measure, it might be useful to distinguish between **purely scientific** data, which are freely exchanged within the community of researchers and **technological data**, which may be exploited by private and/or State financing giving rise to the protection of intellectual property. In practice, the Sub-Commission recommends a distinction between three types of data:

3.1.1. Scientific data: this involves the sharing of knowledge in order to facilitate scientific progress.

3.1.2. Environmental data: quite apart from scientific and specifically commercial data, emphasis must be placed on the special nature of environmental data in the case of which procedures for exchange and sharing between the populations of the planet must be defined.

The aims are:

a) to ensure protection of the planetary environment (global warming, depletion of the ozone layer, sea level);

b) weather forecasting;

c) the prevention of major risks and management of natural disasters. Prior concertation on the procedures for implementing and sharing these technologies must be arranged.

In this respect, a preliminary consultation on how to implement and share these technologies is necessary. A “Charter” already exists between ESA and the CNES with a view to making space data available. Ways and means of allocating the necessary financial resources must be envisaged (IMF, World Bank, agreement between States and insurance companies) with a view to the prevention of natural risks.

In the event of civilian disasters, immediate access must be available to satellite data.

However, the problem of data sharing remains: can information obtained by one State about another be made available to a third (need for a supranational “**co-regulation**” system)? The exchange and sharing of data for humanitarian reasons does not, strictly speaking, permit a commercial return, but does give access to information which can prove useful for the prevention and management of subsequent disasters.

The procedures for making information available to the developing countries and sharing the benefits must be defined, taking due account of the legitimate interests of the developing countries in the most balanced and equitable manner possible.

On this point, the exchange of data from victim States to States which supply data is likely to constitute a fair return in the context of a policy based on the concept of mutual and reciprocal benefits.

3.1.3. Commercial data

- observation of the earth’s surface;
- communications

The question is how to:

- organise procedures for the sale of observation and communication satellites covering both the beneficiary and the supplier;
- define a charter for access to space data founded on an international legal instrument;
- deal with the technical problems involving catalogues, data files, formats and integration systems;

While taking account of:

- the law of the States that are observed;
- equal access (non-discrimination in access);
- the categorization of data;
- data ownership and protection of right of access;
- the commercial logic and conflicts of interest;

- the advantages of space systems to be preserved;
- the recognition of the right of industrial and commercial exploitation, to the extent that private funds have been used;
- policies of general interest and not simply of commercial benefits;
- the necessity to avoid inequalities in access to space data and the emergence of coercitive economic practices.

The ethic of commercial use of high technology space products requires due allowance for[5]:

- procedures for the sale of remote detection products;
- the choice of ground infrastructures;
- commercial management of communication infrastructures.

3.2. Data protection

It is important to make a distinction between:

- the legal protection of databases;
- copyright protection;
- *sui generis* protection[6].

A distinction must also be made between intellectual protection of the systems carried on board satellites, operations on board space stations and data management systems.

The development of space activities and the progress made in the field of space industry area open up new avenues to intellectual property rights. Inventions, processes and products must be appropriately protected in order to provide the element of legal security necessary to enterprises involved in space activities. Such an undertaking is indispensable for private investment and implies:

- the need to establish an international legal framework adapted to intellectual property rights;
- the need for harmonization of norms and legislation on intellectual property rights;
- the need for effective co-ordination and co-operation founded on technology transfer between the public and private sectors and between States and companies;

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5. In the case of systems dedicated to space, an important distinction must be made between commercial and private systems. The commercial system is associated with a product that may be acquired by a private user which will be viable only if the size of the market share is sufficient. On the other hand, the space system of a private nature is one that is managed by a private entity whose direct profitability is not necessarily sought by the financing agency.

6. See Mr Lu Yongxiang's contribution in annex 3.

- in the special case of the International Space Station:
    - The various treaties relating to space contain no juridical definition of the space station, which is regarded as a “bundle” of space objects. The proposal has therefore been made of setting out a precise definition of a permanently manned civilian space station.
    - The legal regime of intellectual property applicable to a space station is set out in an Intergovernmental Agreement (IGA) (Article 21 of the IGA). This regime consists in the application of the legal fiction of extra-territoriality with allowance for the State in which the space object is registered. This approach was criticized by some speakers, who felt that the nationality of the teams making the discoveries should take priority over that of the module in which the discoveries are made.

The Sub-Commission focussed its attention on specific aspects relating to the patentability of space vehicles and of any intervention in outer space. There seemed to be no need to define a new criterion of eligibility for patent to the extent that unjustified applications for patents, such as those relating to the rotation of satellites or orbits of various kinds, did not stand up to detailed analysis, in view of existing patent law.

On the other hand, it was important to bear in mind the need for prior work leading up to an agreement on the management of intellectual property in manned stations. Such co-ordination could take place in the framework of an intergovernmental agreement. As to the patentability of products or processes implemented in orbital stations or associated with materials or vehicles carried on board, it was felt that international patent provisions must be drawn up.

4. Electronic surveillance

In this respect, we must:

- protect the confidentiality of information exchanges between individuals. The individual must be protected without any encroachment on individual freedoms;
- avoid the dissemination of subversive messages or unlawful actions;
- develop legislation on the definition and use of data processed by satellites.

5. Protection of public freedoms and cultural identities

The question is to:

- guarantee cultural identities and freedom of expression;
- allow minority cultures to express themselves;
- avoid the standardization of cultures;

- safeguard the necessary balance between the maintenance of existing cultures and the appearance of new identities arising out of electronic forums, which promote planetary exchanges.

D. SPACE AS A PERCEPTION

1. Risk management

1.1. Management of risks associated with launchers and space objects

32. The need for effective separation of the bodies responsible for safeguarding and implementing the technological instrument presupposes the creation of an independent authority to protect safety.

Efforts to reduce the production of debris must be accepted by all concerned. Unilateral measures would merely create distortions of competition between the traditional or emerging space powers. Be that as it may, a **better definition of the launching State** should be arrived at. At present, a degree of confusion exists between the launch State, the satellite owner and the client.

The Inter Agency Space Committee (IASC) must play a role that is all the more essential in that no international treaty makes provision for the release of space debris.

1.2. Management of risks specific to other space activities

1.2.1. Exploration of the Universe

Precautionary measures are necessary with a view to the return to earth of materials originating from space with a potentially contaminating effect: the classification of the National Research Council is a good example of a hierarchy of risks.

1.2.2. Orbital stations

1.2.2.1. Biological production activities in stations

All precautionary measures must be taken to avoid the long-term consequences bound up with the dissemination of biological products produced in a state of micro-gravity and subject to strong irradiation by electromagnetic fields.

1.2.2.2. Management of risks affecting astronauts

The principle of informed consent must be respected.

The substantial increase in the number of astronauts, even if it tends to make their role increasingly routine, must nevertheless cause them to be regarded as **pioneers of the space conquest**, especially as they take exceptional risks because of the hostility of outer space to human life.

The freedom to accept the risks inherent in space missions must be offset by the obligation of mutual assistance within the capsule and also by the right to obtain assistance. This justifies the development of rescue vehicles intended for the passengers of orbital stations.

1.2.2.3. The use of satellites

Measures must be taken to ensure the protection of individual freedoms (because of the risks of excessive remote surveillance) and cultural identities (because of the risks of standardization bound up with the use of satellites for new technologies of communication and information).

The protection of individual freedoms must not be allowed to threaten the protection of collective freedoms by any activity that might disturb public order or morality.

In such a context, international concertation is imperative in order to define a system of "**co-regulation**" intended to protect individuals, populations and even States.

2. Information of the public

33. The Sub-Commission recognized the need for a broad public dialogue. In this respect, very early steps must be taken to provide training in space technologies and in the challenges of space policy, notably in science and technology centres and museums. Organization of specialized university courses dealing at one and the same time with technological matters, legislation, insurance and the ethics of space is also imperative.

The Sub-Commission strongly urges UNESCO to call upon the network of schools of journalism on scientific communication to ensure that particular attention is given to training in the area of space science and technologies.

The Sub-Commission likewise calls upon UNESCO, having regard to its competency in the cultural sphere, to identify the different parties, which have already become or may be involved anywhere in the world in the domain of the **culture of space**. The example set by ESA of organizing summer schools for universities on the politics and law of space deserves to be stressed. Space agencies, given the great diversity of their cultural contexts, should become involved in networking operations using electronic forums between players in space policy, political decision-makers and the segments of public opinion interested in life in space. This will enable an effective **pedagogy of mediation** to be set up, drawing extensively on ethical reflection.

In order to achieve that objective, the Sub-Commission recommends that the space agencies should set up study groups on the ethics of space in order to throw light on the activities of these agencies from the ethical angle.

The initiation of a process designed to bring about a **culture of space** will enable a new state of mind to be created on the basis of a distinction between publicity for space activities and a concerted dialogue founded on ethical reflection on space activities.

The benefits anticipated for all humankind must be highlighted, while making provision for optimum risk management.

On the benefits side, the following aspects must be stressed:

- the quality of daily life;
- improvement of transport safety: satellite positioning system;
- remote medicine: system of data transmission by satellite for crisis management, to obtain a second opinion on a case or image and to enable patients requiring special medical supervision to remain at home;
- communication: mobile telephones, electronic mail, multimedia;
- environmental management: - meteorology;
  - natural disasters;
- remote observation system: example of monitoring vegetation.

EMERGENCE OF AN ETHICS OF SPACE

34. Worldwide consultations must be intensified with a view to reach a common understanding of rules and norms, which might evolve in the light of progress of knowledge and technologies, while remaining based on unanimously recognized essential principles:

- respect for dignity and socio-cultural identities;
- respect for free choice and a critical spirit;
- respect for the principles of equity and solidarity.

This leads to the:

- definition of a code of ethics accepted by all the organizations involved in space activities;
- continuation of respect for, and compliance with, the principles laid down by the United Nations, notably in the field of space activities;
- assurance of free access to relatively old data with a view to protection of the environment and management of natural disasters;
- creation of a system for management, via the Internet, of space data relating to critical aspects (global warming, climatic change etc.);
- assurance of the sharing of benefits notably by according greater importance to:
  - the needs of the developing countries and,
  - the rights of the observed countries.

while at the same time safeguarding respect for the sovereignty of States (which acquire and supply data or make use of such data).

ANNEXES

Annex 1

PROGRAMME

Monday 10 July

10:00 a.m. - 10:15 a.m.	Opening of the meeting by H. E. Mrs Vigdís FINNBOGADÓTTIR Chairperson of the COMEST.
10:15 a.m. - 11:00 a.m.	Ethical arguments to be developed to avoid conflicts through a debate between scientists, industrialists, decision-makers and the public. *led by: Prof. Jens Erik FENSTAD*
11:00 a.m. - 11:30 a.m.	*Break*
11:30 a.m. - 12:00 noon	Decision-making process and definition of modalities of co-operation with the national space agencies *led by: Mr Franco MALERBA*
12:00 noon - 12:30 p.m.	The role of ethics in the decision-making strategies such as technological feasibility, cost-benefit ratio. *led by: Mr U. R. RAO*
12:30 p.m. - 1:00 p.m.	Is there a specificity of outer space as an inalienable protected domain? *led by: Mr. Antonio RODOTÀ*
1:00 p.m. - 3:00 p.m.	*Break*
3:00 p.m. - 3:30 p.m.	In which areas could space technologies be beneficial to all humankind? *led by: Mr Cheick Modibo DIARRA*
3:30 p.m. - 4:15 p.m.	An integrated planetary system for observation of the earth: can space research contribute to a reduction of pollution of the planet by surveillance of its environment? *led by: Prof. André LEBEAU*
4:15 p.m. - 4:45 p.m.	Managing the risks involved in the use of space techniques and outer space exploration: what are the limits to public acceptability and the cost which the States and the industrial sector are willing to bear? *led by: Prof. Alain POMPIDOU*

4:45 p.m. - 5:00 p.m.	*Break*
5:00 p.m. - 5:30 p.m.	The use of space technologies and access to data: should access to data be based on equity and profit sharing? *led by: Prof. LU Yongxiang*
5:30 p.m. - 6:00 p.m.	Promotion of the outer space law: its application with a view of improving protection of intellectual property and respect for human rights. *led by: Prof. Juan Manuel de FARAMINAN GILBERT*

Tuesday 11 July

10:00 a.m. - 11:00 a.m.	Synthesis by the Rapporteur of the 10 July debates.
11:00 a.m. - 11:30 a.m.	*Break*
11:30 a.m. - 1:00 p.m.	Proposals of draft recommendations that COMEST will examine at its 2nd Session.
1:00 p.m. - 3:00 p.m.	*Break*
3:00 p.m. - 4:30 p.m.	Approval of the draft recommendations.
4:30 p.m. - 5:00 p.m.	*Break*
5:00 p.m. - 18:00 p.m.	Closure of the meeting.

Annex 2

LIST OF PARTICIPANTS

I. SUB-COMMISSION MEMBERS

H. E. Mrs Vigdís FINNBOGADOTTIR
President, Republic of Iceland, 1980-1996
Chairperson of the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST)

Prof. Jens Erik FENSTAD (Norway)
Member of COMEST,
Chairperson of the Sub-Commission on the Ethics of Outer Space,
Chairman of the Standing Committee for the Physics and Engineering Sciences of the European Science Foundation, Member of NATO Science Committee and
of the Executive Council of the International Council of Science (ICSU)

Mr. Antonio RODOTÀ (Italy)
Director-General of the European Space Agency (ESA)

Mr Cheick Modibo DIARRA (Mali)
Member of COMEST,
UNESCO Goodwill Ambassador for Science and Technology,
Manager Jet Propulsion Laboratory of the
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Prof. LU Yongxiang (China)
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Prof. Juan Manuel de FARAMINAN GILBERT (Spain)
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Mr Franco MALERBA (Italy)
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Rapporteur
Professor at the Faculty of Medicine *"Cochin-Port-Royal"*,
University of Paris V,
Member of the *"Conseil d'application"* of the French Academy of Sciences

Prof. André LEBEAU (France)
Member of the *"Académie nationale de l'air et de l'espace"*,
Professor at the *"Conservatoire national des Arts et Métiers"* (CNAM),
Former Deputy Director-General of the European Space Agency,
Former Chairman of the *"Centre national d'études spatiales"* (CNES)

Mr U. R. RAO (India)
Former Chairman of the United Nations Committee
on the Peaceful Uses of Outer Space (COPUOS),
Member of the Indian Space Commission

II. OBSERVERS

H. E. Mr Ali AL-MASHAT
Ambassador, Permanent Delegate of Irak to UNESCO

Mrs Mazlan OTHMAN
Director of the United Nations Office for Outer Space Affairs (OOSA**)**

Mr QIU Juliang
Deputy Director-General
Bureau of International Cooperation
Chinese Academy of Sciences

Miss Valérie ZINCK
Professor Pompidou's Assistant

III. EUROPEAN SPACE AGENCY (ESA)

Mrs Géraldine NAJA
Strategy and Business Development

IV. UNESCO

Mr Georges B. KUTUKDJIAN
Executive Secretary of the COMEST
Senior Director
Division of the Ethics of Science and Technology

Mrs Chantal RALAIMIHOATRA
Program Specialist
Division of the Ethics of Science and Technology

Mr Robert MISSOTTEN
Program Specialist
Division of Earth Sciences

CONTRIBUTIONS

IN WHICH AREAS COULD SPACE TECHNOLOGIES BE BENEFICIAL TO ALL HUMANKIND?

by Mr Cheick Modibo DIARRA (Mali)
Member of COMEST,
UNESCO Goodwill Ambassador for *Science and Technology,*
Manager Jet Propulsion Laboratory of the
National Aeronautics and Space Administration (NASA)

Technology development programs enabling space exploration are the major incubators for most new technologies.

The changes witnessed in the last decade in the world's political landscape forced space agencies to adopt new paradigms and to reinvent themselves. Words such as synergy, partnership, leveraging are more frequent in the speeches of space agency administrators. Agencies are selling their programs to their taxpayers solely on their scientific, technological, educational and social merits alone.

In their selection and approval processes of missions, space agencies are giving more weight to the international partnerships required to pull them off, and to the global aspect of their impact.

The breakthroughs in technology bring us ever closer to the answers to the age-old questions regarding our cosmic origins, the existence of our galactic cousins, our environment, our place and future in the universe.

With the end of the cold war, the technologies enabling space missions find their way to industry much faster pace and are having a positive impact on the quality of our lives.

This is particularly true in the areas of communications, transportation safety, medicine, environment monitoring, industrial productivity and manufacturing technology.

In 1999 alone more than 1,200 spin-off products and processes have emerged from the technologies needed for NASA missions. Each has contributed some measure of benefit to the economy and the quality of life.

- Communications and information technologies are now bringing people closer together even if a large part of the world population has no access yet.
- Engine Management and Predictive Analysis System, the combination of Global Positioning Satellites and area maps, Wide Area Augmentation System (WAAS), Smart panels for airplane cockpit, detection techniques of cracks in aeging aircraft are a few examples of space technology benefiting transportation safety.

- In the area of medicine, the information and communication devices allow networks of doctor to exist and to care more efficiently for patients in addition to spin-off such as the blood collection and eye movements measuring devices.
- In the environment and resources management, augmenting the possibilities of the existing remote sensing devices are:
  - OrbView – 2 satellite with its wide field of view sensor for the monitoring of the Earth's complex biosphere, research intended for human habitats on the Moon and Mars leading to new water purification techniques, fuel cells to provide clean energy, QuikBoost, fluid with zero Ozone depletion potential for heat pumps and air conditioners.
- Industrial productivity and manufacturing technology have become more effective and efficient due to space technology with better robots coming in the workforce.

Space research is playing an increasing role in education. In addition to their commercial aspects, space technologies could bring even more people closer together through our quest for knowledge, new and fair policies to better manage our environment if only all had access to them.

PROMOTION OF SPACE LAW WITH A VIEW TO BETTER PROTECTION OF INTELLECTUAL PROPERTY AND RESPECT FOR HUMAN RIGHTS

by Mr Juan Manuel de FARAMIÑAN GILBERT (Spain)
Professor of International Law,
School of Social and Juridical Sciences, Jaén University,
Member of the Bureau of the Spanish Center for Space Law

INTRODUCTION

1. As Her Excellency Mrs Vigdís Finnbogadóttir points out in the Preface to the Report on the Ethics of Space Policy written by Professor Alain Pompidou on the basis of the work done by the COMEST Working Group on the Ethics of Outer Space: the "criteria for choice guided by economic logic alone find their limitation in the obligation to imperatively respect the rights and freedoms of the individual and the cultural identity of each nation". She goes on to add that "the attainment of this objective is a particularly sensitive issue in a field such as the use of space technologies because of the asymmetrical effects which it may generate in relations between States and between the private sector and society".

Clearly, space research is a constantly evolving topic of great interest. This research cannot and must not leave unanswered the aspect of the law whose mission is to regulate ways and means of advancing knowledge in order to prevent abuse of every kind. In a field such as outer space, which is defined in international law as the shared heritage of humankind (with all the faint differences it implies), legal regulatory provisions must be drafted with great care since advances in this field will serve as the basis for the organization of an entire system. In fact, this being a relatively new field, legal advances must only be brought about after careful consideration.

The definition of space law, as a branch of law which is relatively new, must take account of the progress of science and technology. At the same time, control must be exercised by ethics as a science of knowledge and mutual respect. During the Seminar on the Ethics of Outer Space held in Paris in September 1999, the question was cleverly put (Question 10) in the following terms: "How can the definition of a law of space and its application be promoted with a view to improved protection of intellectual property and respect for the human rights?".

Setting out from this proposition, I will put forward a series of reflections on lines of action around which, in my view, space law must evolve in the context described above.

2. Intellectual property is perfectly defined by law but technological progress, notably the development of activities in outer space, has opened up new opportunities which oblige us to review intellectual property law in depth.

The **human rights** are a field in which important progress has been made since the creation of the United Nations Organization in the matter of the defence and guarantee of the freedoms of the individual. Measures have now been adopted at regional level. Intergovernmental regional organizations served as the framework for promotion of their juridical development through declarations, pacts and conventions. However, the conquest of space has called attention to legal shortcomings which must be filled, in particular because space exploration and research are developing in an environment which should be promoted as common heritage of humankind.

Since outer space is a relatively recent field of research, the law of space has undergone far-reaching transformations in a short lapse of time. A start was made by defining the fundamental principles which should govern the space age in binding treaties. Thereafter laws were needed to regulate human activities in outer space. In other words, a body of law has been adopted to regulate space activities. These provisions are beginning to move away from the strict domain of international law and international organizations to incorporate contract law now that space activities are being pursued by public or private corporations. Because of the technical difficulty of space activities, as operations with an objective risk, requiring the participation of industries, with the support of the States and national and international agencies, the framework of the United Nations in which the law of space began to take shape has now become too narrow.

All these bodies have broadened the domain of law and pointed to the need to develop more specific legal provisions which, without calling into question the progress of fundamental international law, nevertheless oblige us to draw up a body of space law governing telecommunications, contracts, data obtained by remote detection and intellectual property rights.

I. INTELLECTUAL PROPERTY LAW IN OUTER SPACE

1. At present there can be no doubt that the development of space activities and the progress made by the space industry open up new opportunities for intellectual property law. As the Third Conference of the United Nations on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) in 1999 recognized, protection of intellectual property rights plays an essential role in the relationship existing between technology transfer and the application of space techniques. Having regard to the impact which this presupposes on the developing countries, and to give the latter sufficient access to space technologies and applications appropriate to their sustainable development, the following two important aspects must be considered:

a) the many commercial benefits opened up to suppliers of space technologies and the beneficiaries of these techniques, such as the States, and the need to promote and guarantee international cooperation founded on technology transfer;
b) the need to "put in place a suitable international legal framework dealing with questions such as intellectual property rights, trademarks, copyright and foreign licences" (para. 283).

In this context, the appearance of problems posed by new space activities, notably of a technical nature such as the question of space debris, the use of nuclear energy in space and the strengthening of intellectual property rights encouraged the United Nations Organization to adopt an innovative approach to international cooperation since (these activities) raise many delicate legal problems which call for innovative and flexible solutions if space law is to adjust to the rapid evolution of space techniques and activities.

At the UNISPACE III Conference, emphasis was placed on the need to "strengthen the role of the Committee on the Peaceful Uses of Outer Space and its Legal Sub-Committee as bodies responsible for defining the principles and rules governing outer space in order to contend with the rapid evolution of this field of activity" (para. 321). Allowance must be made for the fact that discoveries which may be made in space constitute, with telecommunications and remote detection, aspects of what has been termed the commercialization of space activities resulting from the technical and commercial use of outer space. In the particular instance of the International Space Station, specific study is essential because this is a vehicle created by man which may be inhabited and has technical and scientific resources enabling experiments to be performed in a state of micro-gravity.

2. When it comes to the scientific discoveries which will be made in the International Space Stations Modules (ISS), the question of intellectual property rights is of immediate interest. Even if the station is still being assembled, law seems to move faster than technological progress. The partners concerned have drawn up an Inter-Governmental Agreement (IGA) in an endeavour to define the legal regime of intellectual property in the station (Art. 21 of IGA). As to the content of the concept of intellectual property, the IGA will have to refer to the definition given by the 1967 Stockholm Convention drawn up by the World Intellectual Property Organization (WIPO) which sets out a broad definition including all discoveries and inventions made possible by human intelligence.

For the application of intellectual property law in the station, the legal fiction of extra-territoriality is applied. Allowance must therefore be made for the State in which the space vehicle is registered when the discovery is made in one of the modules which make up the station, as though it were an activity pursued on the territory of the State which registered the module concerned.

These examples serve to illustrate the problems posed by the protection of intellectual property rights in outer space and the need to harmonize norms and legislation on these rights. This harmonization must take place with a view to efficient co-ordination and co-operation between the public and private sectors, between States and companies, with particular reference to:

- the application to outer space of national legislation in the area concerned;
- the ownership and exercise of these rights following a discovery and its application to the development of space activities;
- the law of contracts applicable in the field concerned and licence ownership**.**

II. RESPECT FOR HUMAN RIGHTS

1. Respect for human rights and individual freedoms is a legal question with substantial ethical overtones. In 1999, the countries which took part in UNISPACE III signed the Vienna Declaration on Space and Human Development in which they pointed that “outer space must be laid open to the whole of humankind” and emphasized the need to co-ordinate missions and projects between the Member States by reinforcing international co-operation “in the field of the exploration and peaceful uses of outer space”.

It is on these foundations of interest to humankind and peaceful use of space that our discourse and reflection must be built to prepare a list of necessary actions in outer space. In this context, the COMEST Sub-Commission on the Ethics of Outer Space has a major role to play. We can work on the basis of the principles enshrined in the above-mentioned Declaration on human development, such as protection of the environment and management of its resources, which can have a vital bearing on access to planet observation data; a guarantee of the more effective use of such data and the search for measures enabling the worrying quantities of space debris to be reduced; the conviction of the utility of space applications to human security and well-being by strengthening space techniques in the area of remote medicine and the fight against infectious diseases, especially in the developing countries; the development of scientific knowledge on outer space enabling the health of human beings to be improved and the general public kept informed of the importance of peaceful space activities for the shared economic and social wellbeing of humankind.

Last but not least, we must not lose sight of the fact that space is a *res communis omnium* and that the 1967 Space Treaty already stated that “the exploration and use of space are the privilege of all humankind”. In fact, the recognition of the interests of humankind in an international text is the confirmation of an important legal step, as are the sublimation of the notion of

the “shared heritage of humankind” and the principle of the non-appropriation of space and celestial bodies by the States. Therefore, the exploration and use of outer space must not give rise to a claim to exercise sovereign rights, as is the case on Earth, which gives space a much more altruistic definition in the sense of working for the benefit of humankind.

2. The development of technology has clearly permitted the pursuit of activities in outer space by human beings: we as lawyers feel the need to regulate manned flights and inhabited space stations by giving examples which permit reflection on the matter of concern to us. The presence of human beings in outer space encourages us to draw up codes of conduct which safeguard the respect for human rights in space and prevent the violation of these rights and fundamental freedoms.

The specific status of the astronaut implies a radical change of the criteria which guarantee the “aircraft crew” concept on earth. This is because the 1967 Space Treaty regards astronauts as “emissaries of humankind in outer space” (Art. V). That in turn implies a special juridical status for them as representatives of humankind entitling them to special assistance and security. This special status even gave rise to the agreement on the rescue of astronauts, the return of astronauts and the restitution of objects launched into outer space.

However, we cannot lose sight of the fact that we are referring here to human beings who, under special circumstances, are exposed to severe pressures and unsuspected risks. That is why their activities will have to be regulated by codes of conduct enabling limits to be placed on human behaviour in outer space. Without opening a discussion, which for the time being would still be extravagant, over the possible existence of intelligent life in space and the conduct to be followed in this regard, the existence of human beings in outer space is a matter for both law and ethics.

As a typical example, the case of the manned space station may be cited. Article 11 (devoted to the crew) of the Inter-Governmental Accord (IGA) quoted above provides for the drafting of a code of conduct for the space station which must establish a clear chain of command, set out standards for work in activities in space and, as appropriate on the ground; establish responsibilities with respect to elements and equipment; lay down disciplinary regulations; establish physical and information security guidelines; and provide the Space station Commander with appropriate authority and responsibility, on behalf of all partners, to enforce safety procedures and physical and information security procedures in or on the space station.

Last but not least, if all these objectives are to be attained, the necessary synergy of law and ethics in the field of space activities must be assured.

ETHICAL ARGUMENTS TO BE DEVELOPED TO AVOID CONFLICTS THROUGH A DEBATE BETWEEN SCIENTISTS, INDUSTRIALISTS, DECISION-MAKERS AND THE PUBLIC

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on the Ethics of the Outer Space

ABSTRACT

1. INTRODUCTION

The mandate of COMEST specifies that the Commission should :

- serve as an intellectual forum for the exchange of ideas and experiences;
- detect on that basis early signs of risk situations;
- fulfil an advisor role for decision-makers in this respect;
- promote dialogue between scientific communities, decision-makers and the public at large.

The mandate expresses a concern with ethical reflection and discourse. This does not mean that ethical theory and general principles are irrelevant; they are necessary guidelines in any ethical discourse. The emphasis will, however, be on concrete issues and situations.

2. SOME REMARKS ON THE NATURE OF ETHICAL NORMS AND DISCOURSE

We have learned that knowledge - including ethical knowledge - is situated. We have also experienced that our norm system is never consistent. Thus in almost all situations we are faced with questions of interpretation of and conflict resolution between norms. This shifts the emphasis to ethical discourse and reflection and at the same time underlines the importance of promoting a dialogue between the scientific communities , decision makers and the public at large. Particularily important in this debate is an analysis of options and the proper assessment of associated risks (see references 1 and 2).

3. THE ETHICS OF OUTER SPACE

Space is a new challenge for humankind. In 1998 the Director-General of UNESCO, in cooperation with Mr Antonio Rodotà, Director-General of ESA, created a working group on the ethics of outer space coordinated by Prof. Alain Pompidou. We have now in front of us the report of the working group, The Ethics of Space Policy. This report concludes with a set of recommendations concerning:

- space as an ethical issue;
- space as a dimension;
- space as an instrument;
- space as a perception.

The recommendations are, in particular, meant as a basis for defining guiding ethical principles for the development and use of space technologies.

4. THE SUB-COMMISSION ON THE ETHICS OF OUTER SPACE.

COMEST decided to constitute sub-Commissions to elaborate ethical principles concerning the subjects dealt with by the various working groups of the Commission and to draw up ethical guidelines to be proposed for examination by the Commission. These guidelines will then be presented to the Member States of UNESCO.

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A GLOBAL EARTH WATCH SYSTEM: CAN SPACE TECHNOLOGY HELP TO REDUCE PLANETARY POLLUTION BY ENVIRONMENTAL MONITORING?

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I. INTRODUCTION

We are living in an age of rapid transition that is hard for us to perceive because we are too close to events to appreciate them in their true light. In the space of just one century, the developed countries have passed from a civilization of shortage to one of abundance, brought about by progress of production techniques. At both world and local levels, distribution of the wealth generated in this way does of course present acute difficulties. Those difficulties are compounded by phenomena of uncontrolled population growth. But it is precisely because production problems have now been completely mastered that the aspect of distribution has become so acute.

The civilization of abundance engenders two major problems, which a civilization of shortage was able to disregard: the gradual depletion of non-renewable resources and the management of waste. This waste is in fact produced in such vast quantities that its management calls for an effort, which is by no means negligible today in comparison with the endeavour of production as such.

The idea that almost as much effort should have to be devoted to the disposal of used materials as to their production in the first place is not easy to accept. It fits in with none of the historical traditions dating back to the old days of shortage. However, this disposal is essential in view of the need to control damage to the natural environment that is occurring at every level, from local to global.

This new problem, brought about by technical progress, will certainly not disappear of its own accord. On the contrary, it is set to grow even worse. Assuming that efforts to transform the world economy succeed to such an extent that it only uses renewable or inexhaustible resources, this interaction of man and the planet in the shape of waste materials, which result in the progressive and irreversible deterioration of the biosphere, would still continue.

II. THE INSTRUMENTAL ROLE OF SPACE

The awareness of a global deterioration of the environment, which has crystallized around two phenomena, degradation of the ozone layer and global warming, induces us to examine the resources made available by technology to remedy the resulting problems. This is where space technology comes into its own as a key instrument for monitoring the global environment.

The decisions needed to bring the effects of global pollution under control are by their very nature political. They are difficult – as the obstacles placed in the way of intergovernmental conferences show – because, measured against the anticipated long-term benefits, they inevitably have negative short-term implications for some categories of economic agents. Political attitudes therefore reflect great sensitivity to every type of scientific uncertainty. An important key to global management of the planetary environment resides in the most thorough knowledge possible of this environment and, in particular, of its most fragile components: the earth's atmosphere and the oceans.

Scientific progress in this field is based, as is generally the case for the main natural systems on which no experimentation is possible, on two principal tools: observation and digital modelling. As things stand at present, the inadequacy of observation remains the main weakness in the process by which knowledge of the terrestrial system progresses. It is therefore around observation of the planet that an effort, whose scale calls for extensive international cooperation, must be organized.

In this approach, space technology will of necessity play the central role conferred on it by two specific features:

- it permits extensive measurements across the whole surface of the globe, regardless of the degree of accessibility of the zones that are covered;
- it ensures great homogeneity of measurements, because orbital movement enables the entire surface of the earth to be covered by a single instrument.

In addition, even if some parameters remain inaccessible from space, the diversity and precision of space measurements are constantly growing, so confirming the central role of observation from space.

III. A GLOBAL EARTH WATCH SYSTEM

A continuous global earth watch system, which is perfectly feasible using the technologies available today, does not exist. A number of components of such a system have been put in place, the most important

being the meteorological system and some experimental concepts which prefigure the future but whose permanent survival is not assured. Two key differences exist between the global observation system, needed for management of the planet and this small first step in the shape of the meteorological system:

- The first is technical in nature; it resides in the diversity of the parameters that have to be measured, limited in the case of the meteorological system to the factors relevant to weather forecasting.
- The second difference resides in the fact that the meteorological system answers a need expressed by users who are not short of financial resources. This is generally the case with all systems organized at global level: telecommunications, air traffic control etc… Observation of the earth confronts us for the very first time with a different problem: how can the development of a complex and costly technical system, for which no need is expressed by individuals or by specific activity sectors, be encouraged, a system whose central role is to promote the definition of international political decisions in relation to challenges that are vital but remain remote. The need for such a system only becomes clearly apparent when we recognize the growing need for management of the planet on a time horizon, which is longer than that of market forces, habitual political motivations and institutional interests. There is no historical precedent for such an enterprise.

IV. ETHICAL CHALLENGES

The institutional debate over the action needed to preserve the planetary heritage for the benefit of future generations opposes, as we have seen, short-term and long-term interests with the added specificity that the short-term interests are more often than not local or sectoral – those of a particular country or category of economic agents – while the long-term interests are those of all humankind. Control over the sources of information, which underlies the debate, is therefore in itself an ethical challenge.

In a civilization, which has solved the problem of wealth production but not that of its distribution, the main polluters are of course those who profit from the disparity in the consumption of wealth. They are generally the same persons who possess the technical expertise needed to determine the state of the planet and its evolution. The risk consequently exists that they may use this informational advantage to further their own particular ends and to the detriment of the general interest.

Taken together, all these considerations lead to general conclusions with a major ethical content:

- an important goal of the space programmes pursued by the States should be the creation of an ongoing global system for observation of the terrestrial environment;
- the information acquired by this system, and the advances of knowledge founded on such information, should be made accessible to all the participants in the international debates on the management of the planetary heritage.

The tasks of conception, deployment and operation of the global system of observation should be shared, on the basis of an open worldwide concertation, between the actors who may take part in this process.

THE USE OF SPACE TECHNOLOGIES AND ACCESS DATA: SHOULD ACCESS TO DATA BE BASED ON EQUITY AND PROFIT SHARING?

Sharing space data and its ethical challenges

By Prof. Dr.-Ing LU Yongxiang (China)
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I. INTRODUCTION

At the historic moment as humankind farewells the 20th century and enters into the new millennium, we are very pleased to see that humankind has made unremitting efforts and tremendous progress in space activities over the last half century. As a direct consequence of this dramatic progress, significant data on our planet have been obtained. Currently, the data are still increasing by a Tbyte (terabyte) of information per day.

It is broadly believed and proved that these data are indispensable for the economic development of the world. Data obtained from outer space have not only been used successfully in farming, forestry, animal husbandry, sideline production, fishery, natural resources, industrial construction, regional economic design and various engineering projects, but also provided a scientific basis for addressing global issues such as environmental deterioration, resource depletion, prevention of desertification, flood and earthquake disasters, irrational exploration, and so on.

However, most of the developing countries are inaccessible to space technology and space data through their own technology, though these data are crucial to their development. One question that should be posed is: should access to the data be based on equity and profit sharing? Before trying to find an answer based on ethical decision-making framework, it is necessary to recall the major efforts and related data policies that have been made by international communities in the past decades, in which ethical consideration for using space data has penetrated.

II. THE STATUS QUO

2.1. Space technologies and data volume

Since the United Nations' Convention on Registration of Objects Launched into Outer Space entered into force in 1976, 3,977 space objects have been launched by its signatories, including: Argentina, Australia, Canada, China, Czech Republic, France, Germany, India, Italy,

Japan, Mexico, Russian Federation, Spain, Sweden, Ukraine, the United Kingdom, the United States of America and ESA. Their ongoing satellites make or help to derive key global observations of the atmospheric structures and dynamics, sea-surface temperature, surface parameters, precipitation, land surface characteristics including biodiversity, and selected atmospheric chemical species. They are either geostationary platforms, such as GMS, GOES, GOMS, INSAT and METEOSAT, or polar-orbiting platforms, such as NOAA-AVHRR (US), Fengyun (China), CBERS (China/Brazil), IRS (India), LANDSAT (US), SPOT (France), Resurs-01 (Russia), Sich (Ukraine), Okean (Russia/Ukraine), International Priroda, TOPEX/Poseidon (France/US), TRMM (Japan/US), ERS (ESA), SIR-C/X-SAR-SRTM (US, Germany and Italy), JERS (Japan) and Radarsat (Canada). In the first decade of the new millennium, more than 30 new Earth observation satellites are projected to be launched. Meanwhile, the spatial and spectral resolutions of spaceborne sensors have been improved by around 100 times in the last 20 years. It is undoubted that these progressing space activities can provide an unprecedented capability of obtaining more valuable data from space.

With the advancement of these space activities, the size of Earth observation data archives has been increasing dramatically. On 31 December 1999, for example, there were 7,483,285 SPOT scenes of around 250 Tbytes in the SPOT Image central catalogue. ESA/ESRIN (European Space Agency's Centre in Frascati, Italy) has large volumes of Earth observation data: about 300-400 Tbytes to be maintained. NOAA currently has an archive of approximately 1,000 Tbytes of data from its major systems such as GOES, NEXRAD and DMSP. The archive will grow to approximately 9,000 Tbytes by the year 2010, and to approximately 14,000 Tbytes by the year 2014. NOAA estimates that it would take 80 years to copy its existing environmental data archives, and this estimation assumes extensive and rapid computing facilities. ESA/ESRIN, which is able to receive around 160 Gigabytes of Earth observation data per day, holds 86,000 high-density tapes in its archives, of which 42,000 have been transcribed and recycled more than once. If the transcription activity had not been performed, the actual number of tapes would have been around 160,000.

2.2. Major international activities related to space data policies

Facing rapidly growing data along with the progress of space technology, maximizing their use is becoming a fundamental objective for both data suppliers and international bodies. There are three categories of key issues that affect the problem: technical issues, data policy issues, and ethical issues. Technical issues cover problems such as catalogues, archives, formats, integration, and any things that provide technological exchange/sharing mechanism or methods for space data. Data policy

issues relate to problems like the sensed state's rights, copyright protection, *sui generis* protection, ownership, price and so on. Ethical issues, in making a decision of data policy, refer to the ethical considerations, for example, on moral principles of action, concepts of risk and acknowledgement of sensed states based on respect for all human beings. They may also touch on such considerations as the general relationship between morality and economic profit, the balance between individual and collective interests, and that between ownership protection and access right, etc. Ethics for exploiting space data should be a basis for defining guiding principles of data policies for the development and use of such data.

In fact, international communities and many countries have, as shown in the annex, drafted and ratified their own data policies. Since 1961, the United Nations General Assembly has repeatedly adopted resolutions stating that "space must remain at the service of humanity as a whole", which has set up an ethical basis for using space technology and space data. The UN adopted on 11 December 1986 by consensus a set of 15 Principles Relating to Remote Sensing of the Earth from Outer Space in its Resolution 41/65.

At the Twelfth Meteorological Congress in 1995, for example, the World Meteorological Organization (WMO) adopted Resolution 40 on the policy and practice for the exchange of meteorological and related data and products, including meteorological satellite data. In March 1996, the European Parliament and Council agreed a Directive on the legal protection of databases. The objective of the Directive is to afford an appropriate and uniform level of protection of databases as a means to secure the remuneration of makers of databases. The Directive proposes protection of databases by either copyright protection or by a *sui generis* protection.

III. CHARACTERISTICS OF EXISTING DATA POLICIES

An ethical reflection in making space data policies or in using space data does not necessarily result from the needs of maximizing the use of growing space data. Ethical reflection is a perpetually renewed process, a constant questioning of the whys and wherefores of our acts related to space activities. As data policies can effectively affect the development of the earth observing systems and the use of space data, an ethical reflection should precede and guide data policies, which are usually in the form of a legal instrument. In the field of outer space, especially for space data, difficulties and complexities for establishing a widely acceptable ethical code do not prevent human beings from introducing their ethical viewpoints in various space data policies, as shown in the annex, where human ethical reflection in a quasi-full dimension is dispersed by some means or other.

3.1. On rights of sensed state

The UN Principles cover the freedom of the sovereignty of nations, the conditions of access to Earth observation data by a sensed state and the control of private Earth observation data companies by their national governments.

3.2. On developing countries

Special attention is given in the UN Principles to the needs of developing countries, but not in others.

3.3. On equity access

Non-discriminatory access is a firm term in the Principles of UN, ESA, NASA and the World Data Centers respectively. As Intergovernmental Oceanographic Commission states: “full and open sharing of a wide spectrum of global international data sets for all ocean programmes”.

3.4. On copyright

The Directive of the European Commission provides protection of databases by either copyright or a *sui generis* protection, or both. Copyright provides protection based on the selection or arrangement of the database, and *sui generis* provides protection based upon the content of the database. Copyright protection under sources other than the Directive will continue to apply where appropriate.

3.5. On particular use

By the UN principle on remote sensing, the members of UN should provide on a free and unrestricted basis essential data and products that are necessary for the provision of services in support of the protection of life and property and the well-being of all nations, particularly those basic data and products in space required to accurately describe and forecast weather and climate. CEOS agreed a set of satellite data exchange principles in support of global change research.

3.6. On data category

Little attention is given in the existing data policies to distinguish space data category, even though many data policies were drafted for a specific sort of satellite data. It is impossible to establish a reasonable and feasible data policy without taking into account of data category. Besides the importance of the difference between raw data and processed data mentioned in the UN principle on remote sensing, the value of space data depends largely on their up-to-dateness and their spatial or spectral resolution. SPOT, for example, has the following profile of sales from its archive: 62 per cent of requests are for data less than 1 year old, 82 per cent of requests are for data less than 3 years old and 88 per cent

of requests are for data less than 5 years old. Also, the prices for data of higher spatial resolution could be ten times expensive as those of lower spatial resolution.

Space data policies cannot develop in isolation. It is important to acknowledge that most space data are used in conjunction with other complementary data (for example, land use, topography, population, etc.), so policies for these data will have an impact on the use of space data.

IV. ETHICAL CHALLENGES

4.1. In political aspect

Outer space is widely regarded as a common heritage of humankind. So it is acceptable, as an ethical standard, that its exploration and use, including space data, must be effected for the good and in the interests of all countries, regardless of the situation of their economic and scientific development. Noting the political upheavals resulting from the dissolution of cold war, informatisation and globalisation do not disperse the geographical boundaries between different countries where peoples with common interests agglomerate. National obligations and nationalism will continue to challenge the desire in which the Earth is considered as a global village without any boundaries, and the ethics in which the interests of all peoples should be respected in equity.

4.2. In economic aspect

Space activities usually need huge budgets, accessible mostly to the wealthiest countries. It seems reasonable that, in order to maximize scientific and commercial value, the space sector might tolerate the presence of private funds in space activities. Once this phenomenon becomes more widespread, the “commercial logic”and conflict of interests could strongly challenge the ethical reflection in access to data based on equity and profit sharing, particularly in environmental protection and prevention of major risks. Cost-benefit analysis, generally used as “commercial logic”, weighs alternative actions in terms of such consequences and is not suited for consideration of consequences such as the loss of moral integrity. It should be convinced that data sharing in equity is beneficial not only for all users, especially for those who are not able to access space, but also for space data suppliers who invest and hold space technology.

4.3. In technological aspect

While the spatial resolution of space data has been improved dramatically(by around 100 times in the last 20 years) and everything is photographed or captured from space in a way as clearly as taking a photo of a swimming man in his home pool from a position of around ten

meters high, free access to such kind of information for everyone should fiercely challenge some more general ethical principles such as respect for individual interest and privacy protection.

4.4. In data ownership aspect

When a photographer takes one photo for his customer, that is a response to the demand of the customer, and the customer will become the owner of this photo after performing payment for it. Then if the photo should be used by any other purpose, it can be taken only with the permission of the customer or even with some payment to the customer. But at present, this is not the case in the space data sector. Firstly, any state or region is passively sensed at any time without its permission. Secondly, when the state or region gets its sensed data after it has paid as much as others do, the sensed data of the state or region can still be re-sold, once again without the permission of the sensed state or region. So there arise such questions: Is the sensed state or region a partial owner of these data? What are the rights of a sensed state in space activities? Ethical relativism in the 20th century should face challenges by a sort of such questions.

4.5. In ethical aspect

Without various intellectual innovations, Earth observation data could not have been obtained, and could not have become valuable information. An over-emphasised obligation or pretext for protecting the related intellectual property or copyright could conflict with some ethical principles such as non-discriminatory access, the rights of developing countries and the rights of a sensed state, which have been emphasized in many data principles.

V. SUGGESTIONS

After making the above analyses, it is reasonable for us to reach suggestions as follows:

5.1. It is necessary to establish a code of ethics, which should be designed and clearly accepted by all involved organisations in space activities to harmonize elaboration of data policies and their practices.

5.2. It should continue to respect and follow up the ethical principles established by the UN and other organisations that act as an ethical basis for all actions in the field of exploration of outer space, including the space data sector.

5.3. The archived data being relatively old with lower spatial resolution should be free and accessible to any people or country for the use of environmental protection or disasters monitoring which are crucial issues for the whole world**.**

5.4. It is imperative to establish an Internet system for managing space data for critical issues such as global warming, climate change, human health and sustainable development.

5.5. In the process of making data policies, more attention should be paid to the needs of developing countries, the rights of sensed states and the respect for the sovereignty of these nations, based on the equity and profit sharing principles.

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Annex

EXTRACTS OF SPACE DATA POLICIES

CEOS (Committee on Earth Observation Satellites)

At its sixth plenary meeting held in London in December 1992, members of CEOS agreed a set of satellite data exchange principles in support of global change research. Subsequently, CEOS members agreed a preliminary resolution on the principles of satellite data provision in support of operational environmental use for the public benefits in Washington D.C. in April 1994.

ECSL/ESA (European Center for Space Law/European Space Agency)

“On one side, in respect of the widest availability of data to all interested users each of whom has access to the data on an open and non discriminatory basis. In doing so, we wish to conform and set a practice of conformity to the spirit of the well known "principles relating to remote sensing of the earth from outer space" approved in the united nations framework in 1986”.

ENVISAT/ESA (European Space Agency)

“ENVISAT data shall be available in an open and non discriminatory way, in accordance with the united nations principles on remote sensing of the earth from space (United Nations resolution 41/65, 3 December 1986). The ENVISAT distributing entities shall provide services to users in a fair and non discriminatory way.

GTOS (Global Terrestrial Observing System)

“GTOS data and information should be made available in timely and unrestricted fashion at zero (or minimum cost) GTOS data and information should be easily accessible in a variety of forms to meet the requirement s of the user community”.

IEOS (International Earth Observing System)

IEOS agencies have produced a set of principles to guide their collaboration on data access and utilization. In developing the IEOS principles, the agencies envisaged the implementation of the principles to begin with the new Earth observation initiatives funded by governments during the late 1990s.

“All IEOS data will be made available for peaceful purposes on a non discriminatory basis and in a timely manner”.

IGBP (International Geosphere-Biosphere Programme)

"Full and open sharing of the full suite of global data sets for global change researchers is a fundamental objective".

IGOS (Integrated Global Observing Strategy)

"Access to data is a continuing problem for many users. There are many reasons given for restricting or refusing access to environmental data, ranging from national sovereignty and military security to trade secrets and fear of criticism. In recent years, the demands for cost recovery, the growing commercialization of data providers and the spread of intellectual property rights to data that were once freely exchanged, have brought further complications. One component of IGOS will need to work on widely shared policies for data access and exchange that would allow the most effective use of environmental observations while respecting essential interests in the data".

IOC (Intergovernmental Oceanographic Commission)

IODE statement on data management for global ocean programmes "full and open sharing of a wide spectrum of global international data sets for all ocean programmes is a fundamental objective of the IODE".

NASA (National Aeronautics and Space Administration)

"For data from government-owned or -funded systems, NASA will enforce a principle of non-discriminatory access so that all users within the same data use category will be treated equally. Preferential treatment for u.s. Government users and affiliates will be allowed only where expressly permitted by law".

National Climatic Data Center

"Data are provided without restrictions at the cost of providing the service. Global data exchanged under the world meteorological organization (WMO) world weather watch (WWW) program and held by NCDC are serviced according to the guidelines provided by WMO resolution 40".

RADARSAT

"Radarsat-1 data are acquired for users on an open and non discriminatory basis, in compliance with the UN resolution 41/65 on the principles relating to remote sensing of the earth from outer space adopted by the UN general assembly on December 3 1986".

United Nations Principles on Remote Sensing Principles

"As soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a non-discriminatory basis and on reasonable cost terms. The sensed State shall also have access to the available analyzed information concerning the territory under its jurisdiction in the possession of any State participating in remote sensing activities on the same basis and terms, taking particularly into account the needs and interests of developing countries".

The highlight of UNISPACE III was that international recognition and agreement on space-based technology are fostered with a focus on global access, technology transfer to developing countries, spin-offs and commercial benefits.

USGCRP (The US Global Change Research Program)

"Full and open sharing of the full suite of global data sets is a fundamental objective".

World Data Center

"The data are provided to scientists in any country free of charge, on an exchange basis, or at the cost not to exceed the cost of copying and sending the requested data".

World Meteorological Organization

WMO resolution 40: "as a fundamental principle of the world meteorological organization (WMO), and in consonance with the expanding requirements for its scientific and technical expertise, WMO commits itself to broadening and enhancing the free and unrestricted International exchange of meteorological products; adopts the following practice on the international exchange of meteorological and related data and products. Members shall provide on a free and unrestricted basis essential data and products which are necessary for the provision of services in support of the protection of life and property and the well being of all nations, particularly those basic data and products... required to describe and forecast accurately weather and climate, and support WMO programs".

DECISION-MAKING PROCESS AND DEFINITION OF MODALITIES OF CO-OPERATION WITH THE NATIONAL SPACE AGENCIES

by Mr Franco MALERBA (Italy)
Astronaut

WHY SHOULD SPACE AGENCIES WORRY ABOUT ETHICS OF THE SPACE EXPLORATION?

The simple answer is because it's in their own interest to respond to the profound moral motivations which, in the citizen's perception, justify the space exploration program, because this is what gives the progam long term sustainability.

Today the space race has lost a loto of its appeal. In the sixties everybody understood the space race and how much was at stake in it. The competitions to orbit a man, to land on the Moon the battleground of two conflicting ideologies, two powerful political constructions.

Today space does not make the news too often. Public budgets are stable if not decreasing, political goals unclear to the general public. One may fear that if there were another major accident including life losses like Challenger, even the International Space Station would be at risk. On th eother hand much public attention was produced by the discoveries of "life remnants" on a martian meteoryte, by the presence of water on Mars, by the discussions about life in the Universe, quickly echoed via the net. These facts would suggest that the Space Agencies – the actual promoters of the space programs – are not doing a "good-enough-job" at communicating to the public on the right wavelength.

THE "MINDSET" OF SPACE AGENCIES, FOCUSSED ON SCIENTIFIC MERIT, IS NOT FULLY ADEQUATE

Space Agencies justify their programs in term of scientific and tecnological merit above all. This reasoning may not be tuned to the deep feelings of the citizens. A few examples:

SECURITY OF THE CITIZEN

There is today as strong sense of insecurity among people, not because of "peace and war", but because of health hazards from the food and the air pollution, threats to privete property and to privacy, man-induced environmental changes and catastrophies… Space observation of planet Earth and planetology sciences can provide supporting knowledge to address if not resolve most of these concerns.

YOUTH INSPIRATION IN SCIENCE

In the developed countries there is a concern about the scarsity of new talented engineers and scientists to fill out well qualified jobs in academia and industry today and in the future; it looks as if other professions offer better career and reward. Perhaps a solution would be to involve young people from school in the space exploration programs and feed their curiosity developing at the same time their motivation for sciences.

MANNED SPACE FLIGHT AND SPACE TOURISM

The involvement of astronauts in the space exploration is usually proposed in terms of tecnical and scientific performance, something exceptional that robots could never do… but at the moral level it may be only just, that humankind wants to "get out its nest" (to use Tsiolkowski's metaphore) as soon as the knowledge and the technology allows to do it safely.

RISK MANAGEMENT

Space exploration has a high risk factor associated to it both because of the difficulty of space travel, th ehostility of the environment and the immature technology; accidents may happen again and again. When an accidents occurs, Space Agencies have great difficulty to manage the public communication, to explain the real facts to the public and the media, on their end, often magnify the wrong aspects of the failure.

NATIONAL PRIDE

The US space program is an extraordinary component of the US national pride: the planet Earth history books will record for ever that the Americans have "conquered the Moon" and Neil Armstrong was the first man setting up the stars and stripes flag on the dusty lunar soil… "a giant leap for humankind". I believe that a softer note of "national pride" has to be taken into consideration also by the other countries involved in the space program, and Europe in particular. The first remark is that – although the science and industry world are strongly integrated, the culture and the key notes of the political debate in Europe are still very much "national", therefore the national agencies should be dierectly involved in the communication effort. On the other hand there may be an extraordinary opportunity to contibute simultaneously to the success of the European space program and to the development of the European "sense of citizenship" demonstrating how the political construction of the European Union makes possible to translate into reality programs for which each country has the legitimate ambition, but for which only the "team of the European nations" has the means. In this way our frail European Identity may get stronger in building together the "space highways" like the railways helped nation-states to get stronger (Space highways are Galileo, GMES…).

HOW SHOULD SPACE AGENCIES WORK OUT ETHICS IN SPACE?

The discussion about ethics in science and in space is an on-going process, with no definite end. In theory the ethical debate should anticipate the legislative work and there are indeed dedicated institutions within the UN dedicated to space law. One suggestion could be the creation of a “high authority”, under the auspices of UNESCO, looking after “ethics in space” and take the lead for this concerted dialogue with the Space Agencies (somewhat similar to the Telecommunication Authorities, who check upon the behaviour of the Telecommunication service industries) but honestly the creation of such “Authority” seems premature.

The Space Agencies remain the engine to produce awareness and focus on all the issues related to Space and have institutional links to Governments and should themselves start working at awareness about space ethics and lawmaking, as a facet of their managing complex programs into “uncharted grounds” and associated risks.

Space agencies should:

- survey the public opinion about their programs via professional research;
- promote the public communication to the widest audience both with the traditional media and the most modern multimedia systems;
- coordinate their programs and exchange their experiences and tools;
- fund their “outreach programs” with a meaningful budget in order to involve young science students in their exploration programs.

In conclusion it seems to me that it’s up to space agencies to take the lead on the matter of ethics and public perception of the space program. They shoul promote the discussion on the ethical foundation and justification of the space programs and complement the “scientific merit” assessment with the “benefit for humankind” perspective. The dialogue and the discussion initiated and supported by the UNESCO-COMEST should take care, for the time being, of prospecting the situations and the risks correlated with the civilian space program. It seems wise to take this work and these objectives with full commitment and assume that the work aboard the International Space Station and even more the planetary exploration will lead to highly visible, highly controversial situations, for which we may be otherwise unprepared.

MANAGEMENT OF RISKS GENERATED BY THE USE OF SPACE TECHNOLOGIES: ACCEPTABILITY AND COSTS INCURRED

By Dr Alain POMPIDOU (France)
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After nourishing myths, dreams and man's imagination, space exploration has now become a reality.

The new possibility of projecting human activities into outer space strengthens, by the same token, man's ability to demonstrate his "difference". It enables the inhabitants of planet Earth to envisage new perspectives that are capable of changing the human condition.

The motives for the conquest of space are based on:

- access to inhabited flights, which are a victory of man over himself;
- the possibility of exploring the Universe, so widening our field of knowledge;
- the use of observation satellites to improve weather forecasting, prevent natural disasters, monitor vegetation and the level of the seas which poses a threat to the continents;
- the placing in orbit of communication and positioning satellites; this creates closer ties between individuals and is a commercial factor with high economic added value;
- the increase of military power, especially dissuasive in nature, to prevent conflicts more effectively.

However, these benefits are not without risks.

I. RISKS CREATED BY SPACE TECHNOLOGIES

The acquisition of new knowledge, and the activities authorized as a result, increase humankind's capacity and create new fields of action which in turn raise power issues.

The fascination exerted on men's minds by the political and economic power derived from the use of space technologies must not hide the real or potential risks which, in the short or long run, threaten the identity and autonomy of the individual and also of the Nation States as collective entities.

Of course, some risks are general: they are associated with all space activities, e.g. the use of launchers and the placing of objects in orbit, regardless of their nature or size.

Other risks are inherent in each field of application of space technologies. These are risks specific to:

- exploration of the Universe,
- the success of manned flights,
- observation of the Earth and remote surveillance,
- new communication and positioning technologies.

1.1. Debris

Present estimates suggest the existence of 9,000 objects with a size of more than 10 cm, 110,000 measuring between 1 and 10 cm and 35 million between 0.1 and 1 cm.

Risks of collision exist with such objects at relative speeds that may be as high as 10 to 20 km/s. Such collisions are liable to damage satellites or inhabited space vehicles. The debris also create obstacles on the orbits in which space vehicles are placed. The uncontrollable re-entry of space debris is far from negligible. Similarly, there is a real risk of disturbance of astronomic observations.

1.2. Risks specific to the different space activities

1.2.1. Exploration of the Universe

This does not involve any risk in its own right. But it does present a risk of extra-planetary contamination, notably when samples are brought back from other planets such as Mars.

1.2.2. Manned flights

These entails the risks specific to any experimentation with living beings, but under particularly critical conditions, because of the inhospitable nature of outer space for planetary life. These are constraints which astronauts accept. They are also imposed on experimental animals.

1.2.3. Observation of the Earth

Observation technologies today offer resolution powers of a few dozen metres in civilian applications and a few centimetres in military uses. If appropriate use is made of these techniques, they will certainly be beneficial to the population in general.

But in the longer term, remote surveillance might prove prejudicial to individual freedoms.

1.2.4. New communication and positioning technologies

These too are increasingly powerful. While they bring human beings closer together all over the planet, they are not without certain consequences:

- standardization of communication systems, so endangering cultural diversity;

- virtualization of reality, so denaturing the very content of reality in a dominant cyberspace;
- electronic surveillance which encroaches upon individual freedoms by exploiting knowledge of the position of persons and communications;
- development of mafia or terrorist networks which endanger democracy;
- pedophile and *"soft sex "* networks may endanger public order and are liable in the long run to have an impact on social equilibrium, quite apart from any moral judgements.

The management of such risks poses difficulties. These are political, technological and economic in nature.

At all events, this management calls for an **ethic of responsibility** which requires at one and the same time:

- adequate information;
- legal measures;
- political decisions;
- ongoing and renewed ethical questioning.

II. EXERCICE OF RESPONSIBILITY AND COST OF RISK MANAGEMENT

Here the management of general risks associated with the release of debris into space must be considered in order to restrict the pollution of outer space and permit free access to it.

2.1. Safety of launchers and space objects

An effective separation between the safeguard bodies and the authorities which implement the technological instrument is essential: this requires the creation of an independent security protection authority.

However, efforts made to reduce the occurrence of debris must not lead to unilateral measures, which are liable to create distortions of competition between the traditional and emerging space powers.

In this field, the Inter Agency Space Debris Committee (IADC) must play a particularly vital role, since no international treaty deals with the release of space debris.

However, the 1967 Treaty on State activities in the area of exploration and use of outer space stipulates that:

- each State is responsible for its own activities;
- each State must inform the others and the UN of any factor which may endanger the life of astronauts;
- "the launcher State" is responsible for damage caused by the space objects which he has launched.

This international coordination must lead to the definition of a “code of good conduct” to ensure free access to space, notably for future generations.

2.2. Management of risks specific to the different space activities

2.2.1. Exploration of the Universe

This must lead to the creation of the precautionary measures needed to bring back from space materials which potentially have a biological contaminating effect. In this regard, the *National Research Council* classification is a good example of a risk-taking hierarchy.

2.2.2. Manned flights

These must not be accompanied by any exception from the rules of human or animal experimentation applied in the earth’s atmosphere.

The principle of free consent, with a full knowledge of the facts, must be respected, especially as astronauts are so highly motivated that they might easily accept ill-considered risks.

Animal experimentation must be based on compliance with protection rules that respect current regulatory provisions and are based on ethical, scientific and methodological arguments.

2.2.3. The use of satellites

Sustained efforts must be made to protect individual liberties and cultural identities by prohibiting any measure which might disturb public order and morality.

Because of the commercial applications of communication and positioning satellites, international coordination is vital to draw up a “**co-regulation**” system designed to protect individuals, populations and States in relation to each other, while still permitting the fight against terrorism, the mafia, pedophilia and cyber-crime.

III. INFORMATION FOR THE PUBLIC

This determines acceptability to public opinion.

It is vital because of the breakthroughs in space technology, which touch on the imagination and appeal to human emotions.

Public opinion must be better trained to understand the advances of science and space technology and better informed of their potential uses.

The knowledgeable media must be able to verify scientific and technical information in contact with the world of fundamental research but directed towards practical applications. Researchers bear a large measure of responsibility for the presentation of objective, independent and transparent information, which must be as comprehensive as possible, while still remaining accessible.

The need for a commitment on the part of States, research institutes and industrialists is therefore apparent. This is the only way of setting up and organizing effective "**mediation teaching methods**", designed to lay the basis for objective acceptability to public opinion.

CONCLUSION

Public order and morality are factors that limit acceptability to public opinion, but we must move beyond this limitation and ensure **constructive acceptability** based on the anticipated profits, in an interactive and dynamic framework designed to weigh up advantages and drawbacks.

Efforts must also be made to create an evolutionary framework in which every new technological phase is a further step, opening up a vista of a different horizon.

As to the cost of acceptability, the vital need is to avoid any distortion of competition so as to preserve equal opportunities and competition in the service of all humankind.

Human beings are now part of a system that has become planetary and is open onto the space which surrounds "man on the move", seeking new motivations to inspire him.

We must not refuse any new dimension which human beings are capable of handling.

That in itself is a form of ethics.

THE ROLE OF ETHICS IN THE DECISION-MAKING STRATEGIES SUCH AS TECHNOLOGICAL FEASIBILITY, COST-BENEFIT RATIO

By Mr U.R. RAO (India)
Former Chairman of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), Member of the Indian Space Commission

In recent times, space technology has emerged as a very powerful tool of development because of its global reach and its capability to rapidly transform the human life style even in remote areas of our planet. With appropriate choice of decisions space technology has demonstrated its ability to rapidly promote communication infrastructure, global human connectivity, literacy, environmental protection, agricultural productivity, disaster mitigation and integrated sustainable development. If misused, space technology could lead to continued exploitation of nature beyond its recuperative capability, impoverishment of resource poor vulnerable societies, enhancement of inequity among nations, widening divide between the developed and developing countries, rapid escalation of international tension and global destruction. Future course of human history will to a large extent, depend on the exercise of ethics in the choice of space technology application programs and their relevance to development.

Ethics has crucial role to play in all aspects of decision making in space technology including on technical, financial, economic and societal aspects. The importance of ethics is underscored by the rapid pace at which space technology can impact society. Need to evolve appropriate ethical principles is particularly important in the context of the developing countries which are in dire need of space technology for their own development and countries newly engaged in space exploration. Ethics is involved in every stage of decision strategy from the choice, selection. development to execution and application of each project. It involves both the receiver and the provider, whether they are individuals, industrial units, societies or governments.

Decision making strategies at all levels involve principles of personal, professional as well as global ethics. At personal level, concern for well being of others, respect for others autonomy, trustworthiness, honesty, conformance with law, fairness and objectivity are involved. Professional ethics demands impartiality, objectivity, fairness, due diligence, transparency and openness. At global level, societal benefit, global justice, environmental stewardship etc. need to be considered.

All space projects must carefully consider and objectively analyse various aspects of each project prior to its implementation.

1) Need aspects in relation to other priorities of each nation.
2) Choice of technology and schedule of implementation.
3) Cost of implementation both explicit and hidden and affordability.
4) Manpower development and capability to absorb the technology including training aspects.
5) Environmental impact analysis.
6) Cost-benefit analysis which must take into account the cost of internalisation of external factors such as environmental impact.
7) Societal impact including possible effect on the socio-cultural aspects of the society.
8) Respect for security concerns of other countries.

I. ROLE OF ETHICS IN THE CHOICE OF THE PROJECT

Decision on the choice of any space project/program has to be based on its need aspect, priority vis-à-vis other programs, cost of implementation and overall benefits to the society. It must take into account internal capability including technological, infrastructural and financial aspects. Most often decision makers, in their anxiety to show progress, take up projects without going into all the technical, financial, economic and infrastructural details required for the successful completion of the project. This invariably results in the overrun on the cost, time schedule and often ends up in the failure or non-optimal utilisation of the project. Typical is the delay in the building the ground infrastructure, particularly in communications area, which results in gross under-utilisation of space capability.

Choice of technology and schedule of implementation determine the success probability of any space project. Finally the economics of each project must be affordable. Recent problems encountered by the Low Earth Orbiting (LEO) mobile communication systems are striking examples of project failures, as much due to the substantial cost over-runs making these economically unviable as to the initial over projection on the demand growth rate of the mobile system.

Promotion of Mega projects like Power projects, large dams, industrial complexes etc., has become a fashion in the name of development. While there is no denial that rapid improvement of economic growth demands infrastructure development and industrialisation, the projects must be based on detailed cost-benefit analysis. Developing countries in their anxiety to progress faster often fall prey to high-pressure salesmanship of exotic schemes without going deep into cost benefit analysis. Instances are galore where huge dams have been undertaken, causing large amount of hardship to people and environment. A critical analysis of the

program probably would have shown that a small lowering in the height of the dam would have substantially reduced the environmental damage and hardship to local population at a small reduction in the benefit, maximising cost benefit ratio.

Computation of cost must necessarily take into account the cost of manpower training and human resource development. Most importantly a paradigm shift in decision making process is needed which must consider the hidden cost particularly those related to the environmental impact and depletion of natural resources beyond their recuperative capacity. Assessment of the long term effect on economic security has to be a major criteria in the selection of technology. In order to cover rising import demands for capital goods, poorer countries are often forced to export much of their natural resources at failing real prices which will lead to loss of natural heritage, biodiversity and eventual degradation of natural resources at the cost of future generations. Short-term gains to the detriment of long term prosperity is surely unsustainable. All decisions must be compatible with the philosophy of sustainable development.

II. ETHICS RELATED TO TRANSPARENCY

Total transparency and willingness to hear and synthesize the wide spectrum of views available from other sources are the primary requirements of any decision maker. Starting from the choice of vendor, to technology assessment, financial viability and detailed step by step execution of the project including assessment of associated environmental or other negative impacts must be carefully made. Decision makers are often prone to ignore dissenting voices and consider only data which fits into their picture which are at best unprofessional and at worst can lead to disastrous consequences. Lack of transparency and unwillingness to heed to dissenting voices have led to many catastrophes such as the Challenger failure. At purely personal level, technicians often knowingly suppress or ignore negative information, which if had been projected in time, could have avoided embarrassments later.

At global and societal level, decision makers do not openly come out with a clear assessment of the environmental hazards, risk factors, accident proneness and institute clear risk mitigation procedures for fear of the project being discarded. Lack of adequate safety precautions in the construction of launch and test facilities, poor handling of propellant and hazardous materials, lack of proper arrangements for the disposal of hazardous wastes are examples of some areas, which are often neglected or bypassed.

Space projects being very complicated need end-to-end understanding, careful design and extensive testing for establishing performance reliabilities, rigorous analysis and validation of complex situations and extreme care in implementation. They involve careful review

of all test data, mission evaluation and involvement of multi-disciplinary experts. Decision makers of such projects must consider all technical suggestions including technical dissents if any and resolve them prior to the final execution of the project. They must also respect patents and copyrights in addition to their willingness to uphold contractual obligations and protect legitimate interests of other parties. They are accountable for the entire performance of the project including schedule, budget and performance. Even major space contractors, often, cut corners particularly in testing and fabrication of complex systems to save on schedule and oil cost, which can end up in the failure of the mission. The early fiasco in Hubble project, failure of many satellites and operational launchers are the result of such unethical practices followed in the execution of the project.

IV. ETHICS RELATED TO HIGH TECHNOLOGY SELLING/MARKETING

Ethics involves not only the recipient country but also the technology or equipment provider. High powered salesmanship and purely mercenary considerations have led to the exploitation of many developing countries, through technology dumping either by selling outdated technology or highly sophisticated expensive toys which are not really needed to accomplish the job. Many equipments sold to these countries are lying idle for want of spares and trained personnel to man these facilities[7], thus converting them into dead investments. A detailed cost-benefit analysis would have brought out the necessity of such technology and also indicated the need for manpower development, training etc.

As an example, we consider the high powered salesmanship of selling high-resolution remote sensing data at an exorbitant cost. For many studies on natural resources such as land use monitoring, forest inventory etc., medium resolution lower cost data may be adequate. Likewise the choice of the ground based infrastructure needs to be carefully analysed to ensure that it meets the specific requirements without going for the most expensive option.

In the case of communication infrastructure development, the need of many countries may be to establish basic infrastructure including in rural areas, which may not require very large bandwidths. In the field of broadcasting, indiscriminate exposure without considering the cultural impact of such programmes could lead to cultural invasion and social unrest. Even educational programmes and programmes on entertainment, unless they are culture specific, would do more harm than good. There are many instances of developing countries being sold outdated technology instead of enabling them to leap frog. Equally true is where such countries have been sold very expensive state-of-the-art equipment with capacities far in excess of their need.

7. General Ethics in Space Technology.

V. GLOBAL ETHICS

Even more than the sale of communication equipment, sate of vital data particularly remotely sensed data is beset with serious ethical issues. With the dramatic improvement in the resolution which has already reached l m and is likely to reach 0.1 to 0.2 m in the coming decade, these imageries have gained not only economic but also strategic value. These data can be and often are used for economic exploration as well as military surveillance, causing strategic damage to the sensed state. The current practice of completely open dissemination of data of a country to any third country without restriction needs a careful review. Protection of the legitimate interests of all sovereign states must become the central theme of global ethics if we are not to escalate international tension. The exercise of restraints in this regard, particularly with the rapid commercialisation of remote sensing, is going to be most difficult to enforce.

Thanks to the growing understanding of the consequences of global warming phenomena, depletion of ozone and possible rise of sea level, the need for environmental protection and ensuring green house equilibrium has been universally recognised, resulting in the adoption of treaties such as Montreal protocol. The success of such treaties clearly depends on the availability of environmental friendly technologies including CFC substitutes at an affordable cost to the developing countries. This can only happen when the industrialised nations, having the wherewithal to discover alternate technologies, are willing to make them available to developing countries as a part of their ethical responsibility, since the present global situation is primarily due to their large per capita contribution to environmental degradation and made mandatory.

Growing realisation of the potential threat posed to space activities by fast increasing space debris has led to the evolution of new strategies to mitigate debris generation. Some of these strategies are easy to adopt and should be considered a part of good ethics, till appropriate legal requirements are adopted and made mandatory.

As tensions within and between regions are increasing, nuclear as well as missile proliferation have become common, even cross border terrorism and proxy wars are on the rise. Use of space capabilities particularly missile and anti-missile capabilities for star wars, though on a limited scale, is being freely talked about. The so-called deterrent strategy is in reality a manifestation of MAD (Mutually Assured Destruction) philosophy. In the absence of an alternative credible system for preventing escalations, even developing countries are tempted to fritter away their meagre resources in building disproportional strategic deterrence capability affecting not only their own economic security but also by creating potential threats to world peace through ineffective or accidental triggering of command control mechanisms.

Finally the ethics in the application of embargoes, sanctions and other restrictions on the sale of space hardware needs a careful re-examination. Such restrictions are applied even on purely civilian uses of space technology which are meant for development and extended to dissemination of information even during disaster situations, often dictated by economic interests. Even sale of communication satellites and ground equipment are denied. Developing countries cannot improve the quality of life of their people unless they are provided easy access to environment - friendly technologies and latest developments particularly in the present age of knowledge based global economy.

IS THERE A SPECIFICITY OF OUTER SPACE AS AN INALIENABLE PROTECTED DOMAIN?

by Mr Antonio RODOTA
Director General of the European Space Agency (ESA)

In our mind's eye, we can all see astronaut Armstrong planting the American flag on the surface of the moon. In centuries gone by, this act might have been regarded as a claim to sovereignty over an unexplored land or a colonizing move into a territory inhabited by other populations. But this time that was certainly not the case. It was on the contrary more like the gesture of a mountaineer placing a flag on a newly conquered mountain peak for the first time: a token of success, a sign sent out to the people back home and a message of hope for the whole world. In the field of space exploration, this lack of any claim to sovereignty has a foundation in law.

Non-appropriation is one of the fundamental principles governing the law of space.

The Space Treaty (1967) was drawn up and adopted in the environment of the Cold War. For reasons of prestige and ideology, the United States and the USSR were vying for leadership in the conquest of space: the first satellite in orbit round the earth, the first man in orbit round the earth, the first probe to land on the moon… There remained the great unknown: which of the two superpowers would be the first to enable a man to walk on the surface of the moon? The uncertainty was total. Was there not a risk that the "winner" would regard the moon as its own sovereign territory? A situation of that kind would certainly have heightened political tension, which was already rife, making the space race a threat to peace on earth.

In a geostrategic compromise, the United States of America and USSR abandoned any claim to the appropriation of "outer space, including the moon and other celestial bodies" and, by doing so, created the regime that we know today.

Before considering the specific features of outer space which justify the principle of non-appropriation and assessing its merits, we must clearly acknowledge the fact that this principle cannot be considered in isolation. The regime of protection established by the Treaty is based on three fundamental and inseparable principles, which seek to guarantee for all States and their populations enjoyment of the benefits resulting from the pursuit of space activities. This regime therefore obviously embodies ethical principles. Its three pillars are:

- non-appropriation;
- freedom of exploration and use;
- assignment for the benefit of all humankind.

I. NON-APPROPRIATION

The Space Treaty stipulates in its Article II that outer space, including the moon and other celestial bodies, cannot be the object of national appropriation by proclamation of sovereignty, use or occupation or by any other means. This prohibition must logically be extended to citizens as well. However, press reports state that some private companies are offering plots of land on the surface of the moon, Venus or Mars. Although such sales are manifestly illegal, the plots have nevertheless found many purchasers.

Of course this item of news is anecdotal, but it does show at least two things:

- Man remains fascinated by space and the element of dream, which goes with it, because the purchasers obviously cannot hope to benefit physically from their "property" in their own lifetime.
- Ownership as the right to dispose absolutely of a good is one of the driving forces of our societies and the desire to acquire property knows no frontiers or, in the case of space, does not even recognize the absence of frontiers.

While the desire to own property is perfectly legitimate, when it comes to outer space the principle of non-appropriation must nevertheless be respected. On no account may this principle be diverted from its ultimate objective.

II. FREEDOM OF EXPLORATION AND USE

However, non-appropriation elevated into a unique principle would have the effect of restraining the development of space activities and would therefore deprive the populations of the benefits resulting from such activities.

That is why the Space Treaty establishes, as an appendage to the principle of non-appropriation, the freedom to explore and use space (Art. I, §2). It provides the finest possible guarantee to ensure that States are not tempted to lay claim to sovereignty. Through the respect for these two principles, every State, instead of being limited in its freedom of action by the sovereignty of others, has at its disposal an infinite range of opportunities for exploration and utilization.

Unfortunately, economic and technological barriers have always existed and still exist today. The number of space powers remains small, although it has increased considerably since the Space Treaty was drafted. This situation has in all probability encouraged a number of equatorial States to lay claim to the segment of the geostationary orbit situated above their respective territories (Declaration of Bogota, 1976). Their objective - that of securing economic benefits from the use of the geostationary orbit by other States - is comprehensible. However, acceptance of that claim would involve the risk of seeing the start of a new space race. That would be prejudicial to the entire international community.

The principle of freedom of use is not, however, absolute. When space is a limited resource, as is the case for commercially exploitable orbits, specific rules exist; their purpose is to create a framework for the exercise of freedom of use. Thus, access to these orbits and to the radio frequencies needed for their utilization is governed by ITU regulations.

While the two first principles seek rather to establish a balance between the space powers, the third for its part tends to protect the interests of the States, which do not at present have the ability to participate effectively in the exploration and use of space.

III. THE DEDICATION OF SPACE TO ALL HUMANKIND

To this end, the Space Treaty states in its Article I, para. 1, that exploration and use…must be for the good, and in the interest, of all countries, regardless of the state of their economic or scientific development; they are the attribute of all humankind. The fact that this provision is placed at the head of the Treaty and the use of the verb "must" testify to the importance which the authors accorded to this principle.

IV. IMPLEMENTATION OF THE PRINCIPLES

The outcomes of space activities are highly positive in terms of the benefits brought to "all humankind":

- Remote detection permits better management of resources, environmental monitoring, reliable weather forecasts and early warning and improved management of natural disasters.
- Exploration and scientific research advance the sum of our knowledge.
- Space telecommunications permit communication between populations that had hitherto been isolated and help to assure equality of access to knowledge.
- Orbital stations promote concord and cooperation between the participating States by allowing astronauts of different nationalities to work side by side.

V. FEATURES SPECIFIC TO SPACE

While the regime introduced by the Space Treaty is often compared, given the absence of national sovereignty, with the provisions governing the high seas or Antarctica, it nevertheless remains unique because of the existence of features specific to the space environment, which justify this absence of sovereignty.

i) Symbolic value

In the first place, space has a symbolic value from at least two points of view. Firstly, it represents the "ultimate frontier", an unknown and inaccessible world which fascinates Man. Secondly, it is a unique

environment, providing a view of the earth in its totality. How then might its appropriation by a small number of industrialized countries possibly be envisaged? A vacuum is hard to appropriate. What is more, no consensus exists over the definition of the altitude at which air space gives way to outer space. Some propose the perigee of the satellite in the lowest orbit and others a limit at one hundred kilometres. Be that as it may, everyone agrees that the limit must lie within a zone ranging from eighty to one hundred and twenty kilometres.

ii) Physical features

Moreover, the space environment has specific physical features. Given the nature of celestial mechanics, the territory of a State which comprised the outer space above it would be a territory whose content changed all the time. This situation would create uncertainty as to the "territory" within which a space activity is pursued and, consequently, uncertainty over the applicable law. This holds good for space powers and other States alike.

Celestial bodies for their part are clearly identifiable, but for the geostrategic reasons to which we have already referred, the space powers participating in the drafting of the space Treaty renounced any claim whatsoever to sovereignty over them.

iii) Effective monitoring

One of the essential attributes of sovereignty resides in the ability of a State to effectively monitor its own territory. While a vast majority of States do have the means of exercising effective control over their territorial waters and air space, the same does not hold good for outer space. How then can sovereignty possibly be claimed? Especially if the content of the territory concerned varies all the time…

As to the celestial bodies, in the present state of the technological art, even the space powers would find it hard to exercise effective monitoring.

VI. CONCLUSION

Ethics involve a sustained process of reflection on the consequences of our acts, together with a set of moral principles. Since space applications have already provided, and continue to provide, solutions that bring great benefits to "all humankind", the framework in which they have developed, namely the regime established by the Space Treaty, must be regarded as consonant with ethical principles in the light of the results achieved.

The regime established by the Space Treaty has guaranteed respect for an ethic in which the moral principles coincide with the outcomes.

There was a time when dogmatism raised a barrier to the development of the science of astronomy – witness Galileo Galilei. Today, we must avoid a situation in which economic dogmatism deprives some populations of the benefits brought by space technologies developed within the framework of the Space Treaty.

EXTRACTS FROM THE REPORT OF THE 43rd SESSION OF THE COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE (COPUOS)

Prepared by the United Nations Office for Outer Space Affairs (OOSA)

I. AGENDA ITEMS OF THE COMMITTEE RELEVANT TO SPACE ETHICS

i) General exchange of views.

ii) Ways and means of maintaining outer space for peaceful purposes.

iii) Report of the Science and Technical Sub-Committee on its thirty-seventh session.

iv) Report of the Legal Sub-Committee on its thirty-ninth session.

v) Other matters.

II. GENERAL STATEMENTS

A special presentation was made by the representative of IAA on the IAA position paper, entitled "A Decision Process for Examining the Possibility of Sending Communications to Extraterrestrial Civilizations".

III. WAYS AND MEANS OF MAINTAINING OUTER SPACE FOR PEACEFUL PURPOSES

3.1 The agenda item addresses the concern of the international community about the need to promote international cooperation in the peaceful uses of outer space, taking into particular account the needs of developing countries.

3.2 There was a view expressed at COPUOS that easy and unhindered access to space and access to technology without restraints were essential to pursuing the peaceful uses of outer space.

3.3 Some delegations expressed the view that an international legal regime should be developed for the prevention of an arms race in outer space and to prohibit any militarization of outer space, and that negotiations on an international agreement to prevent an arms race in outer space should be conducted as soon as possible. Those delegations also expressed the view that the existing legal regime was insufficient, especially under present-day conditions, and that additional principles were needed to ensure that outer space was kept free of weaponry. Some delegations also expressed the view that the Committee should consider

the possibility of establishing a mechanism to coordinate its work with other related bodies, in particular with the Conference on Disarmament, since the two bodies shared common interested in promoting the peaceful uses of outer space and preventing an arms race in outer space.

3.4. The view was expressed that the idea put forward earlier of establishing a world space organization responsible for space activities, including satellite communications and the space environment, should be further considered.

4. REPORT OF THE SCIENTIFIC AND TECHNICAL SUB-COMMITTEE

4.1. Implementation of the recommendations of UNISPACE III

Under this item, OOSA proposed a programme on capacity building in space law. This programme can include the issue of space ethics.

4.2. Use of nuclear power sources in outer space

The Committee agreed with the Scientific and Technical Sub-Committe that, while a revision of the Principles was not necessary at the current stage, it was important that States making use of nuclear power sources should conduct their activities in full accordance with the Principles (A/AC.105/736, para. 78).

4.3. Space debris

The Committee agreed with the Scientific and Technical Sub-Committee that consideration of space debris was important, that international cooperation was needed to expand appropriate and affordable strategies to minimize the potential impact of space debris on future space missions and that Member States should pay more attention to the problem of collisions of space objects, including those with nuclear power sources, with space debris and to other aspects of space debris (A/AC.105/736, paras. 95 and 96), in accordance with General Assembly resolution 54/67.

Some delegations expressed the view that the Committee should ask the Legal Sub-Commitee to give its views on the technical report on space debris and on the applicability of the current space treaties to the issues of space debris and should endorse the proposals contained in a working paper (A/AC.105/L.221 and Corr.1) submitted by France to the Scientific and Technical Sub-Committee at its thirty-seventh session. Other delegations expressed the view that it would be premature for the Legal Sub-Committee to discuss legal issues relevant to space debris.

V. REPORT OF THE LEGAL SUB-COMMITTEE ON ITS THIRTY-NINTH SESSION

5.1. Review and possible revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space

The view was expressed that, on the basis of the progress of deliberations in the Scientific and Technical Sub-Cmmittee, it would be appropriate for delegations of the Legal Sub-Committee to begin informal consultations in order to develop essential points for a meaningful discussion on the Principles Relevant to the Use of Nuclear Power Sources in Outer Space.

The Committee agreed that the item entitled “Review and possible revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space” should be retained as a single issue/item for discussion at the fortieth session of the Legal Sub-Committee, in 2001.

5.2. Review of the status of the five international legal instruments governing outer space

The Committee agreed to endorse the recommendations, prepared by the Legal Sub-Committee’s working group on that item, on measures to achieve the fullest adherence to the five international legal instruments governing outer space, contained in the report of the Sub-Committee (A/AC.105/738, para. 75).

5.3. Review of the concept of the “launching State”

The Committee noted that, in accordance with General Assembly resolution 54/67, the Legal Sub-Committee had begun its review of the concept of the “launching State” in accordance with the three-year work plan agreed upon by the Committee at its forty-second session.

The Committee recommended that the Legal Sub-Committee continue its consideration of the item at its fortieth session, in 2001, in accordance with the programme for the second year at its three-year work plan.

5.4. Draft provisional agenda for the fortieth session of the Legal Sub-Committee

The Committee had before it a working paper submitted by the Russian Federation (A/AC.105/L.225 and Corr.1) relating to a proposal, made by that delegation at the thirty-ninth session of the Legal Sub-Committee, to include in the agenda for its fortieth session, in 2001, a new single issue/item for discussion entitled “Advisability of developing a single comprehensive United Nations convention on the law of outer space”.

At the 470th meeting, Bulgaria, China, Colombia, Greece, Iran (Islamic Republic of), and the Russian Federation submitted a working paper (A/AC.105/L.228, Add.1 and Add.2) containing a proposal for the inclusion of a new item in the agenda of the fortieth session of the Legal Sub-Committee, in 2001, entitled “Discussion of the appropriateness and desirability of drafting a universal comprehensive convention on international space law.

Other delegations, however, reiterated their doubts concerning the need for such a convention, arguing that the existing legal regime was sufficient to govern the exploration and use of outer space. The view was also expressed that the drafting of such a convention held the potential to allow for the examination of a multitude of issues relating to activities in outer space and that, therefore, the existing proposal should be made more specific, indicating the limit of the proposed exercise.

Some delegations expressed their concern that this proposal could not reach consensus at that session and recommended that further consultations be conducted.

VI. OTHER MATTERS

Organization of a colloquium on the theme “The human dimension in space science and technology applications”

The Committee endorsed the recommendation of the Scientific and Technical Sub-Committee (A/AC.105/736, annex II, para. 45) that a colloquium on the theme “The human dimension in space science and technology applications” be organized during the forty-fourth session of the Committee, in 2001, with the participation of eminent scientists, sociologists, philosophers and others.

Annex 4

THE ETHICS OF SPACE POLICY[8] – ABSTRACT

By Alain POMPIDOU

CONTENTS

8. This publication is available in English on UNESCO Web Site : http://www.unesco.org/ethics/uk.

ADDITIONAL DOCUMENTS

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Members of the Working Group of COMEST on
"The Ethics of Outer Space"

ADDITIONAL DOCUMENT II

Contributions by the Members of the Working Group

The Development of science and space technology

Use of space technology

Man in space

Manned space flight as a cultural mission

Space and protection of the environment

ADDITIONAL DOCUMENT III

Meeting Reports of the Working Group of COMEST on
"The Ethics of Outer Space"

ADDITIONAL DOCUMENT IV

Final report of the Paris Seminar on
"The Ethics of Outer Space"

ADDITIONAL DOCUMENT V

Summary Record of the Paris Seminar on
"The Ethics of Outer Space"

TECHNICAL ANNEXES

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II Earth watch satellites
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IV Distribution of the market for satellite navigation equipment and services
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IX Space budgets
X General presentation of the European Space Agency (ESA)
XI Scientific missions and long term programmes of the European Space Agency (ESA)

RECOMMENDATIONS

After identifying a number of problems or questions relating to the ethics of science and space technologies, our Working Group proposes several recommendations to COMEST which may, as appropriate, use our work as the basis for defining guiding principles for the development and use of space technologies.

I. Space as an Ethical Issue

Elaboration of ethical norms

- If ethical considerations must help to resolve conflicts that are liable to occur from applications of space technologies, criteria or norms must be established to support the relevant arguments.
- Ethics must precede and guide the law and not vice versa. Ethics represents a permanent movement, which is destined to enlighten regulations.
- Space activities require a precise legal framework subtended by an ethic, which is designed and clearly accepted by all players in the field. For instance, within the United Nations system, general principles must be drafted and adopted in respect of the legal concept of the launcher country and the status of low orbits.
- But even before this, most countries should ratify the legal instruments that already exist in the space sector to enable them to be brought into force.
- The ethical principles should be applied to every phase of development of the space instrument and they should underlie the strategic plans of the space agencies.
- Where appropriate, the establishment of an ethical code should flow from international consultation to harmonize practices and possible legislation in order to avoid the proliferation of norms specific to each country.
- To avoid any shadow zone and permit better understanding and the support of public opinion, the greatest possible clarity and independence must be ensured in putting forward motivations which, regardless of their foundations, underlie decisions on space programmes. This presupposes genuine transparency on the part of the space agencies and governments which take the decisions and also of the media which are their relays in society.
- Definition of the basis of a space culture has become imperative today.

II. Space as a Dimension

- Space as a factor of enlargement of knowledge presupposes the absence of any obstacle to observation of the Universe by astrophysicists, especially the barrier created by electromagnetic pollution.
- To allow scientific work to be pursued under sound conditions, space must be the subject of special protection.
- Space should be proclaimed a scientific territory available to humankind.

Allocation of resources

- Principles must be defined. They should result from the balance to be struck between the general interest of humankind and the particular interest of the various players involved.
- The notion of equity should apply to the distribution of resources to alleviate the competition engendered between different scientific disciplines.

III. Space as an Instrument

Limitation of pollution generated by space activities: space debris

- With a view to limitation of pollution induced by space activities, preventive measures in respect of space debris should be defined and imposed uniformly on all users of space technology to avoid the risks of distortion of competition.
- These preventive measures should be entered in international law.
- The elaboration of an international legal instrument is a matter of priority.
- The notion of space debris should be the subject of a detailed definition.
- The creation of ethical and juridical frameworks presupposes the development of a symbiosis between scientists, lawyers and ethical committees.

Access to data

- Environmental data should be made available to the least prosperous countries. Giving them access is a vital feature of their development.
- Legislation should be developed to regulate access and use of data processed by satellites.
- In the event of natural disasters, the rapid and quasi-free circulation of information must be possible without reference to other more commercial activities by analogy with the procedure in meteorology

where, although meteorological data has a commercial value, the different weather forecasting services worldwide permanently exchange on a daily basis their global observation data on the terrestrial environment.

Space and the environment

- In the short term, space technology must enable a system for management of the global environment to be set up.
- The establishment of a permanent source of knowledge based on observation of the planetary environment should be a major objective for the space nations.
- In the long run, the intervention of space technology could help to rid the Earth's surface of the most dangerous waste material generated by human activity, in particular nuclear waste by putting this material in a circum-solar orbit where storage capacity is unlimited. Nevertheless this implies the attainment of conditions of absolute safety.

Protection of public freedoms and cultural identities

- Satellite broadcasting must be sufficiently diverse to enable minority cultures to express themselves by reaching the populations concerned wherever they may be.
- A balance must be struck between the maintenance of cultural identities, which already exist and the appearance of new identities created by electronic forums.
- We must make sure that the phenomenon of globalization does not lead to the standardization of cultures.
- This circulation of information technologies at world level must guarantee respect for cultural identities and freedom of expression.

Electronic surveillance

- Since electronic surveillance is inevitable, management and control of data must be regulated while protecting the confidentiality of information and individuals.
- Legislation on access and use of data processed by satellite should be developed.
- The techniques of space communication must not be used to circulate subversive messages or pursue unlawful activities.

Commercial and industrial exploitation of space

- The use of data flowing from the development of forecasting capacities must be managed in such a way that inequalities do not widen and coercitive economic practices are not allowed to emerge.

- It is essential to avoid the adoption of a reproving attitude towards commercial and industrial use of space. As long as private funds are used, a commercial logic is justified.
- The advantages specific to space systems must be preserved and care taken, when defining ethical standards, to weigh up their consequences for the different systems and different players.
- The question of commercial practices should be considered in the framework of commercial discussions between countries and in the World Trade Organization (WTO).

Acquisition and protection of space data

- To benefit from the same rights and opportunities, all countries should have access to space data; at the very least a distinction in respect of the cost of access to data might be made as a function of the use that the countries intend to make of it.
- A distinction might also be drawn between three types of data produced by space missions:
  - data with a scientific character which belong to the sphere of fundamental research and must be accessible to researchers and university staff in every country.
  - environmental data which should be placed at the disposal of the less-favoured countries for which access to such data is a major contributory factor to balanced development. In this regard, the practice followed by Eumetsat towards non-member countries, which are expected to pay for data if they are rich but enjoy free access if they are poor, could also apply to environmental data.
  - commercial data in the strict sense of the term (telecommunications), which might alone be governed by a strictly “commercial logic”.
- Although outer space is the shared territory of humankind, space technologies and expertise must be eligible for protection of intellectual property.
- The desirability of drawing up European or international law on space matters must be envisaged, notably in the field of protection of intellectual property in on-board equipment which is currently governed by the legal provisions of a single country.
- However, there is no need to define specific rules for space relating to the protection of intellectual property since the same rules of intellectual property might be applied to space as are applicable to other forms of creation.

IV. Space as a Perception

Risk management

- An independent authority is needed to protect safety; this implies a separation between safeguard instruments and those used to apply the technology involved.
- At the risk of prejudicing the immediate development of the space industry, we cannot afford to wait for damage to occur before placing limits on the use of knowledge: a long-term development policy must be adopted, based on a proportionate precautionary principle.
- The management of risks in relation to society implies not only allowance for the subjective nature of the risk but also its demystification by keeping the public informed of the real risks and establishing a clear and transparent dialogue between society and the different players in space activities to avoid all shadow zones.
- Supranational bodies must be identified with authority to propose rules for balanced risk management and assure monitoring and effective application, notably for protection of the space environment.
- This risk management must also be translated into legal terms at the same time, however, avoiding the risk of over-regulation. Public opinion must be reassured by stressing the notion of responsibility, which must apply in this area.
- Where damage is caused by space vehicle, the possibility of unlimited liability should be envisaged.

Communication

- An ethic of information on aspects of space exploration must be developed in the media.
- Specifications might be envisaged for information about space policy.
- Adequate scientific training must be ensured for journalists to avoid all disinformation. That being so, the space agencies might have a pedagogical role in relation to the media.
- It would be desirable to give the general public better information on space activities. Good information for the public can help to legitimize space exploration.
- Information alone is not enough. Public opinion must be able to understand. Therefore an adequate basic scientific culture must be created to enable the public at large to understand the aims and challenges, as well as the risks of space exploration.

- Programmes to train trainers and scientific mediators should be drawn up and assured by specialized international institutions.
- Better understanding and support by the public could be developed through public debates or hybrid forums bringing together experts, scientists and citizens.
- All these communication efforts must lead to the development of a “Culture of Space” based on the training in mediation which has become imperative today.

CONCLUSION

Outer space is part of the shared heritage of huhumankind and as such its exploration and exploitation must be freely accessible for the benefit of all huhumankind.

The ethical approach to space is a moral principle for action, with due attention to the risks involved and recognition of the rights of others. It must be founded on a new strategy of communication. As part of that strategy, it is imperative to leave room for a dream, as a source of creative imagination and to give fiction its rightful place, while bearing in mind the reality of the future of space policy for the benefit of all humankind.

The work undertaken by the Working Group on the Ethics of Outer Space has enabled ethical problems which arise in this matter to be identified. This report is no more than a preliminary phase. The Group will be submitting its conclusions to COMEST which will then have the task of defining the basis of the Ethics of Space as a first stage to worldwide consultations.