

SOVEREIGNTY AND SPACE TRAFFIC MANAGEMENT

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ABSTRACT

The 1967 Outer Space Treaty states in its Article II that “*outer space including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means*”. However, nobody knows exactly the boundary between *air space*, in which States retain domain, and *outer space*, where the concept of sovereignty is not applicable. Discussions regarding delimitation of outer space occurred as early as the 1930’s. Yet there are still no satisfactory legal definitions of boundaries. How is it possible to provide adequate and just space traffic management if the delimitation of outer space is unknown? This paper presents background data regarding the delimitation of outer space, summarizing the positions of some Latin American countries as presented before the COPUOS Legal Subcommittee to date, and shows the importance of establishing boundaries of national sovereignty to deal with future space shuttles and space planes already on the drawing board.

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INTRODUCTION

According to the Brazilian *Veja* Magazine of May, 7th, 2003 (page 64), Jeffrey Bezos, the North American billionaire owner of the virtual bookstore “Amazon.com”, has contracted former NASA physicists and scientists in order to design spacecrafts to take him to outer space. Three years ago he founded a space research company called “Blue Origin” to promote space tourism.

Another North American millionaire, Dennis Tito, who paid US\$ 20 million to travel in a spacecraft, started this kind of tourism in 2001. Space tourism is already a reality. According to *Veja*, by 2021 many private companies will be able to take around 15,000 tourists per year to outer space.

“Space planes” are already on the drawing boards. One of them is the “Space Ship One” which is being developed by Scaled Composites Company. It was presented to the media in April, 2003. Another one is the “Space X” that has been financed by the South-African Elon Musk, owner of the Internet sales site “Ebay”.

These projects show that there could be traffic congestion in space in the near future. In this context, space traffic management is necessary as soon as possible.

As it was pointed out by the author in another paper, *“while space exploration used to be the exclusive domain of individual governments, nowadays it generally involves large private companies, operating in different countries with different laws. Obviously, when the five international agreements were first issued, we could not predict such complexity involving governments and private business”*¹. Hence, in space activities, the public interest has given way to commercial interests.

One of the pioneer thinkers in space traffic management is the Czech Professor Lubos Perek who states that *“traffic rules play an important role in three environments: on the road, on the sea and in the air. Although the conditions are quite specific for each of the environments, there are some general features. The main aim is to maintain safety of traffic by: a) establishing rules for avoidance of collisions; b) separating traffic in opposite directions; c) establishing specific rules on inactive vehicles; d) requiring specific rules on inactive vehicles; e) requiring proper identification of vehicles; f) requiring high technical equipment and qualification of personnel; and g) establishing rules on protection of environment”*².

These issues have been amply discussed in international forums, but none of these forums dealt with the question of exactly where these laws should apply. How is it possible to regulate space traffic if outer space boundaries are unknown? What is the boundary between air space and outer space?

BACKGROUND

The pioneers of space law were concerned about the need of establishing

boundaries for outer space. In his book *“Origins of International Space Law”*³, Dr. Stephen E. Doyle, Director of the International Institute of Space Law (IISL), provided some background in this regard. He observed *“at an air law conference held in Moscow in December 1926, a paper was presented by a senior official of the Soviet Aviation Ministry, V.A. Zarzar. The paper focused primarily on principles and practices in the history of international air law but, Zarzar saw well the historical debates about the nature and the extent of national sovereignty in air space”*.⁴

Dr. Doyle stated that the Czech Professor Vladimir Mandl wrote the world’s first major work of substance on the entire field of space law in 1932. Doyle called attention to another Czech Professor, Vladimir Kopal, who wrote the Mandl’s biography. Citing Mandl’s monograph *“The Law of Outer Space: a Problem of Space-Flight”*, Professor Kopal presented the concept of space law *“as an independent legal branch, based on specific instruments of space flight and governed by different principles than is the law of the sea or the law of the air (...) Mandl opposed the usual idea of sovereignty as applied to space without limits and asserted that sovereignty of States governs only the adjacent atmospheric space. Beyond the ‘earth coastal spaces’ a vast area begins which is ‘free of the jurisdiction of any earthly State, coelum liberum”*⁵. This freedom may turn to chaos, however, if boundaries and space traffic laws are not established.

According to Dr. Doyle *“in Leningrad in 1933, at a conference dealing with air law, Y.A. Korovin presented a paper addressing issues arising from human penetration of the stratosphere and attendant legal problems”*⁶. In his paper, Korovin stated *“that there is an incontestable right in*

every nation to control its superjacent air space to take any action therein that is necessary to its preservation and at whatever altitude it may be necessary or useful"⁷.

The paper "The Challenge of the Space Ship" presented by Arthur C. Clarke to the British Interplanetary Society in London on October 5, 1946, is also mentioned in Doyle's book. At that time following the Second World War, soon-to-be world famous sci-fi writer Arthur Clarke stated that: "*I do not suggest that lawyers need start worrying immediately about the ownership of the Moon, but the ownership of space is already a matter of acute practical importance. If a country A fires experimental rockets across its neighbor B, what does B do? The air above B is admittedly its own property, but how far does that jurisdiction extend? There must be certainly some equivalent of the [maritime] three-mile limit, otherwise, in the course of a day, every country will lay claim to a large portion of the Universe*"⁸.

Dr. Doyle cited many other authors each of whom stressed the importance of setting the limits for outer space. But the boundaries between air space and outer space have yet to be set. Lack of regulation makes it quite difficult to deal with space traffic.

DELIMITATION OF OUTER SPACE

The question of delimitation is a permanent item on the Legal Subcommittee of Committee on Peaceful Uses of Outer Space (COPUOS). In the 42nd Session of COPUOS Legal Subcommittee, held in April, 2003, the Delegate of the United States stated that this subject was nonsense because it had no practical application. In order to strengthen his position, he mentioned that

the space shuttle was the only object which is able to fly both in outer and in air space. He said that the space shuttle did not fly over other States, but only over oceans and the North American territory during its re-entries into the Earth's atmosphere.

While this may be true at the moment, the former Soviet Union also had its space shuttle called "Buran" which was flown once in 1988. Buran de-orbited over the southern part of South Africa and flew over North Africa and re-entered Baikonur possibly over Turkey⁹. Although there was no formal complaint about this trajectory, there could have been serious legal diplomatic issues if it had crashed. Space traffic is increasing and the delimitation of outer space will be necessary sooner or later. China has already announced that its space shuttle will be able to travel in coming years.

There are several proposals to establish boundaries between air space and outer space. To start with, the boundary between air space might be considered the point at which Earth's atmosphere no longer exerts effects.

On March 28, 2003, during the 42nd Session of the COPUOS Legal Subcommittee, the Ukrainian Delegate Sergei A. Nekoda, stated "*substantial orbital space flight is possible only out of the dense atmospheric layers. Speeds of an atmospheric aircraft are dozens and hundreds of times less than of a spacecraft. These objective performance attributes lead us to the logical conclusion that definitely there is the border between air space and outer space, and this border has not only formal physical meaning.*"¹⁰

In the sixties, the United States National Aeronautics and Space Administration (NASA) undertook the flight of the US Craft X-15 which performed flight at the altitude of 108

kilometers. NASA decided to qualify the pilots as astronauts when they reached 80 kilometers of altitude.

International practice adopts the altitude of 19,8 kilometers as the highest level for aviation activities. However, taking into account technological advancements, it would not be feasible to consider such an altitude as a parameter for the application of State sovereignty. Space planes will become a reality in the near future and they will probably fly in higher altitudes than 19,8 kilometers.

Some experts of the International Civil Aviation Organization (ICAO) consider that the upper limit of civil aviation interests is located at the altitude of 60 kilometers. According to them, activities undertaken above this altitude have space purposes.

The majority of space law experts consider that the lower boundaries to outer space are determined by the minimum perigee for artificial satellite movement, or 100 kilometers above sea level. Thus, States sovereignty might be extended up to this altitude.

Obviously, there are plenty of logical criteria that may be used to set the limits to outer space. What is missing is the will to do so.

AEROSPACE OBJECTS

Sovereignty is the strongest word to justify the delimitation of outer space. State has sovereignty over their air space and the objects traveling through it should be submitted to its national air law. The dual nature of modern air/space craft creates new legal questions. For instance, is a national air law applicable to a space shuttle during its re-entry into the Earth's atmosphere? If the answer is "no" it means that State sovereignty is not applicable to space objects even when they fly over foreign territories; it means

that national speed patterns should not be followed; it means that a space object may do whatever it wants because there are no regulations for it when it is flying in air space; in short, it means that State sovereignty is not complete. On the other hand, if the answer is "yes", it means that a space shuttle may not fly over foreign territories without permission.

Currently, there is no clear definition for an aerospace object either in space law or in air law. The current distinction of crafts is no longer valid now that they navigate in both environments. They have dual status.

The first question of the questionnaire proposed by COPUOS Legal Subcommittee¹¹ is: "*Can an aerospace object be defined as an object which is capable both of traveling through outer space and of using its aerodynamic properties to remain in air space for a certain period of time?*" In this paper, for the sake of discussion, an aerospace object will be considered one that is able to fly either in outer space or in air space and to undertake activities in both environments¹². Hence, space shuttles and space planes may be considered aerospace objects.

The existing legal framework needs to be improved to regulate activities undertaken by such objects. Otherwise there will not be an adequate international legal framework to deal with future legal issues.

If a space shuttle undertakes just an innocent passage through air space, it seems that it does not lose its characteristics as a spacecraft. In the same way, if a space plane undertakes just an innocent passage through outer space it need not be considered as a spacecraft.

Suppose that a space shuttle takes off from the Earth, taking dozens of tourists to the International Space Station. When the space shuttle is returning to the

Earth, it stops in different States in order to leave tourists in their respective countries. In this case, it seems that the space shuttle is functioning as an aircraft that is subject to air law.

Another hypothesis may be considered. If a space plane undertakes remote sensing activities during its flight in outer space it should be subject to the United Nations Space Treaties, because it is acting as a spacecraft.

Thus, the mission purpose is essential to establish what law will be applicable to an object. If an object undertakes just an innocent passage through an environment, it does not lose its status – spacecraft or aircraft; but if it undertakes activities in another environment, it should be subject to the laws of that environment.

This leads, once again, to the delicate question of space traffic management. The French Professor Armel Kerrest states that: *“The corner stone of the system misses: no State can exercise its sovereignty, there is no territorial State, no State able to exercise its territorial jurisdiction. Only personal jurisdiction applies. When there is only one territorial jurisdiction on a national territory, there is many personal jurisdictions applying on an international space if nationals or many States are using this space. When traffic management is concerned the problem is obvious. Who is going to make the rules, who is going to control their implementation, who is going to punish violations? As a matter of principle, if no special international regime is created, only personal jurisdiction applies. The State of nationality, registration, flag is the only competent State to set the rules, control and punish”*¹³. Since State sovereignty is not applicable in outer space, we must know, at least, the limits

of air space, where national laws are valid.

SOME POSITIONS

Some Latin American countries have already sent their answers to the COPUOS Legal Subcommittee questionnaire. All of them are concerned about the lack of legal boundaries to deal with problems that aerospace objects may cause to States, properties, and people. The following countries are cited because their statements summarize the basic issues under debate.

Argentina’s Position

In response to the questions as to whether there should be a new legal regime for aerospace objects, or merely special procedures within the existing regime, Argentina recommended further study. *“It would be necessary to conduct an in-depth study into the necessity of elaborating a new regime for such objects, since advances in aerospace technology may mean that in the future a specific regime will need to be established that takes account of situations not provided for under current international air and space law”*¹⁴.

Chile’s Position

Chile is concerned about the matter of innocent passage. This is one of the answers from Chile to the questionnaire: *“Although there are no provisions currently in effect which specifically regulate aerospace flights at the stage of entry into national air space, we feel that in the interests of the uniformity of the relevant legislation one should stay with the mission of the aerospace object and regulate the latter’s innocent passage only”*¹⁵. In other

words, Chile believes innocent passage through other countries' airspace needs regulation.

Colombia's Position

Colombia considers that the lack of regulation makes it difficult to deal with problems that may be caused by aerospace objects. *"The aerospace object should have a single legal designation, subject to special provisions determining the applicable regime, especially in view of the impossibility of specifying precisely where air space and outer space begin and end respectively, a problem which has made it difficult to reach a consensus on the criteria to be adopted in defining aerospace objects. Consequently, applying either air law or space law depending on the type of space crossed by the trajectory of the aerospace object would cause problems. Our preference is therefore for the second option of applying either one regime or the other throughout the entire flight, according to its destination"* ¹⁶.

Mexico's Position

Mexico states that the delimitation of outer space is necessary, especially to regulate activities undertaken by aerospace objects. In its answer to the questionnaire, Mexico emphasized that *"the particular aspects involved [to define what law is applicable to aerospace objects] should be worked out, but the relevant international legal regime should apply in air space, and the possibility should be considered of establishing a single law for aerospace objects in which the delimitation of air space is taken into account"* ¹⁷.

Peru's Position

Peru goes straight to the point of sovereignty. It stressed that *"because of ongoing advances in technology, situations could arise that are not provided for in the current air and space regimes. This should be taken into account by the creation of a special regime covering new situations and clarifying their legal status, with allowance for the territorial sovereignty of States"* ¹⁸.

Summary

According to the positions from the Latin American countries, delimitation of outer space, States sovereignty, and law regime applicable to aerospace objects are important issues to be solved.

Brazil has not yet sent its answers to the COPUOS Legal Subcommittee. Nevertheless, the Brazilian Society of Aerospace Law (SBDA)¹⁹, a non-governmental entity, established a Work Group in 2002 to study the questions and to propose answers to the COPUOS questionnaire. SBDA's Work Group concluded that differences between air space law and outer space law are fundamental and that the existing legal framework should therefore be improved to deal with future problems. The Brazilian Ministry of Foreign Affairs is analyzing the answers proposed by SBDA in order to confirm if they are consistent with national interests. Brazil should send its answers to the COPUOS Legal Subcommittee before the end of 2003.

CONCLUSIONS

The Brazilian Professor José Monserrat Filho states that some

measures are necessary to deal with space traffic management, such as: “a) a new kind of international co-operation as deep and confident as we do not have yet; b) a complex and competent international system (network) with highly qualified international teams and state of the art hardware to fulfill all involved tasks; c) global space traffic management institutionally established”. He emphasizes, “Without a permanent, efficient and self-sufficient institutional framework, true global space traffic management seems to be impracticable”²⁰.

As it has been seen, beside the measures mentioned by Professor Monserrat, there is the need to delimitate outer space. Many legal aspects are closely related with such a definition, such as, applicable law, innocent flight, and speed patterns among others.

To deal with future legal matters one question has to be answered as soon as possible: what is the boundary of the State sovereignty? Without this answer we do not know what law is applicable: air law or space law.

Some countries consider that delimitation of outer space is not necessary because it has no current practical effects. However, it is important to note that a legislator has to think in advance; he should keep alert to the needs of mankind. If there is no law to regulate a situation it means that the legislator has not done his work well. Remember that at the time when the 1967 Outer Space Treaty was written, the presence of private companies in space activities was yet unknown; militarized space was not a threat. Nevertheless, legislators were sensible enough to foresee these and other aspects and to elaborate a Treaty that keeps working.

Space traffic has increased and absence of law definitely does not protect

the interests of mankind. The COPUOS Legal Subcommittee, the International Institute of Space Law (IISL), and other specialized organizations should propose rules to delimitate outer space and to manage space traffic.

References

¹ See author’s paper “Brazil and the Registration Convention”, Proceedings of the Forty-Fourth Colloquium on the Law of Outer Space, published by AIAA, pages 78-86.

² In its article “Early Concepts for Space Traffic” presented in the IISL/ECSL Symposium on Prospects for Space Traffic Management on occasion of the 41st Session of the COPUOS Legal Subcommittee, in Vienna/Austria, on 2 April 2002.

³ Published by Univelt, Incorporated, San Diego, California – first printing 2002.

⁴ Op. cit., pages 1-2.

⁵ Kopal, V. “Vladimir Mandl: Founding Writer on Space Law” quoted by Stephen E. Doyle (op. cit. page 8).

⁶ Op. cit. page 10.

⁷ Op. cit. page 13.

⁸ Op. cit. page 16.

⁹ Dudar, E.N., “Flight Dynamics Analysis of Aerospace System with Subsonic Carrier Plane”, Russian/Ukrainian/German Symposium on Space Transportation and Propulsion, DGLR Bericht, 26-28 May 1993.

¹⁰ Negoda, Sergei A. “Proposals on Definition of the Border Between Air space and Outer Space”.

¹¹ See document prepared by Office of Outer Space Affairs (OOSA) reference A/AC.105/635 (www.oosa.unvienna.org).

¹² The Space Law Work Group of the Brazilian Society of Aerospace Law (SBDA) proposed this definition.

ABSTRACT

The objective of Project Rondônia is determination of patterns of automatic classification of intrusive granites belonging to the tin-bearing region of Rondonia and localized throughout nearly the totality of the Federal Territory of Rondônia. This project utilized LANDSAT multispectral imagery, copied on paper and on magnetic tapes (CCT-Computer compatible tape). Initially, a photogeological map corresponding to half of the referred territory was constructed at a scale of 1:1.000.000. The final map situates spatially and chronologically granites with cassiteritic (tin-ore) mineralizations. In this stage, a test area was proposed which encompasses the granitic complex of Massangana/São Domingos. Mapping would be carried out by conventional photogeologic interpretation and processing through the IMAGE-100 multispectral analyzer system. Programs used during automatic interpretation included "slicer" and "cluster synthesis" algorithms.

ABSTRACT

Visual and automatic interpretation of multispectral images and computer compatible tapes of LANDSAT System, allowed us to disclose the main controls of the radioactive deposits (Uranium and Thorium) in the Poços de Caldas Alkaline Complex. These results agree with available geological, geochronological, altimetric and geophysical data. It was verified that Known radiometric anomalies and mineral occurrences are located around secondary circular structures associated with the main caldera. The identification of several favorable circular structures is highly suggestive as guide for prospection of new deposits in the area.