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Committee on the Peaceful Uses of Outer Space

Definition and delimitation of outer space: views of States members and permanent observers of the Committee

Note by the Secretariat

Addendum

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II. Replies received from States members of the Committee

Algeria

[Original: French]
[29 December 2022]

Space activities require geographical and physical space in order to be carried out, and legal stability to ensure the scientific and economic opportunities that they offer.

The definition and delimitation of space would help to clarify the rights and obligations of each user, since, while international treaties ensure freedom of use and exploitation of outer space, air law is based on State sovereignty.

A clear definition of the boundary between the two spaces is important for a number of reasons, since the matter affects various rights and obligations of States and operators and calls for clarification of the notions of liability and fault in space law. Moreover, it will draw attention to the difficulties faced with respect to the application of the instruments on outer space.

Indonesia

[Original: English]
[2 January 2023]

Indonesia believes that the issue of airspace and outer space boundaries needs to be continuously discussed by the Working Group of the Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space. This is based on the fact that there are two different regimes: the airspace regime and the outer space regime. The Convention on International Civil Aviation (the Chicago Convention) establishes that every State has complete and exclusive sovereignty over the airspace above its national territory. Meanwhile, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, establishes that outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means. Indonesia has ratified both multilateral agreements.

Indonesia believes that the lack of a definition and delimitation of outer space brings about legal uncertainty concerning the applicability of space law or air law. Matters concerning the boundary between airspace and outer space, which relate to State sovereignty, need to be clarified in order to reduce the possibility of disputes among States.

In this regard, Indonesia has already set out the definition and delimitation of outer space in Law No. 21 of 2013 (see the relevant reply by Indonesia in document A/AC.105/C.2/2017/CRP.31). In article 1 of the elucidation of Law No. 21 of 2013, Indonesia defines outer space as the space, including its natural characteristics, beyond the atmosphere of the Earth, as well as the space surrounding and covering airspace. Outer space is naturally located approximately 100 to 110 km above sea level.

The considerations of Indonesia in determining the delimitation of outer space at between 100 and 110 km above sea level are based on comprehensive aspects, including scientific, technical and physical characteristics, namely atmospheric layers, the capacity of aircraft with regard to altitude, the perigee of spacecraft and the Karman line.

The first consideration is atmospheric layers. It is commonly known that Earth’s atmosphere comprises various layers, located at different heights and with different characteristics. One of the layers is the mesosphere, at an altitude of 80 km above

sea level. At this height, the chemical elements are still stable enough to support aircraft engine operations.

The second consideration is the capacity of aircraft with regard to altitude. Based on the Chicago Convention, an aircraft is defined as any machine that can derive support from the reactions of the air other than the reactions of the air against the Earth's surface. It becomes clear that aircraft rely heavily on the existence of and aerodynamic support provided by the air, which exists up to an altitude of 60 to 80 km. Based on Sanger's diagram, an aircraft's ability to fly is related to the engine it uses and the aerodynamic lift. Aircraft that use propeller engines can only operate up to an altitude of 8 km, while aircraft that use turbine engines can operate up to an altitude of 60 km. Aerodynamic support is estimated to be present up to an altitude of between 60 and 80 km. Currently, uncrewed aerial vehicles with command, control, computer, communications, intelligence, surveillance and reconnaissance capabilities can fly up to an altitude of around 330,000 feet, or around 110 km, above sea level. Thus, it can be concluded that the highest altitude an aircraft can reach with existing technology is already at the maximum. That has been proved through hypersonic research conducted at the edge of space, in which an X-15 aircraft went into free fall at an altitude of about 100 km. Above this point, aerodynamic lift was not present and astrodynamics functioned physically.

The third consideration is the perigee of spacecraft. Generally, the perigee of a satellite's orbit is 80 to 120 km above the Earth's surface. It can be concluded that space begins at this altitude. On the basis of this theory, the lowest point of outer space can be considered to be 100 or 110 km above sea level. Experts supporting this theory have defined outer space as the space surrounding the Earth where objects can move in at least a full orbit without an artificial propulsion system according to the laws of celestial mechanics, without being prevented from doing so by the functional resistance of the Earth's atmosphere. It extends from an altitude of approximately 100 km upwards. This was proved when the aforementioned X-15 aircraft reached an altitude of about 100 km in 1963.

The fourth consideration is the Karman line theory. According to this theory, the lowest point of outer space is based on the change in aerodynamic reactions of an aircraft. Owing to the decrease in air density, the aerodynamic force at a higher point will also decrease. At a certain altitude, this force will be replaced with a centrifugal force, also known as the Kepler force. Based on this theory, the lowest altitude of outer space is established at 100 km. The Fédération Aéronautique Internationale, an international record-keeping body for aeronautics, also defined the boundary between airspace and space according to the Karman line, which is around 100 km above Earth's mean sea level.

Based on the above-mentioned considerations, Indonesia proposes that the boundary between airspace and outer space should be set at between 100 and 110 km above sea level. That proposal is in line with the position of, inter alia, the Russian Federation that the region above an altitude of 100 or 110 km above sea level is outer space (see A/AC.105/C.2/2002/CRP.10); Saudi Arabia, which proposes that the boundary between airspace and outer space should be set at between 100 and 120 km above sea level (see A/AC.105/1112/Add.6); and the World Meteorological Organization, whose recommended definition of space is "the unlimited part of the universe including the upper atmosphere and extending above the atmosphere" (see A/AC.105/1112/Add.2). It is noted that the upper atmosphere is defined in the International Meteorological Vocabulary (WMO No. 182) as the part of the atmosphere above the mesopause, around an altitude of 80 to 90 km.

The proposal is also in line with the working paper prepared by the Chair of the Working Group on the Definition and Delimitation of Outer Space of the Legal Subcommittee (A/AC.105/C.2/L.302), which was submitted to the fifty-seventh session, in 2018. The working paper proposed that "the Working Group could consider, taking into account the above-mentioned arguments, establishing the boundary between airspace and outer space at 100 km of altitude above mean sea

level, with the provision of a special regime applicable to the launching and re-entry of space objects, taking into particular consideration aerospace objects and suborbital flights".

In that regard, as Indonesia stated at the fifty-eighth session of the Legal Subcommittee, Indonesia is of the view that the working paper prepared by the Chair, which is no longer discussed at the sessions of Legal Subcommittee, could be reconsidered by the Working Group as one of the important documents for discussion in order to reach an agreement on the definition and delimitation of outer space issues in the Committee.

Based on the above discussions and justifications, Indonesia proposes a mechanism to discuss the definition of outer space and boundaries between outer space and airspace through an expert group under the agenda item on matters relating to the definition and delimitation of outer space.

Paraguay

[Original: Spanish]
[27 December 2022]

While outer space cannot yet be delimited because its dimensions cannot be established, Paraguay wishes to emphasize the need for such delimitation for the purposes of determining the responsibilities – direct or indirect – of State actors. Delimitation is also needed for the legal, technical and administrative purposes of States in relation to, inter alia, the registration of objects launched into space, space vehicles and requests for launch authorization, in order to identify the assets or objects in question so as to ensure the proper drafting of insurance policies and relevant regulations that contribute to better understanding of the nature of space operations.