ANNALS OF AIR AND SPACE LAW

MCGILL

ANNALES DE DROIT AÉRIEN ET SPATIAL

2006 - VOL. XXXI

I.C.A.S.L., McGill University
Montreal, Canada

The Carswell Company, Ltd.
Toronto, Canada

ISSN 0701-158XXXI

WHO OWNS THE GEOSTATIONARY ORBIT?

by

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SYNOPSIS

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I. Introduction

From 29 November to 3 December 1976, the equatorial States of Ecuador, Colombia, Brazil, Congo, Zaire, Uganda, Kenya, and Indonesia met in Bogotá, Colombia "with the purpose of studying the geostationary orbit that corresponds to their national terrestrial, sea, and insular territory and considered as a natural resource." Gabon and Somalia, also equatorial States, were not present. The "Declaration of the First Meeting of Equatorial Countries," also known as the Bogotá Declaration, was adopted on December 3, 1976. The declaration claimed the right of equatorial States to exercise national sovereignty over the arcs of the geostationary orbit (GSO) that are directly over their territories. This claim was in apparent contravention to the 1967 Outer Space Treaty, which states that "outer space... is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." However, the Bogotá Declaration asserts that "there is no valid or satisfactory definition of outer space," and that the GSO "must not be considered part of the outer space." The legal status of the GSO is tied to the controversy over a legal definition of outer space. Both issues have been debated in the Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) for four decades as well as in the Geneva Conference on Disarmament, and they remain on the agenda. One expert observes that the Bogotá Declaration:

> [...] is quite unpopular among non-equatorial states and the majority of Space lawyers and it is especially unacceptable to the Space Powers. But again this is no compelling argument why the claims under it must be dropped. Therefore, it is still necessary to locate the real reason why the declaration cannot stand.[1]

This article attempts to prove why the Bogotá Declaration cannot stand, on the basis of astrodynamics, analogies to Earthly claims of national sovereignty, the international customary law of outer space, and the language of outer space treaties.

II. The Geostationary Orbit

According to Johannes Kepler's third law of orbital motion, the period of a satellite is proportional to its distance from its primary. Satellites in low Earth orbits, at altitudes of a few hundred to a thousand kilometers, have orbital periods from about 90 minutes to two hours. At the other extreme, the Moon, at a distance of about 384,400 kilometers, has an orbital period of about 655 hours (27.3 days).

The geostationary orbit, also known as the geosynchronous stationary orbit, is the venue of the human race's outer shell of routine

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[1] Oduntan, Gbenga. 2003. "The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space" (2003) 1(2) *Hertfordshire Law Journal* 64, at 78, online: University of Hertfordshire <http://perseus.herts.ac.uk/uhinfo/library/i89918_3.pdf> (date accessed: 19 October 2004).

activities. Over 600 satellites have been placed in the GSO since 1963, some of which have operated for time spans approaching a decade. During the past four decades, spacecraft operating in the GSO have been essential elements in several categories of infrastructure, from both civil and military communications to military intelligence, missile early warning, and arms control verification, to navigation, to data relay between other spacecraft and Earth, to astronomy, environmental monitoring, and meteorology. It was noted that:

> Over 200 satellites now populate the orbit and the waiting list for access includes companies proposing new services (such as direct-to-home broadcast television and mobile communications for trucking or airline fleets) and representing newcomers, particularly developing countries, now entering the market for satellite services.[2]

The GSO is located at an approximate distance of 35,787 kilometers (km) above the Earth's equator. Article 1, Paragraph 1 of the Bogotá Declaration provides some additional facts regarding the GSO:

> The geostationary orbit is a circular orbit on the Equatorial plane in which the period of sidereal revolution of the satellite is equal to the period of sidereal rotation of the Earth and the satellite moves in the same direction of the Earth's rotation. When a satellite describes this particular orbit, it is said to be geostationary; such a satellite appears to be stationary in the sky, when viewed from the earth, and is fixed on the zenith of a given point of the Equator, whose longitude is by definition that of the satellite.

It is important to note the distinction between the geosynchronous stationary orbit and non-stationary geosynchronous orbits. Any orbit whose period is equal to Earth's period of sidereal rotation (23 hours, 56 minutes, 4.2 seconds) is by definition "geosynchronous." However, such an orbit can be elliptical rather than circular, in which case the spacecraft will travel faster in its orbit when nearer the Earth and slower when further away, giving its ground track an east-west oscillation. Similarly, a geosynchronous orbit can be inclined to the equator, thus rising north of the equator during part of its orbit, then dropping south on the other side of its orbit. A geosynchronous orbit can be both elliptical and inclined, which will cause the spacecraft to trace ovals or figure-eights in its ground track, depending on the angular relationship of the orbit's node (the point at which it crosses the equatorial plane) and perigee (its closest point to the Earth). Although this requires antennas on the Earth to move in order to track the spacecraft, such orbits have important applications, signals intelligence (SIGINT) and communications intelligence (COMINT) being among them.

In contrast, an antenna tracking a spacecraft in the GSO can be pointed in a fixed direction, because in theory the ground track of such a

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[2] Molly Macauley, "Allocation of Orbit and Spectrum Resources for Regional Communications: What's at Stake?" (Resources for the Future, Discussion Paper 98-10, December 1997), online: Resources for the Future website <http://www.rff.org/Documents/RFF-DP-98-10.pdf> (date accessed: 31 October 2004) at 1.

satellite is a stationary point on the surface of the Earth. The GSO is therefore a restricted case of geosynchronous orbit. In the case of most GSO satellites, that fixed point is in international waters; however, for some, that stationary point is within the territorial boundary of an equatorial State.

To put some perspective on the distances involved, the GSO is approximately one-tenth of the distance to the Moon. In comparison to the distance to the GSO of some 35,787 km, the equatorial radius of the Earth is 6,378 km, while the distance from one point on the Earth to a point on the other side of the Earth (the antipodes) is about 20,040 km. Most spacecraft operate well below the GSO, usually only a few hundred kilometers above the Earth. Except for nine Apollo missions to the Moon, all human spaceflight has occurred at sustained altitudes of only a few hundred kilometers. By any measure, a claim on an arc of space 35,787 km from Earth is the most distant sovereignty claim in history.

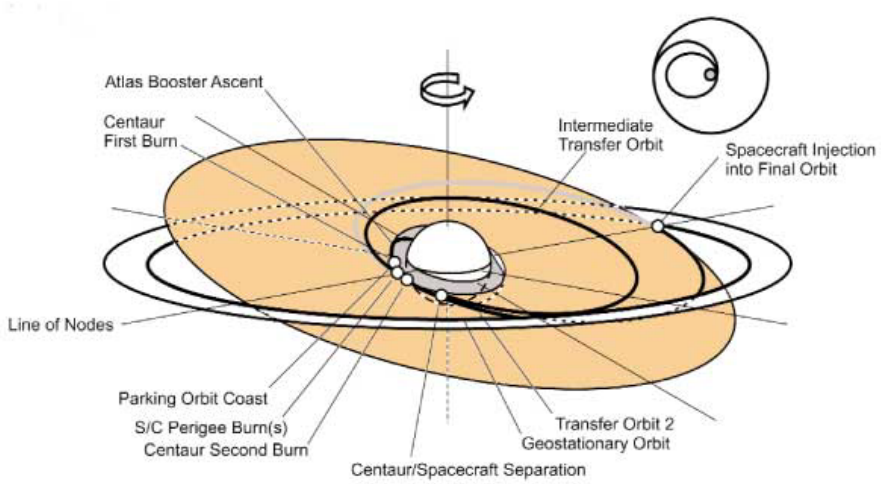

Figure 1: The Geostationary Orbit[3]

[3] Spaceflight Now, online <http://spaceflightnow.com/atlas/ac205/030409orbits.html>.

Table 1: The Equatorial States[4]

Equatorial State	Equatorial Longitude	Long. Span (deg.)	Long. Span (% Total)	Foreign GSO Satellites Above Territory	Foreign GSO Satellites Above Territory (% Total)	OST	BD
Ecuador	80.1W 75.5W	4.6	1.3%	1	0.2%	Ratified 07 Mar 1969	Yes
Colombia	75.5W 70.1W	5.4	1.5%	9	1.5%	Signed 27 Jan 1967	Yes
Brazil	70.1W 49.4W	20.7	5.8%	29	3.9%	Ratified 05 Mar 1969	Yes
Gabon	9.3E 13.9E	4.6	1.3%	17	2.8%	No	No
Congo	13.9E 17.8E	3.9	1.1%	3	0.5%	No	Yes
Zaire	17.8E 29.8E	12	3.3%	24	3.9%	Signed 27 Jan 1967	Yes
Uganda	29.8E 33.9E	4.1	1.1%	6	1.0%	Acceded 24 Apr 1968	Yes
Kenya	33.9E 41.0E	7.1	2.0%	16	2.6%	Acceded 19 Jan 1984	Yes
Somalia	41.0E 44.6E	3.6	1.0%	3	0.5%	No	No
Indonesia	99.7E 103.8E 109.1E 117.6E	12.6	3.5%	25	3.6%	Signed 27 Jan 1967	Yes

The equatorial States span 21.8% of the equator, the remainder being in international waters; however, some locations in the GSO are more useful (and therefore more valuable) than others. By coincidence, this balances out in the case of the equatorial States, and the proportion of satellites in the GSO that have been stationed above their territories is 21.8%. However, Brazil and Indonesia have operated their own GSO satellites above their territories, and when these are removed from the total, 20.5% of all "foreign" satellites have operated above the territories of the equatorial States. This accounting neglects the participation of some equatorial States in consortia operating GSO satellites, partially to their benefit. Regarding the more valuable GSO "real estate," some equatorial States are more favored than others. Brazil and Indonesia have large shares of this "territorial" GSO (3.9% and 3.6%, respectively),

[4] Online: Claude Lafleur's The Space Craft Encyclopedia, Spacecraft in Geostationary Orbit <http://www.sciencepresse.qc.ca/clafleur/Scfam-geostationary.html> (date accessed: October 2004); US Department of State, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies <http://www.state.gov/t/ac/trt/5181.htm> (date accessed: October 2004); Japan Aerospace Exploration Agency, Declaration of the First Meeting of Equatorial Countries (Adopted on December 3,1976) <http://www.jaxa.jp/jda/library/space-law/chapter_2/2-2-1-2_e.html> (date accessed: October 2004).

while the proportions of GSO satellites above Ecuador, Congo, and Somalia are tiny (0.2%, 0.5%, and 0.5%, respectively).

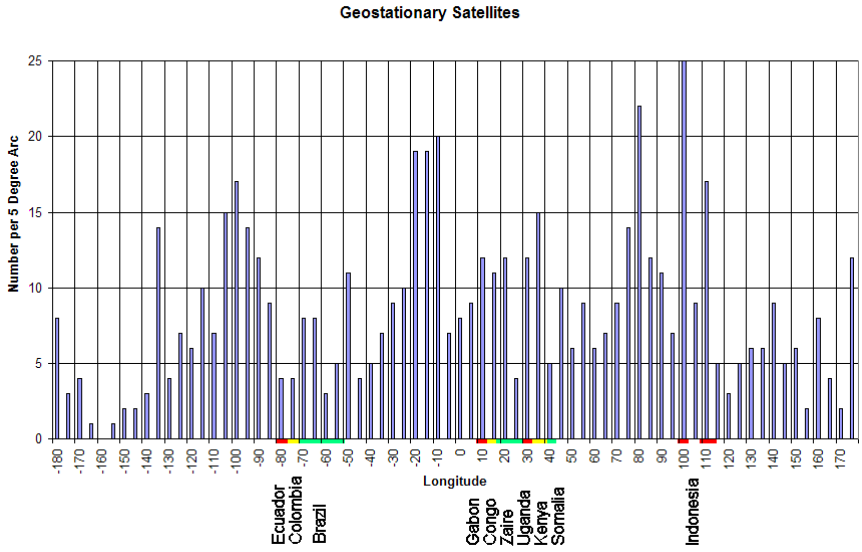

Figure 2: Positions of Geostationary Satellites[5]

III. Where Space Begins

Over the past several decades, the issue of who, if anyone, can lay claim to any portion of the GSO has been tied to varying degrees to the issue of an internationally recognized understanding of what is in outer space and what is not.

The Earth's atmosphere does not suddenly end at a specific altitude; it continues upward for more than 1,600 km, with gradually decreasing pressure and density. However, it has been calculated that above 83 km the atmosphere is so thin that an airfoil will no longer produce aerodynamic lift. From this point of view, the vehicle is in outer space.[6] Another possible definition of outer space is that it begins at the lowest altitude at which an object can complete one orbit of the Earth without propulsion.[7] Probably the lowest operational orbits were those of the US Corona KH-4B reconnaissance satellites, which orbited as low as 130 km[8]; however, estimates on the theoretical limit are as low as 70

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[5] Data compiled from online: Claude Lafleur's The Space Craft Encyclopedia, Spacecraft in Geostationary Orbit <http://www.sciencepresse.qc.ca/clafleur/Scfam-geostationary.html> (date accessed: October 2004)

[6] Oduntan, *supra* note 1 at 72.

[7] *Ibid.* at 79.

[8] United States Geological Survey, "Declassified Satellite Imagery - 1 (1996)" (2003), online: US Geological Survey <http://edc.usgs.gov/guides/disp1.html> (date accessed: 28 October 2004).

km, below which atmospheric drag would slow objects below orbital velocity and they would fall to Earth.[9] The altitude of 100 km established by the Federation Aeronautique Internationale (FAI) is the most widely used definition as the boundary between atmosphere and space (Thefreedictionary.com 2004).[10]

IV. The Basis of the Equatorial States' Claim

The following paragraphs of the Bogotá Declaration enunciate the basis of the equatorial States' claim to national sovereignty over certain arcs of the GSO:

> Equatorial countries declare that the geostationary synchronous orbit is a physical fact linked to the reality of our planet because its existence depends exclusively on its relation to gravitational phenomena generated by the earth, and that is why it must not be considered part of the outer space. Therefore, the segments of geostationary synchronous orbit are part of the territory over which Equatorial states exercise their national sovereignty.[11]

There is no valid or satisfactory definition of outer space which may be advanced to support the argument that the geostationary orbit is included in the outer space. The legal affairs sub-commission which is dependent on the United Nations Commission on the Use of Outer Space for Peaceful Purposes, has been working for a long time on a definition of outer space, however, to date, there has been no agreement in this respect.[12]

V. Arguments Based on Astrodynamics

The Bogotá Declaration states that in the GSO, "such a satellite appears to be stationary in the sky."[13] In fact, it is not stationary; it is in motion around the Earth. It obeys Kepler's laws of orbital motion. It is simply that this motion around the Earth is synchronous with the rotation of the Earth. Furthermore, *any* "orbit is a physical fact linked to the reality of our planet because its existence depends exclusively on its relation to gravitational phenomena generated by the earth." It does not logically follow from these statements that one type of orbit "must not be considered part of the outer space," when all other orbits are so considered.

The Bogotá Declaration defines the GSO as "a circular orbit on the

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[9] Oduntan, *supra* note 1 at 79.

[10] Thefreedictionary.com (2004), "Boundary to space", online: Encyclopidia Thefreedictionary <http://encyclopedia.thefreedictionary.com/Boundary%20to%20space> (date accessed: 28 November 2004). For example, the Ansari X Prize recently was awarded to the first privately-developed spacecraft with seating capacity for three people to fly twice above 100 km within a 14-day period (X Prize Foundation 2004). See Part VII. B, *infra*, for additional discussion of the definition and delimitation of outer space.

[11] Colombia, Ecuador, Brazil, Congo, Zaire, Uganda, Kenya, and Indonesia, "Declaration of the First Meeting of Equatorial Countries" (1976), online: Japan Aerospace Exploration Agency <http://www.jaxa.jp/jda/library/space-law/chapter_2/2-2-1-2_e.html> (date accessed: 28 October 2004) [hereinafter Bogotá Declaration], §1(3).

[12] *Ibid*., § 4(2).

[13] *Ibid*., § 1(1).

Equatorial plane"[14] whose period is synchronous with the rotation of the Earth. In practice, no orbit is perfectly circular; there will always be some degree of eccentricity. In other words, even if the orbit is perfectly synchronous with the Earth's rotation, the satellite will dip below synchronous altitude during part of its circuit around the Earth, then climb above that altitude. This causes the satellite's ground track to wobble in an east-west motion. In the same vein, no satellite will orbit exactly in the equatorial plane; rather, it will be inclined by some fraction of a degree, however slight. This causes the satellite's ground track to wobble in a north-south motion.

Consider that if a satellite were in an orbit infinitesimally higher (or lower) than the GSO, it would not maintain the same position above a point on the Earth, but would drift to the west (or east). Can such a satellite be said to be in space, whereas at the same time a satellite right next to it in the GSO can be considered to be not in space? This is far from being a hypothetical argument. Because the Earth is not a perfect sphere, because the mass of the Earth is unequally distributed, and because other celestial bodies (principally the Moon and the Sun) exert gravitational forces on satellites in the GSO, the GSO is unstable. Left to itself, a satellite will eventually drift out of the GSO (and as the equatorial States would have us believe, from non-outer space into outer space) via a natural process. The GSO in practice can only be approached but not perfectly attained, nor can even the approximation of the ideal type be maintained except via the periodic firing of stationkeeping thrusters.

There is fundamentally no difference between the GSO and any adjacent orbit in terms of the space environment in which the satellites must operate, no difference in the technology required to build such satellites, no difference in the technology required to launch such satellites, and no difference in the technology required to operate such satellites. By the logic of the Bogotá Declaration, one might also claim that the land, sea, or air along the equator—in a *legal* sense—is fundamentally different from the land, sea, or air anywhere else on Earth. Common sense alone is sufficient to lead one to the conclusion that this is simply not the case.

VI. Arguments by Analogy

Assuming, for the sake of argument, that the GSO is not part of outer space, and can be considered as territory over which States can exercise national sovereignty, on what basis can national sovereignty be recognized? If the GSO is not part of outer space, it must be part of the terrestrial environment, and therefore must have a legal status analogous either to land, sea, or air.

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[14] *Ibid*.

A. The Land Argument

Could the segments of the GSO above the territories of the equatorial States be considered as analogous to land, and therefore subject to territorial claims? There are in traditional international law five different modalities for the acquisition of territory: occupation, cession, prescription, conquest and accession. In the context of outer space, only occupation is relevant. A State may acquire territory through occupation provided two conditions are satisfied: (1) the territory claimed must be *res nullius*, i.e., belonging to no other State or to the international community, and (2) the claimant State exercises effective control over such territory.

The criteria for effective occupation were enunciated in the Island of Palmas arbitration by the Permanent Court of Arbitration in 1928. In that case, the United States based its title on discovery, in that the island was part of the territory of the Philippines, discovered by Ferdinand Magellan in 1521 and claimed for Spain, which ceded the territory to the US in 1898, following the Spanish-American War. The Netherlands, however, asserted that it had possessed and exercised rights of sovereignty over the island, either directly or through the Dutch East India Company, as part of the Dutch East Indies since at least 1677, and possibly prior to 1648, whereas Spain had never done so. The arbitrator in the case, Max Huber, wrote that "the continuous and peaceful display of sovereignty... is as good as title." Huber also observed, "[a]ccording to the view that has prevailed since the 19th century, an inchoate title of discovery must be completed within a reasonable period by the effective occupation of the region claimed to be discovered."[15]

The equatorial States did not "discover" the GSO. Anyone conversant in astrodynamics can calculate the semimajor axis of an orbit whose period will exactly match the rotational period of the Earth. Possibly the earliest mention of the GSO as being a useful location for satellites was an article by Arthur C. Clarke, a British citizen.[16] The GSO is sometimes referred to as the "Clarke orbit" in his honor.[17]

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[15] 2 U.N. Rep. Intl. Arb. Awards 829.

[16] Arthur Clarke, C. 1945. "Peacetime Uses for V2" [February 1945] *Wireless World*, online: Ladkiva website organization <http://lakdiva.org/clarke/1945ww/1945ww_feb_058.html> (date accessed: 31 October 2004).

[17] Kenneth Gatland, *The Illustrated Encyclopedia of Space Technology* (New York: Orion Books, 1989) at 90.

Table 2: The Launching States[18]

Launching State	First Satellite		First GSO Satellite		Outer Space Treaty
	Name	Launch Date	Name	Launch Date	
USSR/Russia	*Sputnik 1*	04 Oct 1957	*Kosmos 637*	26 Mar 1974	Ratified 10 Oct 1967
USA	*Explorer 1*	01 Feb 1958	*Syncom 1*	14 Feb 1963	Ratified 10 Oct 1967
France/ESA	*Asterix 1*	26 Nov 1965	*Meteosat 2*	19 Jun 1981	Ratified 05 Aug 1970
Japan	*Osumi*	11 Feb 1970	*ETS 2/Kiku 2*	23 Feb 1977	Ratified 10 Oct 1967
China	*Dong Fang Hong 1*	24 Apr 1970	*Shiyan Tongbu Tongxin Weixing T2*	08 Apr 1984	Acceded 20 Dec 1983
UK	*Prospero*	28 Oct 1971	N/A	N/A	Ratified 10 Oct 1967
India	*Rohini 1B*	18 Jul 1980	N/A	N/A	Ratified 18 Jan 1982
Israel	*Offek 1*	19 Sep 1988	N/A	N/A	Ratified 18 Feb 1977

Nor were equatorial States the first to possess or occupy the GSO. The United States placed the first spacecraft, *Syncom 1,* in the GSO on 14 February 1963. The US first occupied Brazil's segment of the GSO on 26 July 1963 with *Syncom 2,* and again on 19 August 1964 with *Syncom 3,* yet Brazil did not object in either case. Likewise, Britain occupied Kenya's segment of the GSO with *Skynet 1A* on 22 November 1969 (although the launching State was the US), yet Kenya did not object at this time.

Most equatorial States neither have used nor "occupied" the GSO. Brazil has operated five of the 29 satellites in the GSO above its territory, and Indonesia has operated three of the 25 satellites in the GSO above its territory. However, neither of these States has launched its own satellites; rather, both have contracted launch services with other States or with international agencies of which they are not members. For the equatorial States to claim national sovereignty over the GSO is analogous to the officers of a State that possesses no seafaring capability booking passage on another State's ship to an island previously discovered but for some reason unclaimed, and then claiming sovereignty over that island, in contradiction to the fact that it did not discover the island, cannot use or occupy it without the intervention of another State, and cannot exercise effective control over it.

It is the various launching States that operate the large majority of

[18] Online sources: Satellite Encyclopedia <http://www.tbs-satellite.com/tse/online/thema_first.html> (access restricted to subscribers of TBS-satellite); Claude Lafleur's The Space Craft Encyclopedia, Spacecraft in Geostationary Orbit <http://www.sciencepresse.qc.ca/clafleur/Scfam-geostationary.html> (date accessed: October 2004), US Department of State, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies <http://www.state.gov/t/ac/trt/5181.htm> (date accessed: October 2004).

satellites in the GSO above the territory of the equatorial States. If the GSO is subject to territorial claims, then on the basis of use or occupation, it is the launching States that have the better claims, by virtue of "the continuous and peaceful display of sovereignty," even if such sovereignty has not heretofore been asserted (sovereignty might have been claimed were it not for the 1967 Outer Space Treaty). If the GSO were to be generally recognized as lying outside the jurisdiction of that treaty, the GSO could not now be considered as *terra nullius,* and therefore subject to claim by the equatorial States, because large segments of the GSO have been occupied by other States for four decades. Rather, the GSO could only retroactively be considered to have been *terra nullius* prior to the time of its first "occupation" by launching States, and the launching States would thus have titles founded on long and peaceful possession since then.

In the Island of Palmas case, Arbitrator Huber also stated, "Although States have in certain circumstances maintained that islands relatively close to their shores belonged to them in virtue of their geographic situation, it is impossible to show the existence of a rule of positive international law to the effect that islands situated outside territorial waters should belong to a State from the mere fact that its territory forms the *terra firma* (nearest continent or island of considerable size). "[19] The claim of the equatorial States over the GSO is akin to this. The specific GSO arc above each State's territory may be though of as an island "situated outside territorial waters" (directly above their territory) to which "its territory forms the *terra firma,*" although at one-tenth the distance to the Moon, it can hardly be considered "relatively close."

The claim of sovereignty over the GSO based on a land analogy fails. If any land analogy is to be made regarding the GSO, and indeed all of outer space, the more appropriate analogy is Antarctica. Article IV, Paragraph 2 of the 1959 Antarctic Treaty states: "No new claim, or enlargement of an existing claim, to territorial sovereignty shall be asserted while the present Treaty is in force."

B. The Sea Argument

Could the segments of the GSO above the territories of the equatorial States be considered as analogous to territorial sea or to maritime exclusive economic zones? Indeed, the early development of outer space law has its roots in the law of the sea, as well as in air law.

If the GSO arcs above the equatorial States are analogous to territorial sea, the right of innocent passage, as stated in Article 17 of the United Nations Convention on the Law of the Sea (UNCLOS)[20], would not apply. Article 18 defines "passage:"

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[19] 2 U.N. Rep. Intl. Arb. Awards 829.

[20] 10 December 1982, 21 I.L.M. 1261 [hereinafter *UNCLOS*] (entered into force on 16 November 1994).

> 1. Passage means navigation through the territorial sea for the purpose of:
> (a) traversing that sea without entering internal waters or calling at a roadstead or port facility outside internal waters; or
> (b) proceeding to or from internal waters or a call at such roadstead or port facility.
> 2. Passage shall be continuous and expeditious....

Satellites in the GSO do not traverse the arcs of the GSO claimed by the equatorial States, but remain stationed within those arcs. This cannot be construed as passage.

UNCLOS Article 56, Paragraph 1 provides that the coastal State has "sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources" of the exclusive economic zone, as well as jurisdiction with regard to "the establishment and use of artificial islands, installations and structures," "scientific research," and "the protection and preservation of the... environment," as well as "other rights and duties". If the GSO arcs above the equatorial States are analogous to exclusive economic zones, equatorial States would have "sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources." GSO satellites would be analogous to "artificial islands, installations and structures" and would be within the jurisdiction of the equatorial States. The equatorial States would also have jurisdiction with regard to spacecraft debris in accordance with the protection and preservation of the environment in their GSO arcs.

However, the concepts of territorial waters[21] and exclusive economic zones[22] are based on their contiguity to the territory of the coastal or archipelagic State. Contiguity is implicit in the definitions of these zones, while a third type of maritime zone defined in UNCLOS Article 33 is explicitly contiguous by its very name: the "contiguous zone." No State may claim an area of the sea that is not contiguous with some territory under its sovereignty. However, the equatorial States lay claim to the segments of the GSO above their territories, while making no such sovereign claims to the 35,780 km stretch of outer space between the limit of their national airspace (about 100 km) and the GSO (35,787 km). Thus, if the GSO is analogous to sea, there is no contiguity from the baselines of the equatorial States (their land surfaces) to the GSO, and the analogy to any type of maritime zone is non-existent. Contrary to the assertion that the Bogotá Declaration "claimed sovereignty up to the geostationary orbit;"[23] a careful reading of the Declaration shows this not to be the case.

C. The Air Space Argument

Since air law has close relationship with outer space law, could the

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[21] *Ibid.*, Art. 3.
[22] *Ibid.*, Art. 57.
[23] Oduntan, *supra* note 1 at 75.

segments of the GSO above the territories of the equatorial States be considered as analogous to national airspace? An important distinction between the legal regimes of air space and outer space is that the former is subject to national sovereignty, while the latter is not. If the GSO could be considered a part of the sky that is not in outer space, portions of it would legitimately be subject to claims of national sovereignty by the equatorial States beneath.

For centuries, the common law doctrine was, "*Cujus est solum ejus est usque ad coelum et ad inferos,*" or "He who owns the land owns all the way to the sky and to the depths." With the development of aircraft in the 20th century, *usque ad coelum* as a principle of private ownership had to be modified. In *U.S. v. Causby,* the U.S. Supreme Court ruled in 1946 that private air rights exist only to the extent essential to the use and enjoyment of the privately owned land beneath it. In essence, ownership "all the way to the ceiling" was transferred to the State.

> The customary rule according to which sovereignty of a state extends into the airspace over its territory, including its territorial waters, is reflected in all major multilateral treaties in the field of the air law and the law of the sea. The Paris Convention on the Regulation of Aerial Navigation (1919), the Ibero-American Convention relating to Air Navigation (Madrid Convention-1926), the Pan American Convention on Commercial Aviation (Havana Convention-1928), the Treaty Regarding Civil Aviation, between states of the Arab League, adopted in 1946, the Convention on Air Navigation adopted by the states of the Balkan Entente (Yugoslavia, Romania, Greece and Turkey) and the Convention on International Civil Aviation (the Chicago Convention-1944), all recognized the right of "every State" to exercise "complete and exclusive" sovereignty in the airspace over its territory, including its territorial waters.[24]

Article 1 of the Chicago Convention reads:

> The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory.

While the Convention does not explicitly define airspace in terms of altitude, it is clear that the airspace follows State sovereignty. In law and in practice, each State has sovereignty over all airspace above its territory to an undetermined altitude. At present, there is no agreement regarding the upper limit of national airspace. The upper limit of airspace (and conversely, the lower limit of outer space) under discussion by COPUOS over the past four decades has been in the range of 90 to 110 km, well below the GSO altitude of 35,787 km.[25] On the point regarding contiguity, it is important to note that at this time States regard the area, e.g., up to 30,000 meters above their territory, to be national airspace, subject to their sovereignty. To reiterate, while the

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[24] George Assonitis, "The Greek Airspace: The Legality of a 'Paradox.'" (1997), online: United States Air Force Academy <http://www.usafa.af.mil/dfl/documents/grairsp.doc> (date accessed: 29 November 2004).

[25] See Part VII. B, *infra.*

equatorial States lay claim to the segments of the GSO above their territories, they make no such sovereign claims to the 35,780 km stretch of outer space between their national airspace and the GSO. Thus, there is no contiguity, and the analogy to national airspace does not fly.

D. Arguments by Analogy Not Persuasive

If the GSO "must not be considered part of the outer space," it must be considered part of the Earth, and since the three environments of the Earth are land, sea, and air, in accordance with this theory, GSO must be analogous to one of these environments. However, neither the land, sea, nor air analogy support a claim of national sovereignty over the GSO.

VII. The Delimitation of Outer Space and Customary Law

Is the GSO part of outer space, even in the absence of a universally recognized definition of "outer space"?

Central to the equatorial States' claim is that since there is no agreed legal definition of outer space, they are free to assert that the GSO "must not be considered part of the outer space." The issue of an exact definition brings to mind US Supreme Court Justice Potter Stewart's famous remark regarding obscenity: he could not fully define it, "But I know it when I see it...." Similarly, there is broad agreement on what outer space *is*. Most people know it when they see it, and the contentious issues of what outer space *is not* are confined to regions very near the Earth. While it is true that outer space has not been defined in any treaty, and indeed there in no agreed, comprehensive, legal definition of outer space, it is not entirely true that "there is no valid or satisfactory definition" as asserted in the Bogotá Declaration.

A. The Precedent for the Right of Orbital Overflight

In the late 1940s it was already clear that satellites were going to have military utility, especially in terms of reconnaissance. As early as 1947, the Soviet press was denouncing the prospect of American satellites as "instruments of blackmail." Obviously, the idea of American cameras orbiting overhead with impunity was extremely unnerving to the secretive Soviet State, and a 4 October 1950 RAND Corporation report warned that the response of the Soviet Union to the launching of an American satellite might be dangerous. The RAND report concluded that any such launch should be done with advance publicity, especially if it stressed that the spacecraft was not a weapon in any sense. It was assumed that the Soviets would "consider satellite reconnaissance as an attack upon their secrecy and therefore illegal. But was it illegal? The question was open." Overflight of a non-assenting nation was contrary to international law, but did airspace have an upper limit? "It was very doubtful that the USSR would accept any vertical limitation on its sovereignty or accept that any passage of a spacecraft over its territory

might be innocent. Rather, orbiting a satellite over the Soviet Union might be construed by the Kremlin as an act of aggression."[26]

Historian Walter A. McDougall points out that "just as important as developing such [satellite reconnaissance] technology was establishing the legal right to use it." The RAND report concluded, "Our objective is to reduce the effectiveness of any Soviet counteraction…. Perhaps the best way to minimize the risk of countermeasures would be to launch an 'experimental' satellite on an equatorial orbit." Since such a satellite would not have an overt military mission and would not overfly Soviet territory, it would test the "freedom of space" issue in the best political environment.[27]

By the mid-1950s, the Eisenhower Administration was studying the possibility of either freezing or limiting the deployment of nuclear weapons, and a nuclear test ban treaty. The problem of any arms control agreement was verification, and in the absence of such an agreement, management of an arms race required adequate intelligence on Soviet capabilities. U-2 high altitude reconnaissance aircraft began secret, illegal overflights of the USSR in June 1956. The intercontinental ballistic missile (ICBM) test center near Tyuratam was discovered in early 1957. However, these flights were a blatant violation of Soviet airspace. Furthermore, it was recognized that it was only a matter of time before the Soviets developed an air defense missile capable of shooting down the U-2s. Meanwhile, in March 1955, the USAF had begun WS-117L, a development program for a "strategic satellite system".. Against this backdrop of intelligence requirements, the Eisenhower Administration returned to the question of how to establish the legal precedent of the "freedom of space?" The opportunity for a credible, innocuous satellite program presented itself when on 4 October 1954, the Special Committee for the International Geophysical Year recommended to participating governments to launch satellites in the interest of science.[28]

In 1954, the US already had a missile powerful enough to serve as the basis for a satellite launch vehicle. It was simply a matter of adding a cluster of small, "off-the-shelf," solid-fuel rockets to serve as upper stages. The problem was that the purpose of the missile, and its heritage, were anything but peaceful. The Redstone missile was a US Army intermediate range ballistic missile (IRBM) designed to deliver a nuclear warhead. Meanwhile, the US Naval Research Laboratory had developed the Viking sounding rocket for scientific purposes. It was much less powerful than the Redstone, and the upper stages necessary for it to put a satellite in orbit would have to be designed from scratch. The Army configuration could do the job in a few months; the Navy configuration (later called Vanguard) hoped to achieve a launch by the end of 1958. The 3-to-2 vote of the Stewart Committee in favor of the Navy proposal

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[26] Walter McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, Inc., 1985) at 107-109.
[27] *Ibid*. at 109-110.
[28] Ibid. at 114-118.

occurred on 3 August 1955.[29]

In retrospect, the Stewart Committee's split decision in favor of the Navy proposal may look like a quirk of history, and indeed, had the decision gone the other way, the US could have launched a satellite more than a year before *Sputnik 1.* However, the decision was not at all out of step with national policy. There was a critical need to monitor Soviet ICBM development, so the first priority was to establish the legality of satellite overflight to clear the path for reconnaissance spacecraft. There were two ways to do this. "One was if the United States got away with an initial small satellite orbiting above the nations of the earth 'for the advancement of science'—and had no one object to it. The other way was if the Soviet Union launched first." The second solution was obviously less desirable because of the prestige gained from launching the first satellite.[30]

Thus the right of orbital overflight, being recognized from the very beginning by the two original launching States, and not objected to by any other States, became a customary norm virtually instantaneously, and one that continued to hold as other States placed satellites in orbit either by their own means or by the means of other launching States. This right was well established as customary law by the time of the Bogotá Declaration in 1976, 19 years after the launch of *Sputnik 1.*

B. A Debate Without Limit

The assertion of the Bogotá Declaration notwithstanding, there are a number of definitions "which may be advanced to support the argument that the geostationary orbit is included in the outer space."[31] And they have been advanced. The principal bone of contention in the debates that have raged for four decades in the COPUOS is over the fixing of a specific lower limit that defines outer space, i.e. a boundary between airspace and outer space. When such spatial limits are discussed, they are usually in the range of 90 to 110 km (as noted earlier, 100 km is the definition accepted by the FAI), well below the GSO altitude of 35,787 km.

The COPUOS Legal Subcommittee considered the questions of the definition of outer space for the first time at its sixth session, in 1967.[32] The Outer Space Treaty of the same year contained no explicit definition. In 1968, the Legal Subcommittee considered the report of the Scientific and Technical Subcommittee.[33] The report stated that it was not possible at that time to identify a scientific or technical basis for a precise and lasting definition of outer space, and that any (essentially arbitrary) definition of outer space was likely to have important operational

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[29] *Ibid*. at 119-122.
[30] *Ibid*. at 122-124.
[31] Bogotá Declaration, *supra* note 11, § 4(2).
[32] COPUOS A/AC.105/C.2/SR.80-84.
[33] COPUOS A/AC.105/39.

implications as space technology developed in the future. The Scientific and Technical Subcommittee recommended that it continue its consideration of the matter.[34] In the nearly four decades since, little progress has been made. Some delegations, particularly the United States, continue to hold the view that it is not possible to identify scientific or technical criteria to permit a precise and lasting definition or to foresee all possible implications that further space exploration and research could have for the definition, and further that the history of spaceflight has shown that no such precise definition is necessary, since the absence of such a definition has not resulted in any legal or practical problems and it has not obstructed the development of activities in either airspace or outer space. Other delegations remain convinced that a definition and delimitation of outer space is necessary; however, those delegations are not in agreement on the approach to be taken. Some hold the view that the delimitation should be altitude-based, whereas others support the functional approach, i.e., a definition of outer space activities that is distinct from airspace activities. As an example of the former or "spatial" approach, in 1975, Italy proposed a precise delimitation of outer space at an altitude of about 90 km. On the other hand, the functionalist approach cites activities that can only be performed in outer space, such as the orbiting of spacecraft, as defining that an object is in outer space. A functional definition might also need to take into account suborbital flights such as those that won the Ansari X Prize, but this opens the thorny issue of addressing the less-innocuous suborbital flights of ballistic missile tests, ballistic missile defense system tests, and other military activities.

In 1983, the USSR submitted an imaginative proposal[35] combining the two approaches. First, the boundary between outer space and air space would be established at an altitude not exceeding 110 km above sea level. Secondly, a space object would retain the right of innocent flight at altitudes lower than the agreed boundary for the purpose of reaching orbit or returning to Earth. In 1987, the Soviet Union refined its proposal to the effect that establishing a preliminary boundary between airspace and outer space would be "without prejudice to the final position concerning the upper limit of state sovereignty".[36] If there needs to be a precise legal definition of outer space, the Soviet proposal is a reasonable basis for discussion.

In 1978, in light of the Bogotá Declaration, the Legal Subcommittee changed the wording of the agenda item to "Questions relating to the definition and/or delimitation of outer space and outer space activities, also *bearing in mind questions relating to the geostationary orbit*".[37] The wording of the agenda item went through several changes in the 1990s and, by 1998, the second part of the item had become "the character and utilization of the geostationary orbit, including consideration of ways

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[34] COPUOS A/AC.105/39, para. 36.
[35] COPUOS A/AC.105/C.2/L.139.
[36] COPUOS A/AC.105/L.168.
[37] COPUOS A/AC.105/218, para. 39 (*italics added*).

and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of the International Telecommunication Union".[38] In 2000, these two issues were separated so that they could be discussed independently. This change in the phrasing of the issue is important, for it signals that equatorial States' claim to sovereignty over GSO arcs overhead has been put aside for now, and replaced by the discussion of the rational and equitable use of the GSO. This is a reasonable point of controversy, for the ITU's regulatory system has frequently been abused by entities filing applications for positions in the GSO in order to deny other entities the opportunity to file applications for the same position. Macauley observes:

> Because the orbit is allocated on a first-come, first-served basis, the inefficiencies and rent-seeking typically ascribed to such nonprice administration might be expected to arise. An extensive economics literature has followed these developments, alleging the inefficiency, unfairness, or both of the regulatory process.[39]

Article 1, Paragraph 5 of the Bogotá Declaration reveals the central motivation of the equatorial States:

> The solutions proposed by the International Telecommunications Union and the relevant documents that attempt to achieve a better use of the geostationary orbit that shall prevent its imminent saturation, are at present impracticable and unfair and would considerably increase the exploitation costs of this resource especially for developing countries that do not have equal technological and financial resources as compared to industrialized countries, who enjoy an apparent monopoly in the exploitation and use of its geostationary synchronous orbit. In spite of the principle established by Article 33, sub-paragraph 2 of the International Telecommunications Convention, of 1973, that in the use of frequency bands for space radiocommunications, the members shall take into account that the frequencies and the orbit for geostationary satellites are limited natural resources that must be used efficiently and economically to allow the equitable access to this orbit and to its frequencies, we can see that both the geostationary orbit and the frequencies have been used in a way that does not allow the equitable access of the developing countries that do not have the technical and financial means that the great powers have. Therefore, it is imperative for the equatorial countries to exercise their sovereignty over the corresponding segments of the geostationary orbit.

There is arguably a case for reforming the system for allocating radio frequencies and positions used by GSO satellites; however, the redress of these grievances need not and should not include any recognition of national sovereignty over the GSO. The most recent statement by the United States regarding the definition and delimitation of outer space and the status of the GSO, delivered in April 2004, declares:

> As we have stated on previous occasions the United States is firmly of the view that there is no need to seek a legal definition or delimitation for

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[38] COPUOS A/AC.105/C.2/L.221, para. 8 (c).
[39] Macauley, *supra* note 2 at 2.

> outer space. The current framework has presented no practical difficulties and indeed, activities in outer space are flourishing. Given this situation, an attempt to define or delimit outer space would be an unnecessary theoretical exercise that could potentially complicate existing activities and that might not be able to anticipate continuing technological developments. The current framework has served us well and we should continue to operate under the current framework until there is a demonstrated need and a practical basis for developing a definition or delimitation.
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> From the legal point of view, it is clear that the GSO is part of outer space and its use is governed by the 1967 Outer Space Treaty (as well as the International Telecommunication Union's treaties). As set forth in Article 1 of the Outer Space Treaty, "Outer space... shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law...." Article II of this Treaty further states that outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation or by any other means. These articles make clear that a party to the Outer Space Treaty cannot appropriate a position in outer space, such as an orbital location in the GSO, either by claim of sovereignty or by means of use, or even repeated use, of such an orbital position.[40]

VIII. Applicable Treaties and UN Resolutions

A. The Outer Space Treaty

Article II of the 1967 "Treaty on Principles Governing the Activities of States in the Exploration of Outer Space, Including the Moon and other Celestial Bodies," also known as the Outer Space Treaty,[41] states:

> 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.

Of the eight signatories of the Bogotá Declaration, all but Congo are parties to the Outer Space Treaty. The Bogotá Declaration attempts to sidestep this prohibition by claiming, "There is no valid or satisfactory definition of outer space which may be advanced to support the argument that the geostationary orbit is included in the outer space".[42]

However, Article IV of the Outer Space Treaty states: "States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner." This article declares

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[40] United States Department of State, "Agenda Item 8, Definition and Delimitation of Outer Space and the Character and Utilization of the Geostationary Orbit, Statement by the Delegation of the United States of America" (2004).

[41] *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, 27 January 1967, 610 U.N.T.S. 205, 18 U.S.T. 2410, T.I.A.S. No. 6347, 6 I.L.M. 386 [hereinafter *Outer Space Treaty*] (entered into force on 10 October 1967).

[42] Bogotá Declaration, *supra* note 11, § 4(2).

objects "in orbit around the Earth" to be subject to the treaty, therefore they must be in outer space.

B. The Registration Convention

Article II of the 1974 "Convention on Registration of Objects Launched Into Outer Space," also known as the "Registration Convention,"[43] states: "When a space object is launched into earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary-General of the United Nations of the establishment of such a registry." Article V begins with the phrase, "Whenever a space object launched into earth orbit or beyond...." In both articles it is clear that an object "launched into earth orbit or beyond" is a "space object" that is subject to the convention.

Article IV of the Registration Convention requires each State of registry to furnish to the Secretary-General of the United Nations information concerning each space object carried on its registry, including "basic orbital parameters." Paragraph 3 of this article states: "Each State of registry shall notify the Secretary-General of the United Nations, to the greatest extent feasible and as soon as practicable, of space objects concerning which it has previously transmitted information, and which have been but no longer are in earth orbit." Again, the language of the convention makes plain that an object in earth orbit is subject to the Convention.

C. The UN Resolution on the Use of Nuclear Power Sources in Outer Space

The 1992 "Principles Relevant to the Use of Nuclear Power Sources in Outer Space" resolution of the UN General Assembly,[44] or the "Nuclear Power in Outer Space Resolution," also contains language in which the understanding is implicit that objects in orbit around the Earth are in outer space. Principle 3, paragraph 1 (b) begins: "During the normal operation of space objects with nuclear power sources on board, including re-entry from the sufficiently high orbit as defined in paragraph 2 (b)....". There are 18 instances of the words "orbit" or "orbital" appearing in the resolution.

D. Summation of Treaty and Resolution Language

While outer space is not explicitly defined in any space-related agreement, language in the 1967 Outer Space Treaty, the 1974 Registration Convention, and the 1992 Nuclear Power in Outer Space Resolution is very clearly and consistently referring to objects in orbit

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[43] *Convention on Registration of Objects Launched Into Outer Space*, 14 January 1975, 1023 U.N.T.S. 15, 28 U.S.T. 695, T.I.A.S. No. 8480, 14 I.L.M. 43 [hereinafter *Registration Convention*] (entered into force on 15 September 1976).

[44] UN Resolution 47/68.

around the Earth as space objects, operating in outer space, and are therefore subject to these international agreements. No distinction is made in any treaty or UN resolution between the GSO and any other kind of orbit. Therefore, the assertion of the Bogotá Declaration that the GSO "must not be considered part of the outer space" is baseless.

IX. Conclusion

The essence of the equatorial States' claim to national sovereignty over the GSO above their territories is that since there is no legal definition of outer space, the GSO is a special case, that solely by virtue of the synchronicity of the orbital period with the Earth's rotational period, "must not be considered part of the outer space." On the basis of astrodynamics, there is no question that the GSO is part of outer space, and that left to itself, any satellite in the GSO gravitates into another orbit. The GSO is an ideal that in practice can only be approached, but not perfectly attained, and can only be maintained by periodic corrective thrust. Also, there is no analogy with land, sea, or air that can be reasonably drawn that would lend credence to the idea that the GSO would be subject to claims of national sovereignty by the equatorial States even if the GSO could be somehow considered as part of the Earth environment and not part of outer space. Furthermore, there is a body of customary law, beginning with the launch of *Sputnik 1* in 1957, supporting the contention that all satellites, being in orbit around the Earth, have the right of innocent overflight by virtue of being in outer space and above national sovereign airspace. While the legal definition and delimitation of outer space (or even the need for one) continues to elude consensus, it is clear that any functional definition must include objects in orbit around the Earth, and that any spatial delimitation will probably be at an altitude in the range of 90 to 110 km, far below the 35,787 km altitude of the GSO. Finally, regardless of the absence of a legal definition and delimitation of outer space, treaty language is unambiguous that objects in orbit around the Earth are in outer space. This holds for any orbit, including the GSO. By any rational criterion, the Bogotá Declaration is insupportable.

At the same time, not only the equatorial States, but other developing nations, have legitimate concerns regarding the process by which the ITU allocates GSO positions. Although there are currently only five States capable of launching spacecraft into the GSO, many other entities have contracted with these launching States to place their own satellites in the GSO, and this number will only grow as more States develop the need for positions in the GSO. The Bogotá Declaration does nothing to address the legitimate concerns of non-equatorial developing nations regarding their future access to the GSO. This ill-advised document has been a 30-year distraction from addressing the real issues of allocating the GSO equitably for all States.