

ACTIVIDADES LATINOAMERICANAS EN EL ESPACIO ULTRATERRESTRE EN EL SIGLO XXI: UNA ACTUALIZACIÓN

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Resumen

En el siglo XXI, los países latinoamericanos han hecho esfuerzos significativos para avanzar en sus programas espaciales. Estos esfuerzos han abarcado desde una indagatoria sobre la instalación de un sistema de satélites, como es el caso en Colombia, hasta el lanzamiento de satélites con la ayuda de gobiernos extranjeros, en el caso de Brasil, Argentina y Bolivia. En todos estos casos, la falta de un marco jurídico coherente que apoye un programa espacial sólido que proporcione comunicaciones por satélite a las poblaciones más vulnerables es uno de los desafíos más apremiantes. El Consejo Asesor de Generación Espacial (SGAC) podría resolver este problema mediante un proyecto unificador que pondrá todas las mentes y desarrolladores en el objetivo común de alcanzar la autonomía espacial para América Latina.

Palabras clave: Derecho espacial, satélite, comunicaciones, América Latina, telecomunicaciones.

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LATIN AMERICAN SPACE ACTIVITIES IN THE 21st CENTURY: AN UPDATE

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Abstract

In the twenty-first century, Latin American countries have made significant efforts to advance their space programs. These efforts have ranged from inquiring about setup of a satellite system, as is the case in Colombia, to launching satellites with the aid of foreign governments, in the case of Brazil, Argentina and Bolivia. In all these cases, the lack of a coherent legal framework that supports a solid space program that provides satellite communications to the most vulnerable populations is one of the most pressing challenges. The Space Generation Advisory Council (SGAC) could solve this problem in the form of a unifying project that will put all minds and developers to work towards the common goal of achieving space autonomy for Latin America.

Keywords: space law, satellite, communications, Latin America, telecommunications.

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This paper will review some of the major space-related accomplishments that have taken place in Latin America since 2000. Significant among these have been the launch of several large communication satellites, two manufactured and launched by the Chinese for Venezuela and Bolivia, respectively, and two satellites manufactured by a native Argentinean corporation, and launched by Arianespace. Several smaller ‘cubesats’ were manufactured in Brazil, Ecuador, Colombia, and Peru, and orbited by different launch service providers.

In addition to technical advances, such as the orbiting of satellites and sounding rockets, several international, regional, and national conferences related to space activities were held in Latin America, with the aim of developing space policies and eventually establishing a regional space agency.

Certain measures have been taken toward achieving this goal, notably setting up national space agencies or commissions in each of the South American countries, in some of the Central American nations, and in Mexico. Some of these national space agencies were created as a result of the Space Conferences of the Americas (CEA, *Conferencia Espacial de las Américas*). The CEAs have been instrumental in fomenting interest and involvement in space activities, since the first one was held in Costa Rica in 1990, and the most recent one, the VII CEA, was held in Nicaragua in November 2015.

Despite all these meetings and activities, are the Latin American countries closer to achieving their goal of establishing a regional space agency? What steps could they take, at the national and regional levels, to attain their objective? Are there models from other regions that they could emulate or set aside? What measure could be taken to ensure that space activities in Latin America will be viable as well as productive in the short- and long-term?

Would ratifying the principal space treaties be a good starting point? Alternatively, would drafting sector-specific legislation, based on the international instruments, be a better starting point? This paper aims to address some of the issues that stand in the way of regional cooperation and offers recommendations to overcome them. Perhaps dancing to the same musical beat would help!

Background

Latin America, like Africa, is frequently referred to as a monolithic entity. A closer look, however, reveals many countries, with different cultures, languages, and music, some indigenous, and some imposed by the European colonizers: French, Dutch, British, Spanish, and Portuguese.

As to space activities, there are some similarities between Africa and Latin America. Whereas in the 1980s, the emphasis was on acquiring a national or regional communications satellite, many countries now are studying the possibility of obtaining remote-sensing/earth observation satellites. Several countries in Africa, (Algeria, Morocco, Nigeria, and Tunisia) already have remote sensing satellites and/or centers,¹ but in South America, Venezuela and Brazil have remote-sensing/earth observation satellites, and now Peru.² Venezuela's "Miranda" earth observation (EO) satellite was built and launched by the Chinese in 2012, while Brazil and China have been cooperating on the CBERS³ program since the 1980s. But the similarity between Africa and Latin America seems to end here, as the two continents are quite different from each other.⁴

Currently, the most prevalent languages in Latin America are Spanish (18 countries) and Portuguese (Brazil), although French, English, and Dutch are spoken in some of the Caribbean islands.⁵ This paper will focus on the 'continental' countries, where Spanish and Portuguese are dominant in urban areas,⁶ each language with its unique lilt and rhythm; and each country and region within a country with its particular accent. Are these linguistic differences reflected in their approach to space

¹ The Regional Center for Remote Sensing of North African States, established in 1990, is headquartered in Tunisia; its members include Algeria, Mauritania, Morocco, Tunisia, Libya, Egypt, and Sudan. See <http://www.crtean.org.tn/>.

² Peru launched its first earth observation satellite on September 16, 2016.

³ CBERS is the acronym for the China-Brazil Earth Resources Satellite(s).

⁴ See Sylvia Ospina, "The Digital Divide and Space Activities in the Southern Hemisphere(s): A General Overview of Africa and South America" (presentation, International Astronautical Congress, /IAC-11.E.7.3.6, Cape Town, South Africa, 2011).

⁵ The International Telecommunication Union (ITU) lists 35 countries in its 'Americas' Region. See "Country Classifications," <http://www.itu.int/en/ITU-D/Statistics/Pages/definitions/regions.aspx>.

⁶ See "Country directory," *Latin American Network Information Center*. <http://lanic.utexas.edu/subject/countries/>. According to the United Nations Development Programme (UNDP), 80% of the population in Latin America lives in urban areas and have greater access to telecommunications, including internet. In rural and remote areas, where other indigenous languages are spoken (e.g. Aymara, Quechua, Guarani, etc.), there is a lack of telecom services, further isolating them from mainstream activities. See UNDP "About Latin America and the Caribbean," <http://www.latinamerica.undp.org/content/rblac/en/home/regioninfo.html>.

activities? After all, language⁷ seems to reflect a society's structure, its values, and perhaps even its participation in space endeavors!

The 1976 Bogotá Declaration⁸

A significant event in Latin American space policy was the 1976 Bogotá Declaration, which put into question some of the fundamental principles of space law embodied in the 1967 Outer Space Treaty (OST).⁹ Whereas Art. II of the OST states that no part of outer space is subject to national appropriation by any means, the 1976 Bogotá Declaration posited that some segments of the geostationary orbit were part of the underlying country's national, sovereign resources. The signatories of the Declaration based their claim on the fact that the OST does not provide a definition or delimitation of outer space, an issue widely debated in many fora without reaching an agreement in the international community.¹⁰

Further, the Bogotá Declaration put into question the space powers' use of outer space, which was based on the "first come-first served" practice. The Bogotá Declaration was the first *de jure* challenge to the *de facto* monopoly of the industrialized countries over the orbit/spectrum resources.¹¹ The Declaration prompted many developing countries to question the allocation of space resources, such as orbital slots and associated radio frequencies, and to stimulate their interest in space activities. The issue of sovereign rights over segments of the *geosynchronous orbit* (GSO)

⁷ University of Pennsylvania, "Language Structure Is Partly Determined by Social Structure." *Science Daily*. January 28, 2010. www.sciencedaily.com/releases/2010/01/100121140347.htm. But Juan Carlos Moreno Cabrera argues the contrary: "...no direct relationships between words and social organisation can be established," en "Commentary: Linguistic Structure and Social Structure," *Journal of Multicultural Discourses* 1, no. 2, 2006: 117, www.academia.edu/2605939/Linguistic_Structure_and_Social_Structure.

⁸ "The Bogotá Declaration," *Journal of Space Law* 6, num. 2, 1978: 193-196. <http://www.spacelaw.olemiss.edu/jsl/pdfs/back-issues/jsl-6-2.pdf>

⁹ The "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies" entered into force in December 1967 [cited as the Outer Space Treaty or OST hereinafter]. See United Nations Office for Outer Space Affairs. <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>.

¹⁰ The International Astronautical Federation (IAF) has posited that air space 'ends' at about 100 km above the surface of the Earth, and outer space 'begins' between 100 and 110 km above the Earth's surface. See Stephan Hobe, ed., *Pioneers of Space Law: A publication of the International Institute of Space Law (IISL)*, Leiden: Martinus Nijhoff Publishers, 2013).

¹¹ Ram Jakhu, "The 1988 Space WARC: A Third World Perspective." *Space Communication and Broadcasting* 6, no. 3 (July 1988). For another account on developing countries and their influence at the ITU, see Sylvia Ospina, "The Third World Countries' Challenges and Contributions to Space Law" in *Proceedings of the 31st Colloquium on the Law of Outer Space of the IISL*, Bangalore, India, October 1988 (Washington: AIAA, 1988), pp. 135-141.

has been incorporated in the Colombian and Ecuadorian National Constitution(s), thus influencing their space policies, particularly in Colombia.¹²

The *Conferencia Espacial de las Américas* (CEA) (Space Conference(s) of the Americas)

In addition to the Bogotá Declaration, other events have influenced Latin American space policies. These include several workshops sponsored by the United Nations Office for Outer Space Affairs (UNOOSA), the International Academy of Astronautics (IAA), and other space-related organizations. More importantly, the *Conferencia Espacial de las Américas* (CEA), or Space Conference(s) of the Americas, have brought together government officials, space agencies, scientists, academics, and corporations from many different countries and regions, in a forum to promote knowledge and application of scientific and technological advances related to space activities in the region.¹³ The first CEA was held in San José, Costa Rica in 1990, and the most recent one in Nicaragua in 2015. The CEAs take place about every 4 years.¹⁴

Since their inception, the CEAs have been advocating for greater cooperation in space-related matters at the regional level, while being mindful that national priorities may be different. The CEAs became an important forum for exchanges and cooperation, and at the II CEA (Chile) the Pro-Temp Secretariat was established, in order to have systematic follow-up mechanisms. Moreover, certain rules were adopted during the III CEA (Uruguay) to ensure their viability and continued exchanges among the participating countries.¹⁵

The CEAs have stressed the importance of regional cooperation in specific areas, such as disaster management, environmental monitoring and management, distance education, *inter alia*. While to date these regional projects do not seem to have

¹² In 2014, Colombia acceded to the 1975 Registration Convention and ratified the 1972 Liability Convention, but it has yet to ratify the 1967 OST. Ecuador has ratified the four major space treaties. See Irmgard Marboe, ed. *Small Satellites: Regulatory Challenges and Chances* (Leiden: Brill Nijhoff, 2016).

¹³ Jaime Barberis Martínez, pro tempore Secretary of the V CEA (Ecuador), gives an account of the CEAs, from their inception through 2009, in his article "Presente y futuro de la Conferencia Espacial de las Américas" ["Present and future of the CEA"], published in *AFESE (Asociación de Funcionarios y Empleados del Servicio Exterior Ecuatoriano)*, vol. 50, pp. 85-98. <https://afese.com/img/revistas/revista50/presfutesp.pdf>.

¹⁴ The *Agencia Espacial Mexicana* (AEM) also provides a good synopsis of the various CEAs, their themes, results, and/or action plans in "Conferencia Espacial de las Américas CEA," www.gob.mx/aem/acciones-y-programas/conferencia-espacial-de-las-americas-cea.

¹⁵ Barberis Martínez, "Presente y futuro."

succeeded, the CEAs have stimulated the Latin American nations in other respects. One result is that every country in South America now has a space agency or space commission; Paraguay's space agency, set up in 2014, is the newest one. But establishing space agencies or commissions, once seen as a major achievement, has not been sufficient to sustain them. Most, if not all, are under-funded, lack trained personnel, and lack coherent policies that could lead to the drafting of national space laws, let alone regional space policies.

Despite the CEA's goals and declarations, and the establishment of national space agencies or commissions, there are still no over-all regional space policies, nor specific projects involving most, if not all, the countries. Rather, each country seems to pursue its own agenda, cooperating with more established space agencies, such as NASA, European Space Agency (ESA), Japan Aerospace Exploration Agency (JAXA), and the Chinese National Space Administration (CNSA). A look at the space activities of a few South American countries follows.¹⁶

Brazil

The two Latin American countries with the most advanced space sector are Brazil and Argentina. Brazil's state-owned communications agency, EMBRATEL launched its first national communications satellites in 1985 and 1986. Further, since the 1980s, Brazil has partnered with China in the remote sensing field. The Brazilian National Space Research Institute (INPE) (acronym in Portuguese) and the Chinese Academy of Space Technology (CAST) signed an agreement for the joint development of two earth-imaging satellites. The China-Brazil Earth Resources Satellite (CBERS) program (*Satélite Sino-Brasileiro de Recursos Terrestres*) has been modified and/or renewed several times, but has suffered financial and technical setbacks. The loss of CBERS 3, launched in 2013, has spurred Brazil to renew its launch vehicle program, and decrease its dependence on the Chinese.¹⁷ One of the benefits of the CBERS program is that its images have been made available at no charge to numerous users and institutions in many countries, thus making Brazil the largest distributor of satellite imagery of the world.¹⁸

¹⁶ See Sylvia Ospina, "New National Space Agencies in South America: New opportunities for Collaboration?" (presentation, 25th Symposium on Space Policy, Regulations, and Economics. IAC-12.E3.4.8, X113731, Naples, Italy, 2012), for more information on national space agencies in South America.

¹⁷ See "China-Brazil satellite launch fails, likely fell back to Earth," *Reuters*, Dec. 10, 2013. www.reuters.com/article/us-space-china-brazil-satellite-idUSBRE9B90XK20131210.

¹⁸ For data regarding CBERS Program, see www.cbers.inpe.br.

Brazil has also been a leader in the manufacture of ‘cubesats’, or ‘nanosats’, which are small satellites that are often launched together with bigger satellites, and/or from the International Space Station (ISS).¹⁹ While relatively effective in Brazil, it has been less successful in promoting regional interest in a cooperative program involving cubesats and universities in different countries in Latin America. . Brazil has not been able to ‘export’ its interests in cubesats to other countries.²⁰

Despite its achievements, the Brazilian space program has encountered several obstacles since its inception. One of them has been the United States’ export control regulations (ITAR),²¹ which has hindered transfer of space-related technology to Brazil. In an effort to overcome this political barrier, Brazil has partnered with China and Ukraine to develop its launch capabilities. The Ukraine-Brazil program suffered a severe setback in 2003, when a launch vehicle exploded in Alcântara, killing more than 20 persons. More recently, in 2015, the Brazilians terminated their agreement with Ukraine for various reasons, among them, economics. Brazil will continue developing smaller launch vehicles, however.²²

As to drafting sector-specific legislation, Brazil, like most of the Latin American countries, lags behind its technological advances. The Brazilian Space Agency (AEB) (acronym in Portuguese), set up in 1994 as a civilian agency, is now part of the Ministry of Science, Technology, and Innovation. Despite increasing awareness of the need for an all-embracing national legal space framework, such a legal framework is still in the works. The Brazilian Space Agency (AEB), the National Institute for Space Research (INPE) and other institutions, like the Brazilian Association of Air and Space Law, have been working on promoting such a law for several years.²³

In the last 10 years, some progress has been made, but the space sector is still waiting for the over-arching law on space activities, and frequently, for the funds

¹⁹ Dinorah Ereno’s article “Small satellites make their mark” provides a good account of Brazil’s cubesat / nanosat origins and manufacture. *Revista Pesquisa FAPESP* 219 (2014). <http://revistapesquisa.fapesp.br/en/2014/05/20/small-satellites-make-mark/>.

²⁰ A. dos Santos and José Monserrat Filho provide in-depth information on Brazil’s space program in their contribution to the IAA’s Study Group 5.11 Report on Regional Cooperation (to be published by the IAA). The IAA has held 2 regional workshops in Brazil on cubesats, in 2014 and 2016, respectively. These were attended by mostly Brazilian engineers and scientists. See, e.g., <https://iaaweb.org/content/view/640/845/>.

²¹ ITAR is the acronym for the US Department of State’s International Traffic in Arms Regulations.

²² Peter B. de Selding, “Brazil is pulling out of Ukrainian Launcher Project.” *Space News*, April 16, 2015. <http://spacenews.com/brazil-pulling-out-of-ukrainian-launcher-project/>.

²³ José Monserrat Filho, “Remarks on Brazilian space laws” (presentation, United Nations/Nigeria Workshop on Space Law, Abuja, Nigeria, November 21-24, 2005). <http://www.sbda.org.br/artigos/anterior/23.htm>.

to implement its technological progress.²⁴ Budgetary constraints lead to lack of trained personnel and lack of students interested in space technologies and sciences, so the Brazilian space sector's development continues to lag behind other BRIC countries.²⁵ Brazil, however, still remains at the forefront of the Latin American countries in the development of space activities and small satellites.

Argentina

Argentina had an active space sector for many years prior to creating the *Comisión Nacional de Actividades Espaciales* (CONAE) in 1991. At the international level, Argentina has made important contributions to space law, in the writings of Dr. Aldo Armando Cocca, a lawyer, who was instrumental in drafting the Outer Space Treaties and in promoting the concept of space as 'the common heritage of mankind', as enshrined in the Moon Agreement, and in the Outer Space Treaty as the 'province of mankind.' Dr. Cocca also posited that the right to communicate is a basic human right, "a basic human need, and is fundamental to all social organization."²⁶ And to communicate requires at least two entities, at least 'two to tango.'

Like in the case of Brazil, Argentina's interest in developing its space activities has led to cooperation with international and regional space agencies, notably with NASA and ESA. By 1995, Argentina had created its National Register for Space Objects, in conformity with the UN Registration Convention,²⁷ and has ratified the major international space treaties, except for the Moon Agreement, which Dr. Cocca was instrumental in drafting.²⁸ Perhaps Argentina will ratify the Moon Agreement in the near future, since it has agreed with China to build a tracking station to monitor Chinese spacecraft sent to the Moon, for exclusively peaceful purposes, 'with no military use'.²⁹

²⁴ Monserrat Filho, "Remarks."

²⁵ See São José dos Campos, "Ten, nine, ten..." *The Economist*, August 8, 2015. www.economist.com/news/americas/21660572-rocket-science-hard-rocket-diplomacy-harder-ten-nine-ten.

²⁶ "Aldo Armando Cocca, The Right to Communicate webpage, <http://righttocommunicate.com/?q=node/118>.

²⁷ The "Convention on Registration of Objects Launched into Outer Space" entered into force in September 1976 (cited as Registration Convention hereinafter). See United Nations Office for Outer Space Affairs, <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introregistration-convention.html>

²⁸ Julian Hermida, "Regulation of Space Activities in Argentina," in Ram S. Jakhu, ed., *National Regulation of Space Activities* (Springer Netherlands, 2010), p. 24, fn. 8.

²⁹ "China plans to track moon spacecrafts from its station in Argentine Patagonia." *Mercopress* (Montevideo, Uruguay), April 28, 2016. <http://en.mercopress.com/2016/04/28/china-plans-to-track-moon-spacecrafts-from-its-station-in-argentine-patagonia>.

According to Hermida, the regulation of space activities and satellite communications in Argentina is rather complex, and perhaps hinders the growth of some space-related activities, such as the development of launch vehicles.³⁰ CONAE, a civilian organization, is entrusted with the administration of the National Space Plan, and while this agency does not have regulatory powers, it is considered a regulatory agency with wide-reaching influence.³¹

Satellite communications come under the aegis of the National Communications Commission (*Comisión Nacional de Comunicaciones*, CNC), but according to Hermida, some of its functions overlap with those of CONAE.³² In the 1990s, Argentina launched the NAHUEL satellite(s), built by a consortium of primarily European companies.³³ NAHUELSAT S.A. became ARSAT³⁴ in 2006, and has been in charge of the manufacture of a domestic satellite. ARSAT 1 was launched in October 2014, and ARSAT 2, built in Argentina by INVAP and Thales Alenia Space, was launched in September 2015. Both were launched by Arianespace. Argentina plans to build at least three more satellites, and has already contracted with Arianespace for their launch.³⁵ Some of these plans may be put on hold, however, following the change of government in Argentina in November 2015.

Between January and April 2016, the government laid off thousands of workers (state employees), including some 100 technicians involved in telecommunications projects, like ARSAT.³⁶ The discontent has led to massive protests against Macri's policies.³⁷ Whether this dissatisfaction will lead to changes in funding for the satellite/space sector remains to be seen.

³⁰ Hermida, "Regulation of Space Activities," supra, note 28, p. 25.

³¹ Hermida, supra, note 28, p. 25

³² Hermida, "Regulation of Space Activities," 31.

³³ "Historia satelital Argentina: Parte 2 (B) La historia de los 'Nahuel.'" *El blog de Maloco*, June 4, 2013. <http://malocoblog.blogspot.com/2013/07/historia-satelital-argentina-parte-2-b.html>. It provides an interesting and detailed account of the NAHUELSAT project, including some of its political intricacies.

³⁴ ARSAT is the Spanish acronym for the *Empresa Argentina de Soluciones Satelitales* (AR-SAT S.A.)

³⁵ See "Arianespace signs contract with ARSAT to launch a new satellite for Argentina, plus two options," *arianespace.com*, last modified September 30, 2015. www.arianespace.com/press-release/arianespace-signs-contract-with-arsat-to-launch-a-new-satellite-for-argentina-plus-two-options/.

³⁶ The Macri government was elected in November 2015, but, by January 2016, unhappiness began to emerge. See "Layoffs continue in Argentina, now for technicians," *The Dawn News*, January 14, 2016. www.thedawn-news.org/2016/01/14/layoffs-continue-in-argentina-now-for-technicians/. In an article in *Fortune* magazine, Mark Weisbrot comments that Macri's win is bad news for Argentina and for the region. See "Why Macri's win is bad news for Argentina," *Fortune*, Nov. 24, 2015. <http://fortune.com/2015/11/24/mauricio-macri-presidential-win-bad-for-argentina/>.

³⁷ See "Argentina: Massive protest against Macri's government," *The Dawn News*, April 29, 2016. www.thedawn-news.org/2016/04/29/argentina-massive-protest-against-macris-government/. More

While Argentina's space sector may be in flux, due to changing economic policies and conditions, it is still a leader in Latin America in terms of building its own satellites and developing its space industry.³⁸ Further, this country's space lawyers continue to influence space policy at the national and international levels.³⁹

Perhaps once Macri's proposed changes to the telecommunications sector take place, i.e. 'liberating' the media from the grip of a few large companies,⁴⁰ more progress will be seen as well in the space/satellite sector. But this change will not come without a price. After all, the media (TV) help fill the satellites' transponders, and, in turn, communication satellites help fill the coffers...

Bolivia

Bolivia established its Space Agency, *Agencia Boliviana del Espacio* (ABE), in 2010, and is charged with the launch, management, and use of the national satellite, Túpac Katari. The country accepted a loan from the Chinese to build, launch, (and control?) a communications satellite; it was launched in December 2013 and entered into service in April 2014. According to one press account, it is functioning well, and more than 60% of its capacity has been sold or is being used by private and public entities.⁴¹ President Evo Morales stated that communications costs would be lowered, and coverage would be expanded with the satellite.⁴² Other press comments were less favorable to Bolivia, stating that the country paid the

recently, *The Economist* wrote that "Mauricio Macri's reform plans suffer a judicial blow. Argentina's Supreme Court blocks a rise in gas prices," August 22, 2016. <http://www.economist.com/news/americas/21705571-argentinas-supreme-court-blocks-rise-gas-prices-mauricio-macris-reform-plans-suffer>.

³⁸ Alejandro G. Belluscio presents a good account of ARSAT-2, and Argentina's consolidation as Latin America's satellite leader in "ARSAT-2: Argentina consolidates as Latin American satellite leader," *NASA Spaceflight*, September 21, 2015. www.nasaspaceflight.com/2015/09/arsat-2-argentina-consolidates-latin-american-satellite-leader/.

³⁹ See, for example, the writings by Prof. Maureen Williams, a national of both Argentina and the United Kingdom, and current Chair of the ILA's Space Law Committee. Since 1990, the ILA has been a permanent observer of the UNCOPUOS's Legal Subcommittee, to which it reports annually (www.ila-hq.org/en/committees/index.cfm/cid/29).

⁴⁰ According to one press report, "Macri gutted the country's media law through a decree that absorbed two regulatory agencies into a new entity known as the National Agency of Telecommunications, thus toppling the 2009 media law that sought democratization of media outlets by ordering the breakup of media monopolies." See "Argentine media workers demand Macri to respect media law," *Telesur*, July 30, 2016. <http://www.telesurtv.net/english/news/Argentine-Media-Workers-Demand-Macri-to-Respect-Media-Law-20160730-0019.html>.

⁴¹ "First Bolivian telecom satellite enters service," *BBC News*, April 2, 2014. www.bbc.com/news/world-latin-america-26850393.

⁴² "First Bolivian telecom satellite."

Chinese much money to simply obtain a TV repeater in orbit that beams down Chinese programming.⁴³

That Bolivia, one of the poorest countries in South America, has progressed is evident in the increased number of people having access to internet and wireless communications systems. According to the International Telecommunication Union (ITU), 96 of 100 inhabitants have access to mobile telephones, whereas only 8 out of 100 persons have fixed line service. While internet penetration has also grown, it remains low: only 17% of households have internet access, although 35% have computers.⁴⁴ But, according to the national telecommunications regulatory authority, *Autoridad de Regulación y Fiscalización de Telecomunicaciones y Transportes* (ATT), there are 7.2 million internet connections, an increase of more than 3000% since 2008, while mobile telephony grew from 2.4 million users to more than 10 million 'lines'.⁴⁵

Bolivia has plans to bring more rural communities into the internet network, by setting up telecom centers away from the main cities (Sucre, La Paz, Cochabamba). According to Ivan Zambrana, director of the Bolivian Space Agency (ABE), a national satellite is the most cost-effective way of providing access across Bolivia's diverse rural terrain, and bringing telecoms, through telecenters,⁴⁶ to these remote communities.⁴⁷ Hopefully, the telecenters will operate not only in Spanish, but in other official languages of Bolivia, such as Aymara and Quechua. The telecenters are likely part of "PRONTIS,"⁴⁸ a national program aimed at providing communications and internet connectivity at affordable rates to areas that have traditionally been underserved. It also aims to provide programs of social interest, such as education, health, and governance. According to ABE's director, the satellite project could

⁴³ "Restos del satélite boliviano caen en China oriental," *Bolivia Prensa*, December 21, 2013. <http://boliviaprensa.com/index.php/noticias-bpa/item/910-restos-del-sat%C3%A9lite-boliviano-caen-en-china-oriental>.

⁴⁴ www.itu.int/net4/ITU-D/di/2015/#idi2015countrycard-tab&BOL. Information included in *Measuring the Information Society Report 2015* (Geneva: ITU, 2015). . See also Internet World Stats. Usage and Population Statistics, "Bolivia." www.internetworldstats.com/sa/bo.htm.

⁴⁵ See "Personal boliviano asegura operaciones de satélite Túpac Katari," *Jornadanet.com*, May 27, 2016. <http://www.jornadanet.com/n.php?a=129413-1>.

⁴⁶ Telecenters as instruments of development are not new or specific to Bolivia. A telecenter may be defined as a "shared site that provides public access to information and communications technologies," in Francisco J. Proenza, Roberto Bastidas-Buch, and Guillermo Montero, *Telecenters for Socioeconomic and Rural Development in Latin America and the Caribbean* (Washington, DC: FAO, ITU, IADB, 2001), p. iii. http://www.itu.int/ITU-D/ict/mexico04/doc/doc/10_telecenters_e.pdf.

⁴⁷ Gustav Cappaert and Chris Lewis, "With its own satellite, Bolivia hopes to put rural areas on the grid," *Inter Press Service*, June 23, 2014. www.ipsnews.net/2014/06/with-its-own-satellite-bolivia-hopes-to-put-rural-areas-on-the-grid/.

⁴⁸ PRONTIS is a program of the Bolivian Ministry of Communications (www.oopp.gob.bo).

have a big impact on life in rural Bolivia. It would be a “window to the world” for children living in the rural areas.⁴⁹ Up-to-date statistics on the telecenters and internet penetration in rural areas will provide further proof of the satellite’s success.⁵⁰

In July 2015, Bolivia signed an agreement with Gilat Satellite Networks to install a VSAT hub, to serve as the foundation of a nationwide network.⁵¹ The ABE stated that in 2015, revenue was forecast to be \$19 million, and would reach \$24 million in 2016.⁵² With the implementation of the VSAT hub, and sale of most of its capacity, perhaps it will achieve its goal of generating \$500 million in the next 15 years, the useful lifetime of the satellite.⁵³ Bolivia took another step in expanding its satellite services by contracting with Hughes Network Systems to provide a gateway and approximately 550 terminals to power Entel’s delivery of internet access service in remote areas and for satellite backhaul of cellular base stations. The services will operate in the Ku-band satellite spectrum over the Túpac Katari 1 satellite.⁵⁴ The VSAT hub and the Hughes Network terminals will increase access to telecoms and help bridge the current communications gaps in rural areas.

Bolivia has started repaying the Chinese for its loan to build the satellite, but still remains fairly indebted to the Asian country.⁵⁵

In addition to its functioning satellite, another measure of Bolivia’s success in space is the establishment of a Bolivian Space Generation Advisory Council (SGAC) that,

⁴⁹ Another press report states that implementing satellite communications and internet through telecenters has been slow and challenging, since there is a lack of trained personnel, and not enough financial incentives to expand telecom services in rural areas. Monica Newell, “Bolivian Satellite to Expand Internet Access,” *BORGEN Magazine*, July 10, 2014. www.borgenmagazine.com/bolivian-satellite-to-expand-internet-access/.

⁵⁰ According to a newsflash of the Bolivian Ministry of Communications, more than 1000 telecenters have been installed. www.oopp.gob.bo/vmtel/index.php/informacion_institucional/PRONTIS,1022.html.

⁵¹ “Bolivian Space Agency Selects Gilat for its National VSAT Platform Enabling Comprehensive Connectivity Capabilities,” *Gilat*, July 6, 2015. <http://www.gilat.com/Bolivian-Space-Agency-Selects-Gilat-for-its-National-VSAT-Platform-Enabling-Comprehensive-Connectivity-Capabilities>.

⁵² According to a press report of August 24, 2016, Túpac Katari expects to achieve US \$35 million annual turnover (no other specifics are given), <http://www.convergencialatina.com/Presentacion-A-Diario>.

⁵³ Peter B. de Selding, “Bolivia’s TKSAT-1 Expected to Generate \$500 Million,” *Space News*, December 28, 2015. <http://spacenews.com/bolivas-tksat-1-expected-to-generate-500-million>.

⁵⁴ Hughes Network Systems press release, “Entel Bolivia Selects Hughes JUPITER System for Satellite Internet and Cellular Backhaul Services,” *Hughes*, March 6, 2016. www.hughes.com/company/newsroom/press-releases/entel-bolivia-selects-hughes-jupiter-system-for-satellite-internet-and-cellular-backhaul-services.

⁵⁵ According to a press report of June 2, 2016, Ivan Zambrana, executive director of the ABE, stated that Bolivia has paid back US \$50 million to the Chinese, and with continued use of the satellite, Bolivia hopes to cover the initial investment costs in 15 years (The Bolivian government still owes more than \$400 million to the Chinese). See “Bolivia to pay back loan to China for Tupac Katari satellite,” *Space Daily*, June 3, 2016. http://www.spacedaily.com/reports/Bolivia_to_pay_back_loan_to_China_for_Tupac_Katari_satellite_999.html.

in turn, has set up the Latin America Discovery Adventure (L.A.D.A.). One of its aims is to involve the younger generation(s) and to encourage greater participation in space-related studies and activities. L.A.D.A. had several conferences and other events planned for 2016.⁵⁶ Thus, Bolivia is moving ahead in satellite-provided communications, and perhaps the younger generation of space enthusiasts will serve as models for other countries.

Colombia

In some respects, Colombia has been a pace-setter for space policies in Latin America. As noted earlier, the 1976 Bogotá Declaration⁵⁷ served as a 'wake-up' call for the developing countries on the importance of communication satellites in geostationary orbit and the use of the associated frequencies, and highlighted the lack of delimitation/definition of outer space. While serving to spur interest in space activities, the Declaration has also hindered Colombia's progress in the space sector.

In May 2002, Colombia hosted the IV CEA in Cartagena, and submitted the results in a report to the UNOOSA in 2005.⁵⁸ Participants in this CEA called upon the countries in the region to continue identifying and implementing projects that would make use of space technologies for disaster mitigation, environmental protection, sustainable development, and stressed the importance of international cooperation as a means to strengthen peace, security, and human development, while making peaceful use of outer space.⁵⁹ This CEA also recommended seeking funding from several sources, including the private sector, to implement some of its plans.

One result of the Cartagena CEA was the eventual creation of the Colombian Commission on Space. In 2006, Decree 2446 established the *Comisión Colombiana del Espacio* (CCE). The CCE's overriding objective is to make the best use of space science and technology, and apply them to solving national problems, to strengthen every sector of society from government institutions to sustainable development, and to improve the competitiveness of the country.⁶⁰ Since its inception, the country's

⁵⁶ "SGAC Bolivia," *Space Generation Advisory Council*. <http://spacegeneration.org/sgac-regions/south-america/bolivia.html>.

⁵⁷ See *supra*, note 8

⁵⁸ See Declaration of Cartagena de Indias, IV Space Conference of the Americas, Cartagena, Colombia, May 14-17 2002. Report to COPUOS, UN Doc. A/AC.105/L.261, 1 July 2005.

⁵⁹ Declaration of Cartagena de Indias. Also see Barberis Martínez, "Presente y futuro."

⁶⁰ Ministerio de Relaciones Exteriores, "Considering" [Preamble], Decreto 2442 de 2006 (julio 18)" [Decree 2442 of July 18, 2006, whereby the Colombian Commission on Space (CCE) is created] (English version

Vice-President serves as President of the CCE. At first, the CCE was comprised of 15 entities; now it includes 23 members, ranging from several Ministries and other official entities to universities and research centers.

Between 2006 and 2012, the Instituto Geográfico Agustín Codazzi (IGAC), the Colombian entity responsible for cartography, *inter alia*, acted as Executive Secretary of the CCE. In 2012-2013, the Colombian Air Force (FAC) (acronym in Spanish) took over that role. Both the IGAC and the Air Force seem to be keen on acquiring an earth observation/remote sensing satellite, rather than a communications spacecraft, but there does not seem to be any clear plan in place.

The CCE is aware that in order to succeed in advancing space technologies and their use, it must coordinate closely with the 23 different institutions involved, to make the most efficient use thereof.⁶¹ The CCE is also aware that many of its members lack qualified personnel to undertake the day-to-day management of space-related programs, and, furthermore, there does not seem to be a clear plan of action. Recently it was proposed that the CCE become a Space Agency, in order to better coordinate its programs and to ensure funding for the space-related projects, such as the acquisition of a spacecraft.⁶² However, this proposal did not prosper, and the CCE seems to be in some disarray at this time.

On a more positive note, in 2015, Colombia was visited by Charles Bolden, NASA's Administrator, and a Colombian delegation visited the Mexican Space Agency (AEM) (acronym in Spanish), also in 2015, to learn more about its organization and structure, and to strengthen relations between these two organisms. The country has also entered into several agreements with the European Space Agency (ESA), with views to benefit from the European "Copernicus" GNSS satellite project.⁶³

Despite efforts to improve relations with other space agencies, and the existence of a Space Commission in the country, Colombia has no coherent space policy. As

of the Spanish text by this author). https://www.cancilleria.gov.co/sites/default/files/Normograma/docs/pdf/decreto_2442_2006.pdf

⁶¹ Comisión Colombiana del Espacio. *Visión Colombia II Centenario: Aprovechar el potencial del espacio extraterrestre para contribuir al desarrollo sostenible y la competitividad del país* (To take advantage of the outer space's potential to contribute to the country's sustainable development and competitiveness) (Bogotá: CCE, 2011). https://www.cce.gov.co/sites/default/files/adjuntos_basico_page/Visi%C3%B3n%202019%20Consolidado%20ver%206%20definitivo.pdf.

⁶² See CCE. *Visión Colombia*.

⁶³ Fuerza Aérea Colombiana, *Informe de Gestión 2015 (Informational Bulletin 2015, English version of the Spanish text by this author)* (Bogotá, 2016). <https://www.fac.mil.co/informe-de-gesti%C3%B3n-2015>.

noted above, attempts to modify the structure of the CCE⁶⁴ and to transform the CCE into a space agency have not been successful.⁶⁵ Further, even though Colombia participates in the annual meetings of the Committee on the Peaceful Uses of Outer Space (COPUOS), it has yet to ratify most of the international treaties related to space activities. (In 2014, it ratified the 1972 Liability Convention and the 1976 Registration Convention,⁶⁶ seven years after launching “Libertad1,” a university-built cubesat. The National Registry has yet to be established).

Colombia’s stance on the geostationary orbit (GSO)—its claims to sovereign rights over certain segments of the GSO (although modified)—seems to act as a deterrent to any significant progress in its own country. Short of amending the 1991 Constitution and repealing Article 101⁶⁷ that states that segments of the geostationary orbit (GEO) are part of the Colombian territory, not much progress can be expected. In this author’s view, an important step forward would be Colombia’s ratifying the 1967 Outer Space Treaty, which could then serve as an ‘umbrella’ framework for further legislation regarding national space activities.

Telecommunications by satellite are an important component of socio-economic progress, if not a fundamental prerequisite in the 21st century. Until now, Colombia has not succeeded in acquiring its own satellite, whether for communications or for earth observation, although it has issued several requests for proposals (RFPs) for a spacecraft.⁶⁸ In July 2014, Colombia submitted to the ITU’s Radiocommunication Bureau (ITU-R) a new API (advance publication information) for a Colombian satellite network, COLSAT-1A, at 70.9° W, thus reaffirming its interest in accessing this orbit/spectrum resource. The ITU extended the deadline for bringing into operation

⁶⁴ Presidencia de la República. “Decreto 1649 de 2014.” Bogotá, July 18, 2014. <http://es.presidencia.gov.co/normativa/normativa/Decreto-1649-2014.pdf>.

⁶⁵ Jairo A. Becerra, “Colombia’s Space Policy: An Analysis of Six Years of Progress and Challenges” (Paper presented at the 23rd United Nations/International Astronautical Federation Workshop on “Space Technology for Economic Development.” Beijing, China, September 20-22, 2013).

⁶⁶ The Convention on International Liability for Damage Caused by Space Objects entered into force in 1972; the Convention on Registration of Objects Launched into Outer Space entered into force in 1976.

⁶⁷ *Constitución Política de la República de Colombia*, Título III, Cap. 4, Art. 101, “Del Territorio”.

⁶⁸ In September 2009, Colombia’s Ministry of Information Technology and Communications (MINTIC (acronym in Spanish) opened a bidding process for the acquisition of a communications satellite. Several consortia submitted bids, but the Colombian government deemed that none of them met all the requirements, and the tender was declared void in September 2010. See Juan Pedro Tomás, “MINTIC declares Satcol tender void,” *Business News Americas*, Sept. 2, 2010. www.bnamericas.com/en/news/telecommunications/Mintic_declares_Satcol_tender_void. *Small Satellites: Regulatory Challenges and Chances*. I. Marboe, Editor. Brill Nijhoff, Mar 14, 2016.

the Colombian satellite system for three years as of the end of WRC-15 or until 2018.⁶⁹ Whether Colombia will be able to meet this deadline is an open question.

In the meantime, Colombia has been attempting to bridge the digital divide by linking up rural communities and municipal centers via a fiber optic cable network through the *Viva Digital* initiative.⁷⁰ Similar to the Bolivian PRONTIS program, *Viva Digital* has established internet access centers in many remote towns and military outposts. The Colombian government is aware of the difficulty of achieving the internet penetration it envisions without having adequately trained personnel and alternative means of transmission to overcome topographic barriers. Further, the cost of deploying an internet network and the cost of user equipment (computers) are also barriers to penetration.⁷¹ While bringing some municipalities closer together, many rural/remote areas are still without basic telecommunications, let alone internet connections, and these would greatly benefit from satellite connectivity. Possibly the recently signed peace agreements between the Colombian government and the FARC will bring the necessary telecoms connections to these remote areas, if nothing else, as a means of verifying that all parties are adhering to the peace plan.

Conclusions and recommendations

While many Latin American countries have made progress in their space activities, most, if not all, still lack a coherent legal framework in which to undertake them. Many of them have not signed or acceded to the basic space law instruments, such as the 1967 Outer Space Treaty, the 1972 Liability Convention, or the 1976 Registration Convention.

Venezuela has ratified the OST and the Liability Convention, but neither Venezuela nor Bolivia has ratified the Registration Convention, even though they have satellites in orbit.⁷² Peru, on the other hand, has ratified all five major space treaties. Bolivia and Colombia have yet to ratify the OST, although Colombia has ratified the Liability Convention and the Registration Convention. Venezuela, Bolivia, and Colombia would do well to accede to the OST and set up their National Registry

⁶⁹ ITU Plenipotentiary Conference 2014 (PP-14), Busan, Republic of Korea, 20 October – 7 November, 2014. <http://www.itu.int/en/plenipotentiary/2014/Pages/default.aspx>

⁷⁰ The *Viva Digital* plan supersedes the COMPARTEL plan, set up in the 1990s, to bring internet connectivity to rural areas. The MINTIC set up the Directorate of Connectivity to deploy the *Viva Digital* project, which aims at massive internet penetration throughout the country. See www.mintic.gov.co/.

⁷¹ See www.mintic.gov.co/.

⁷² Marboe, *Small Satellites*.

of Space Objects, as required by the Registration Convention. They would gain greater credibility within the space community, while protecting the State from disputes (read: lawsuits) in the event that their satellite(s) should cause harm or damage to spacecraft of other States.

Further, these international legal instruments could serve as the basis for the national legislation of space activities, tailored to the country's needs and taking into account the country's developing space sector. Perhaps Paraguay could serve as a model or pilot project, since its Space Agency, while still in its infancy, is studying the implications of drafting sector-specific legislation.

A few factors seem to handicap all these agencies: lack of trained personnel to operate the spacecraft or to interpret data from remote sensing satellites; lack of coordination amongst the different government agencies involved in the national space agency or commission; lack of adequate financial resources, *inter alia*. While several of the Latin American countries are interested in ensuring the sustainability of outer space and space activities,⁷³ it would behoove them to ensure the viability of their national space agency or commission as well.

On the upside, telecoms, particularly mobile telephony, have had a tremendous impact in Latin America, and made possible wireless communications accessible to millions of people. Programs like PRONTIS in Bolivia and *Viva Digital* in Colombia, part of what seem to be universal services as promoted by the ITU, the Broadband Commission, and the Worldwide Summit on the Information Society (WSIS), all have had a positive impact and could have even more impact on social development if more attention (and budget) were given to increasing the infrastructure—the terrestrial part of space communications.

There seem to be sufficient satellites already in orbit to meet users' growing demands,⁷⁴ but none is used as part of a regional plan to provide regional satellite telecommunications. An exception might be the 2010 SES-Astra Agreement with the *Comunidad Andina de Naciones* (CAN) countries (Bolivia, Colombia, Ecuador, and Peru), to provide high-powered broadband services in the region, but

⁷³ See Laura Delgado-López, "Space sustainability approaches of emerging space nations: Brazil, Colombia, and Mexico." *Space Policy* 37, no. 1 (2016): 24-29.

⁷⁴ See Bernardo Schneiderman, "The Latin American Satellite Market," *Satellite Markets & Research*, August 2015. <http://www.satellitemarkets.com/pdf2015/latin-american-marketbrief.pdf>.

implementation of this agreement seems to be delayed.⁷⁵ Each country leases its own capacity on different satellites, with the exception of Bolivia, which has its own satellite for its national communications. Thus, what could be or could have been a step forward in regional cooperation in space has not become reality yet.

Access to the satellites, through greater availability of and accessibility to the spacecraft as well as to less costly terrestrial equipment, are of key importance not only in South America, but in all 'developing' regions. However, while interest in expanding the terrestrial infrastructure may seem less appealing than launching a national satellite, planners should recall that users may see the terrestrial part of their telecoms system, but the satellite in orbit, whether in GEO or a lower orbit, is invisible. In some ways, it is an act of faith that a national satellite will produce the intended results, i.e., improve terrestrial communications and access to the internet, nationally and at the international level.

In the last decades, the countries in Latin America have tried to establish regional space policies, and have managed to establish national space agencies or commissions. What seems to be lacking is a specific project that will help unify these countries and build up interest in regional space activities. Possibly, the next generation of young professionals will achieve these and other goals. And perhaps the appropriate organization to accomplish these objectives is the Space Generation Advisory Council (SGAC), which came into existence as a result of UNISPACE III, held in Vienna, Austria in 1999.⁷⁶ Its headquarters are in Vienna, Austria, and has representation in many countries through its National Points of Contact (NPoC).⁷⁷

Since 2001, SGAC has Permanent Observer status at the UNCOPUOS; currently it has more than 4000 members worldwide, and already involves many universities and young professionals in a variety of programs and projects. The SGAC also has the financial support of the major well-established space agencies, (e.g.

⁷⁵ A press release from SES S.A., dated on Feb 8, 2010, states that SES WORLD SKIES reached an agreement with the Andean Community of Nations (CAN) regarding the long-term use of the 67 degrees West orbital position "to deepen and strengthen the economic integration and socio-cultural cohesion of its Member Countries, as well as expand communications throughout the region." www.ses.com/4233325/news/2010/. The latest press release regarding this arrangement is dated on April 15, 2011: an SES agreement with AXESAT, a Colombian company, to provide capacity on the SES AMC satellite launched in September 2010 for regional communications in the CAN countries. www.satellitetoday.com/. No further press releases or information on the 2010 SES-CAN agreement are available.

⁷⁶ See <http://spacegeneration.org/> for a description of the SGAC's numerous projects and meetings, and National Points of Contact (NPoC).

⁷⁷ <http://spacegeneration.org/>.

NASA, ESA, JAXA,) and corporations, such as Lockheed Martin and Arianespace, and several others.⁷⁸ Most importantly, its members have great enthusiasm for this organization and its many activities, and do not seem to carry much ‘political baggage.’ Thus, they can propose and undertake projects faster and perhaps with less political ‘static’ than more established older entities and practitioners. These can serve as mentors to the younger generation, thus ensuring continuity as well as transmission of information and knowledge of space activities. After all, the future of space activities is in the hands of future practitioners and enthusiasts!

References

- Agencia Espacial Mexicana. “Conferencia espacial de las Américas CEA.” Accessed June 22, 2016. <http://www.gob.mx/aem/acciones-y-programas/conferencia-espacial-de-las-americas-cea>.
- “Argentina: Massive protest against Macri’s government.” *The Dawn News*, April 29, 2016. www.thedawn-news.org/2016/04/29/argentina-massive-protest-against-macris-government/.
- Argentine media workers demand Macri to respect media law.” *Telesur*, July 30, 2016. <http://www.telesurtv.net/english/news/Argentine-Media-Workers-Demand-Macri-to-Respect-Media-Law-20160730-0019.html>.
- Arianespace, “Arianespace signs contract with ARSAT to launch a new satellite for Argentina, plus two options.” Last modified September 30, 2015. www.arianespace.com/press-release/arianespace-signs-contract-with-arsat-to-launch-a-new-satellite-for-argentina-plus-two-options/.
- Barberis Martínez, Jaime. “Presente y futuro de la Conferencia Espacial de las Américas.” *AFESE 50* (2009): 85-98. <https://afese.com/img/revistas/revista50/presfutesp.pdf>.
- Becerra, Jairo A. “Colombia’s Space Policy: An Analysis of Six Years of Progress and Challenges.” Presentation at the 23rd United Nations/International Astronautical Federation Workshop on “Space Technology for Economic Development,” Beijing, China, September 20-22, 2013.
- Belluscio, Alejandro G. “ARSAT-2: Argentina consolidates as Latin American satellite leader,” *NASA Spaceflight*, September 21, 2015. www.nasaspaceflight.com/2015/09/arsat-2-argentina-consolidates-latin-american-satellite-leader/.
- “Bolivia to pay back loan to China for Tupac Katari satellite.” *Space Daily*, June 3, 2016. http://www.spacedaily.com/reports/Bolivia_to_pay_back_loan_to_China_for_Tupac_Katari_satellite_999.html

⁷⁸ <http://spacegeneration.org/>.

- “Bolivian Space Agency Selects Gilat for its National VSAT Platform Enabling Comprehensive Connectivity Capabilities.” *Gilat*, July 6, 2015. <http://www.gilat.com/Bolivian-Space-Agency-Selects-Gilat-for-its-National-VSAT-Platform-Enabling-Comprehensive-Connectivity-Capabilities>.
- Cappaert, Gustav, and Lewis, Chris. “With its own satellite, Bolivia hopes to put rural areas on the grid.” *Inter Press Service*, June 23, 2014. www.ipsnews.net/2014/06/with-its-own-satellite-bolivia-hopes-to-put-rural-areas-on-the-grid/.
- “China plans to track moon spacecrafts from its station in Argentine Patagonia.” *MercoPress* (Montevideo, Uruguay), April 28, 2016. <http://en.mercopress.com/2016/04/28/china-plans-to-track-moon-spacecrafts-from-its-station-in-argentine-patagonia>.
- “China-Brazil satellite launch fails, likely fell back to Earth.” *Reuters*, Dec. 10, 2013. www.reuters.com/article/us-space-china-brazil-satellite-idUSBRE9B90XK20131210.
- Comisión Colombiana del Espacio. *Visión Colombia II Centenario: Aprovechar el potencial del espacio extraterrestre para contribuir al desarrollo sostenible y la competitividad del país*. Bogotá: CCE, 2011. https://www.cce.gov.co/sites/default/files/adjutnos_basic_page/Visi%C3%B3n%202019%20Consolidado%20ver%206%20definitivo.pdf.
- Delgado-López, Laura. “Space sustainability approaches of emerging space nations: Brazil, Colombia, and Mexico.” *Space Policy* 37, no. 1 (2016): 24-29.
- Dos Campos, São José. “Ten, Nine, Ten...” *The Economist*, August 8, 2015. www.economist.com/news/americas/21660572-rocket-science-hard-rocket-diplomacy-harder-ten-nine-ten.
- Ereno, Dinorah. “Small satellites make their mark.” *Revista Pesquisa FAPESP* 219, Mayo 2014. <http://revistapesquisa.fapesp.br/en/2014/05/20/small-satellites-make-mark/>.
- “First Bolivian telecom satellite enters service,” *BBC News*, April 2, 2014. www.bbc.com/news/world-latin-america-26850393.
- Fuerza Aérea Colombiana. *Informe de Gestión 2015*. Bogotá, 2016. <https://www.fac.mil.co/informe-de-gesti%C3%B3n-2015>.
- Hermida, Julian “Regulation of Space Activities in Argentina.” In Ram Jakhu, ed., *National Regulation of Space Activities*. Springer Netherlands, 2010, 23-35.
- “Historia satelital Argentina: Parte 2 (B) La historia de los ‘Nahuel’.” *El blog de Maloco*, June 4, 2013. <http://malocoblog.blogspot.com/2013/07/historia-satelital-argentina-parte-2-b.html>.
- Hobe, Stephan, *Pioneers of Space Law: A publication of the International Institute of Space Law* (Leiden: Martinus Nijhoff Publishers, 2013).
- Hughes Network Systems. “Entel Bolivia Selects Hughes JUPITER System for Satellite Internet and Cellular Backhaul Services,” *Hughes*, March 6, 2016. www.hughes.com/company/newsroom/press-releases/entel-bolivia-selects-hughes-jupiter-system-for-satellite-internet-and-cellular-backhaul-services.

- International Law Association. "Space Law." Accessed June 18, 2016. <http://www.ila-hq.org/en/committees/index.cfm/cid/29>.
- International Telecommunication Union. "Country Classifications." Accessed June 18, 2016. <http://www.itu.int/en/ITU-D/Statistics/Pages/definitions/regions.aspx>.
- International Telecommunication Union. "ITU Plenipotentiary Conference 2014 (PP-14), Busan, Republic of Korea, 20 October – 7 November, 2014." June 22, 2016. <http://www.itu.int/en/plenipotentiary/2014/Pages/default.aspx>
- International Telecommunication Union. *Measuring the Information Society Report 2015*. Geneva: ITU, 2015. <http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf>.
- Internet World Stats. Usage and Population Statistics. "Bolivia." Accessed June 19, 2016. www.internetworldstats.com/sa/bo.htm.
- Jakhu, Ram. "The 1988 Space WARC: A Third World Perspective." *Space Communication and Broadcasting* 6, no. 3 (July 1988), 18-20.
- Latin American Network Information Center. "Country Directory." Accessed June 23, 2016. <http://lanic.utexas.edu/subject/countries/>.
- "Layoffs continue in Argentina, now for technicians," *The Dawn News*, January 14, 2016. www.thedawn-news.org/2016/01/14/layoffs-continue-in-argentina-now-for-technicians/.
- Marboe, Irmgard, ed. *Small Satellites: Regulatory Challenges and Chances*. Leiden: Brill Nijhoff, 2016.
- "Mauricio Macri's reform plans suffer a judicial blow. Argentina's Supreme Court blocks a rise in gas prices." *The Economist*, August 22, 2016. <http://www.economist.com/news/americas/21705571-argentinas-supreme-court-blocks-rise-gas-prices-mauricio-macris-reform-plans-suffer>.
- Ministerio de Relaciones Exteriores. "Decreto 2442 de 2006 (julio 18)." Accessed June 22, 2016. https://www.cancilleria.gov.co/sites/default/files/Normograma/docs/pdf/decreto_2442_2006.pdf
- Monserrat Filho, José. "Remarks on Brazilian space laws." Presentation at the United Nations/Nigeria Workshop on Space Law, Abuja, Nigeria, November 21-24, 2005. <http://www.sbda.org.br/artigos/anterior/23.htm>.
- Moreno Cabrera, Juan Carlos. "Commentary: Linguistic Structure and Social Structure", *Journal of Multicultural Discourses* 1, no. 2, (2006): 115-120. www.academia.edu/2605939/Linguistic_Structure_and_Social_Structure.
- Newell, Monica, "Bolivian Satellite to Expand Internet Access," *BORGEN Magazine*, July 10, 2014. www.borgenmagazine.com/bolivian-satellite-to-expand-internet-access/.
- Ospina, Sylvia. "New National Space Agencies in South America: New opportunities for Collaboration." Presentation at the 25th Symposium on Space Policy, Regulations, and Economics, Naples, Italy, September 2012.

- Ospina, Sylvia. "The Digital Divide and Space Activities in the Southern Hemisphere(s): A General Overview of Africa and South America". Presentation at the International Astronautical Congress/IISL Colloquium, Cape Town, South Africa, 2011.
- Ospina, Sylvia. "The Third World Countries' Challenges and Contributions to Space Law". *Proceedings of the 25th Colloquium on the Law of Outer Space of the IISL* (Washington: AIAA, 1988), 135-141.
- "Personal boliviano asegura operaciones de satélite Túpac Katari." *Jornadanet.com*, May 27, 2016. <http://www.jornadanet.com/n.php?a=129413-1>.
- Presidencia de la República. "Decreto 1649 de 2014." Bogotá, July 18, 2014. <http://es.presidencia.gov.co/normativa/normativa/Decreto-1649-2014.pdf>.
- Proenza, Francisco J., Bastidas-Buch, Roberto, and Montero, Guillermo. *Telecenters for Socioeconomic and Rural Development in Latin America and the Caribbean*. Washington, DC: FAO, ITU, IADB, 2001. iii. http://www.itu.int/ITU-D/ict/mexico04/doc/doc/10_telecenters_e.pdf.
- "Restos del satélite boliviano caen en China oriental." *Bolivia Prensa*, December 21, 2016. Accessed June 20, 2016. <http://boliviaprensa.com/index.php/noticias-bpa/item/910-restos-del-sat%C3%A9lite-boliviano-caen-en-china-oriental>.
- Schneiderman, Bernardo. "The Latin American Satellite Market." *Satellite Markets & Research*, August 2015. <http://www.satellitemarkets.com/pdf2015/latin-american-marketbrief.pdf>.
- Selding, Peter B. "Bolivia's TKSAT-1 Expected to Generate \$500 Million," *Space News*, December 28, 2015. <http://spacenews.com/bolivias-tksat-1-expected-to-generate-500-million>.
- Selding, Peter B. "Brazil is pulling out of Ukrainian Launcher Project." *Space News*, April 16, 2015. <http://spacenews.com/brazil-pulling-out-of-ukrainian-launcher-project/>.
- Space Generation Advisory Council. "SGAC Bolivia." Accessed June 25, 2016. <http://spacegeneration.org/sgac-regions/south-america/bolivia.html>.
- The Bogotá Declaration." *Journal of Space Law* 6, no. 2, 1978: 193-196. <http://www.space-law.olemiss.edu/jsl/pdfs/back-issues/jsl-6-2.pdf>
- The Right to Communicate. "Arlo Armando Cocca." Accessed July 1, 2016. <http://rightto-communicate.com/?q=node/118>.
- Tomás, Juan Pedro. "MINTIC declares Satcol tender void." *Business News Americas*, Sept. 2, 2010. www.bnamericas.com/en/news/telecommunications/Mintic_declares_Satcol_tender_void.
- "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies." Accessed June 24, 2016. <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>
- United Nations Development Programme. "About Latin America and the Caribbean." Accessed June 29, 2016. <http://www.latinamerica.undp.org/content/rblac/en/home/regioninfo.html>.

United Nations Office for Outer Space Affairs. "Convention on Registration of Objects Launched into Outer Space." Accessed June 25, 2016. <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introregistration-convention.html>.

University of Pennsylvania. "Language Structure Is Partly Determined by Social Structure." *Science Daily*. January 28, 2010. www.sciencedaily.com/releases/2010/01/100121140347.htm.

Weisbrot, Mark. "Why Macri's Win is Bad News for Argentina." *Fortune*, November 24, 2015. <http://fortune.com/2015/11/24/mauricio-macri-presidential-win-bad-for-argentina/>.