Media Cartographies of Broadband Access in Brazil:
The Case of the Geostationary Defense and Strategic Communications Satellite (SGDC-1) and Rural Schools

by

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ABSTRACT

The launch of the Geostationary Defense and Strategic Communications Satellite (SGDC-1) in 2017 materialized the Brazilian government's long-standing political desire to achieve national strategic communications. Representing one of the most expensive investments in the space and telecommunication sectors in 21st-century Brazil, the SGDC-1 emerged in the public discourse not only as a high-capital and sophisticated artifact capable of fostering national pride but also as a savior of broadband Internet connectivity for Brazil's rural and remote schools. This thesis critically examines media cartographies and discourses surrounding the SGDC-1 and points out how Brazil's strategic agendas and modernization campaigns were channeled into connectivity initiatives in rural schools.

By offering a humanistic approach to untangle the complex systems that enable the SGDC-1's operations throughout Brazil's territory, I unravel major points of contention in the conceptualization of rural schools as "dark spots of information" in government discourses. I then proceed to explore the government's use of the televisual as part of its strategy to frame what I call a "space-telecom propaganda." Drawing upon materials including government reports, popular press articles, datasets, court hearings, televisual texts, and satellite footprint maps, I demonstrate how the SGDC-1 functions not only as a high-technological artifact but also as a political tool interwoven with the government's efforts to shape how citizens engage with notions of the "global village" and "digital divide."

Through a critical media studies approach, I describe how the satellite's sociotechnical relations reveal what remains largely obscure to Brazilian publics. From questions pertinent to militarization, governance, and public-private partnerships to issues of long-term strategies, sustainability, and potential infrastructural disruptions, I argue these issues deserve public scrutiny as the SGDC project might be at stake in the foreseeable future given the current political conditions. To mitigate those potential shortcomings, I suggest the creation of a National Internet Satellite Plan to undertake some of these questions and orient future policy frameworks that may rely on the SGDC's constellation for broadband-enabled inclusion, national integration, community development, and socioeconomic progress.

Thesis Supervisor: Lisa Parks
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but whom also reminded me—and every other Brazilian at the Institute—that it is possible to remain in close connection with our home country even from afar. The Lemann Fellowship offered generous support during my time at MIT and inspired me to continue working for the betterment of Brazil, in addition to allowing me to meet my great friend, Caroline Rozendo, from the MIT Media Lab's Object-Based Media group, who was a good companionship during my time as a graduate student.

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As I finish up this chapter of my life, there is a growing feeling of uncertainty in the world. I had to unexpectedly move out of my apartment on the MIT campus, leave Cambridge, and fly back to Eugene, Oregon. Each day has been a bewildering mix of anxiety and fear, but also some hope for a better future. The COVID-19 pandemic has impacted everyone I know and forced me to rethink everything about myself and the world around me.

Pushing through the final line to complete this thesis, however, seems an affirmation of the fact that there will be a future and that, more than ever, we must critically reflect about the roles of governments and other powerful institutions in safeguarding people's dignity and fundamental human rights, in shaping our relationship with one another, as well as in providing the technologies we use to access information and feel connected, and various civic duties we can perform for the benefit of all. I hope this thesis, too, can function as an affirmation for a more participatory and inclusive future for those who long remained ostracized.

"We, this people, on this wayward, floating body
Created on this earth, of this earth
Have the power to fashion for this earth
A climate where every man and every woman
Can live freely without sanctimonious piety
Without crippling fear."

— Excerpt from the poem "A Brave and Startling Truth" written by Maya Angelou in 1995 to celebrate the 50th anniversary of the United Nations. In December 2014, Angelou's writing flew to space aboard NASA's Orion spacecraft.

"I know that science and technology are not just cornucopias pouring gifts out into the world. Scientists not only conceived nuclear weapons; they also took political leaders by the lapels, arguing that their nation—whichever it happened to be—had to have one first. (…) Our technology has produced thalidomide, CFCs, Agent Orange, nerve gas, pollution of air and water, species extinctions, and industries so powerful they can ruin the climate of the planet. Roughly half the scientists on Earth work at least part-time for the military. While a few scientists are still perceived as outsiders, courageously criticizing the ills of society and providing early warnings of potential technological catastrophes, many are seen as compliant opportunists, or as the willing source of corporate profits and weapons of mass destruction - never mind the long-term consequences. The technological perils that science serves up, its implicit challenge to received wisdom, and its perceived difficulty, are all reasons for some people to mistrust and avoid it. There's a reason people are nervous about science and technology. (…) We've arranged a global civilization in which most crucial elements - transportation, communications, and all other industries; agriculture, medicine, education, entertainment, protecting the environment; and even the key democratic institution of voting—profoundly depend on science and technology. We have also arranged things so that almost no one understands science and technology. This is a prescription for disaster. We might get away with it for a while, but sooner or later this combustible mixture of ignorance and power is going to blow up in our faces."

— Excerpt from the 1995 book *The Demon-Haunted World: Science as a Candle in the Dark* by Carl Sagan and Ann Druyan.

"One of the most noticeable traces of the present historical period is the truly despotic role of information. (…) New technical conditions ought to permit the enlargement of the knowledge of the planet, the objects that form it, the societies that live in it, and humanity in its intrinsic reality. All the same, the techniques of information are principally utilized in the present conditions by a handful of actors in accordance with their particular aims. These techniques of information are appropriated, for the time being, by some states and companies, thus worsening the processes of the creation of inequalities. In this way, the periphery of the capitalist system ends up becoming even more peripheral, whether because this periphery cannot completely possess the new means of production or because the possibility of control escapes from it."

— Excerpt from the 2000 book *Por uma Outra Globalização: Do Pensamento Úniico à Consciência Universal* by Brazilian geographer Milton Santos.

"I am a biologist and I travel a lot through my country's savannah. In these regions, I meet people who don't know how to read books. But they know how to read their world. In a such a universe where other wisdom prevail, I am the one who is illiterate. I don't know how to read signs in the soil, the trees, the animals. I can't read clouds and the likelihood of rain. I don't know how to talk to the dead, I've lost all contact with ancestors who give us our sense of the eternal. In these visits to the Savannah, I learn sensitivities that help me to come out of myself and remove from my certainties."

— Excerpt from a 2008 keynote address by Mozambican author Mia Couto to the WALTIC International Literature Conference in Stockolm, Sweeden. The original keynote title in Portuguese was "Linguas que não Sabemos que Sabíamos."

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Abbreviated Terms

ADSL: Asymmetric Digital Subscriber Line

AEB: Brazilian Space Agency

ANATEL: National Telecommunications Agency

ASCEND: Advanced System for Communications and Education in National Development

ATS-6: Applications Technology Satellite-6

BITNET: Because It's Time Network

CAC: Community Access Center

CETIC.br: Regional Center for Studies on the Development of the Information Society

Cetic.br: Regional Centre of Studies for the Development of the Information Society

CGI.br: Brazilian Internet Steering Committee

COPE-P: Main Space Operations Center

COPE-S: Secondary Space Operations Center

ELETROBRAS: Centrais Elétricas Brasileiras S.A.

EUROSTAT: European Statistical Office

IDEB: Brazilian Education Quality Index

FED-STD-1037C: Federal Standard 1037C.

GESAC: Electronic Government – Citizen Assistance Service

Gbps: Gigabits per Second

HTS: High-throughput Satellite

ICT: Information and Communications Technology

INEP: National Institute for Educational Studies and Research "Anísio Teixeira"

INPE: National Institute for Space Research

ITU: International Telecommunication Union

Kbps: Kilobits per Second

LMS: Learning Management Systems

Mbps: Megabits per second

MCTIC: Ministry of Science, Technology, Innovation and Communication

ME: Ministry of Education

NASA: National Aeronautics and Space Administration

NTIA: National Telecommunications and Information Administration

OPGW: Optical Ground Wire cables

PBLE: School Broadband Plan

PC: Personal Computer

PIEC: Connected Education Innovation Program

PNBL: National Broadband Plan

PNIS: National Satellite Internet Plan

RFI: Request for Information Process

RFP: Request for Proposal

SACI: Advanced Interdisciplinary Communications Satellite

SGDC: Geostationary Defense and Strategic Communications Satellite

STF: Brazilian Supreme Federal Court

TCU: Brazilian Federal Court of Accounts

TELEBRAS: Telecomunicações Brasileiras S.A.

UNESCO: United Nations Educational, Scientific and Cultural Organization

Visiona: Visiona Space Technology

VSAT: Very Small Aperture Terminal

Introduction

One of my earliest encounters with the computer and the Internet in the school environment happened in 2006. Sitting at a small and dusty library in a public urban school in the small town of Extrema, in the Brazilian state of Minas Gerais, the two available computers wired to white-colored cathode-ray tube monitors were the only available machines connected to the Internet. At that time, my school had no wi-fi routers, cell phones had no camera, and only one geography teacher possessed a laptop, which he used to routinely bring to the classroom to teach us about cartography, statistical graphs, and diverse landscapes of the world. Up until that point, the only media technology objects used for learning at my school were a movable wooden-made cabinet attached to metal rollers on the bottom that housed a TV and DVD sets, as well as a small radio that teachers would take around the school whenever they wanted to screen a documentary or play dialogues to help us practice our listening comprehension in the English language. Those two computers running on a Windows 98 operating system, however, remained vacant at the small and dusty library, mostly turned off and covered with an almost transparent plastic, paradoxically making the machines invisible to most students. For me, the only utility value of computers was for typing up stories on the keyboard for a Portuguese class, using the mouse to manipulate an on-screen calculator for math exercises, or merely spending time playing a pre-installed pinball game that came with most Microsoft computers of that time.

However, my understandings of what constituted artificial satellites occurred much before my first interactions with the computer itself. Around 2002, my family had moved to an agricultural town called Jarinu, as life near São Paulo's metropolitan area was becoming increasingly difficult for a working-class family. Due to the distance from the city, the only possible way of watching TV was by acquiring a relatively expensive satellite dish, which my father installed on top of our house's roof. In Portuguese, we called it *antena parabólica.* I recall the uncountable times I tried to set up the signal receptor with a remote control in the living room while yelling from the nearest window to my father, who would often climb to our house's roof so that we could get a better TV signal. Insofar the images were getting better or worse, my father would slowly adjust the antenna's orientations on top of our house, trying to point to the same spot in the sky as the other installed dishes in the nearby

houses. After a few weeks, as I started to come home from school around noon, I vividly remember being frustrated because I wanted to watch Pokémon, but the content projected on the TV screen kept on freezing, going completely black while making strange hissing noises. At first, we thought that we had either acquired defective cables or the signal receptor was not adequate for our TV set. Later, we thought that perhaps we needed to adjust the satellite dish on a daily basis due the windy patterns—a family epistemology we had to naturally develop upon experiencing constant thunderstorms in Jarinu. However, it took only a few days to learn from the neighbors that the signal interference was a common thing in the town we had just moved to. I recall our neighbors in Jarinu telling us that due to interference caused by the Sun's electromagnetic waves (back then, they used to call it *explosões solares*, or solar explosions in English), satellite signal interferences were common phenomena every day around lunchtime. There was no way to bypass the lack of TV signals, given that virtually everyone relied on the same source. Over time, we started to rely on the signal interference as a cultural practice that would inform us when it was time to turn off the TV and prepare for lunch. We did not grasp what a satellite was or how it transmitted the data through the TV in our living room, but we knew that its high-technical functionalities were somehow interwoven with our ordinary lives in consuming media content.

Around 2007, the Internet rapidly became more pervasive in the fabric of our school lives to the point that it would propel us to ask ourselves: when was it that we became so connected and our physical distances obsolete? Our sense of "self" suddenly became intertwined with events and peoples across regions, languages, and distinct cultural realities. In navigating cheap Internet at local cybercafes after school and signing up for expensive dial-up installations at the houses in my bucolic neighborhood in Extrema, my friends and I yearned to find out what it was really about, although that often meant playing computer-based games such as *Counter-Strike* (2000) and *Grand Theft Auto: San* Andreas (2004), chatting friends on MSN, illegally downloading MP3 songs on our made-in-China portable music players, and writing each other notes on Orkut—a now-extinct Google-owned platform that represented Brazil's most popular social network site until 2012. Amid those transformations that modernized our everyday lives lied the invisible workings of satellites, computers, and the Internet. Operating in varied ways and in consonance with a much larger infrastructural scheme, they largely paved the way for our

integration to the "global village" without us even knowing what these objects were about or what it even meant to be "global."

In 2008, when I moved to a rural public school in the city of Atibaia, in the southeastern state of São Paulo, I was shocked by what I saw: numerous piles of cardboard boxes containing black-colored flat-screen computers that the Brazilian government had provided to schools to establish a local computer lab. In a matter of weeks, the new lab was finally open to the school community, and every now and then, we would have classes there. Despite the apparent innovation and pedagogic opportunity to engage students with computer technologies and with what they had to offer, we faced one critical issue: the lack of Internet connection. When we questioned the school staff, the administrators would tell us that they were waiting for the government to install on-ground infrastructure to allow the flow of the Internet into the building. Given that the school was in a remote, impoverished, rural area, it was clear to me that the priority was not teaching the students how to navigate the Internet; after all, not even teachers knew what it really constituted. The adjustment from urban to rural made me question various assumptions I had about what it meant to navigate the Internet and about the country that I was living in; after all, how come could it be possible that most of my peers in the rural school did not even know what an email or a blog was? Was that what "modernity" truly entailed?

While navigating that urban-rural dichotomies and facing an imminent lack of Internet access, it did not take long for me to realize that no Internet meant that we could not access YouTube, Wikipedia, and other kinds of useful websites for learning, playing, or socializing. So, "what is the point of having a computer at school?"– I recall asking myself. The lack of Internet also implicated that most of us would need to take an hour-long bus ride to the city center to use the public library computers or access LAN Houses, places of intense sociability that received significant cultural attention in the first decade of the 21st century in Brazil.[1] For the next years in that school, the computer lab was an empty and dusty place, and our class visits were only for practicing keyboard writing, playing with pre-installed CD-ROM games and drawing softwares, while hoping that one day we would be able to fully use the capacity of the brand new computers we had at our disposal. In the eyes of the

[1] Ronaldo Lemos and Paula Martini, "LAN Houses: A New Wave of Digital Inclusion in Brazil." *Information Technologies & International Development 6* (SE), 2010: 31–35, http://publius.cc/lan_houses_new_wave_digital_inclusion_brazil/091509

government, we were perceived as the "unconnected" or students living in what came to be known, years later, as "dark spots of information," regions that lack telecom infrastructure for Internet connectivity and, as such, arguably have no access to global information.

More than a decade later and with 95 percent of Brazil's cities benefiting from 4G coverage,[2] my personal anecdotes from the first decade of the 21st century likely remains the same for millions of rural students across the Brazilian territory.[3] Nonetheless, the images, videos, illustrations and a vast array of visual media portraying rural school students framed near satellite dishes, computers, screens, and cables are becoming increasingly popular in Brazil's news media outlets as the government advances its political strategies of "connecting the unconnected" (fig. 1 and 2).

Figure 1. Entrance of a rural school in Pacaraima, Roraima, displaying a satellite dish installation for SGDC-1's data transmission.

[2] Marcela Brandão, "Tecnologia 4G Está Disponível a Mais De 95% dos Brasileiros." *Agência Brasil*, May 1, 2019. https://agenciabrasil.ebc.com.br/geral/noticia/2019-05/tecnologia-4g-esta-disponivel-mais-de-95-dos-brasileiros.
[3] Élida Oliveira, "43% Das Escolas Rurais não têm Internet por Falta de Estrutura da Região, diz Pesquisa." *G1*, July 18, 2019. https://g1.globo.com/educacao/noticia/2019/07/18/43percent-das-escolas-rurais-nao-tem-internet-por-falta-de-estrutura-na-regiao-diz-pesquisa.ghtml.

Figure 2. Representatives from the federal government engaging with students from a rural school in Pacaraima, Roraima, right after activating the broadband signal from the SGDC-1.

These photos at Escola Estadual Indígena Tuxaua Silvestre Messias and Escola Casimiro de Abreu, in the city of Paracaima, located in the northern state of Roraima near Brazil's border with Venezuela, are interesting for one striking reason: they mark the very beginning of a long-awaited broadband connection enabled by the country's very first communication satellite.

Unlike previous satellites programs in Brazil, this one emerged in the public's imaginary with extra societal importance given that it is fully operated by Brazilians to serve the "unconnected," who often remain at the margins of society in the condition of public rural school students. If before one could argue that these students were forgotten and invisible, the government's attention to promote the Internet in rural areas now turned its narrative to include the expensive, techno-scientific power of a communication satellite capable of offering broadband to Brazil's most remote regions. If in my early school years the Internet signals were coming through cables and local towers, now the use of a domestic communication satellite, owned and operated by the Brazilian government for the unconnected Brazilians, is becoming the new infrastructural norm that is arguably capable of leveraging social and digital inclusions while hovering thousands of kilometers away from Brazil.

Operating in the classified Geosynchronous Equatorial Orbit (GEO) about 35,000 kilometers above the Brazilian territory, the Geostationary Defense and Strategic Communications Satellite—or SGDC-1 as it is abbreviated from its Portuguese name *Satélite Geoestacionário de Defesa e Comunicações Estratégicas*—is the country's first government-owned-and-operated communication satellite with coverage across all Brazil's five regions. From the Amazon basin region to the southern borders with Uruguay and from portions near the Andean region to the Atlantic coast, one could also classify the SGDC-1 as a territorial integrator for an unprecedent capacity for data transmission. By installing the on-ground segments of the satellite at rural public schools to connect with the SGDC-1's high-speed Ka-band as part of a business partnership with the U.S. company Viasat, the functionalities and technological potentials of the satellite partially emerge in the general public's imaginary insofar rural teachers and students begin to explore what the "global village" has to offer. With news stories and TV coverage sprouting throughout the country celebrating the satellite-enabled broadband connectivity at rural public schools, the civil role of the SGDC-1 becomes explicit and yet obscure.

Largely speaking, this happens as the workings of the satellite appear to contribute to the government's commitment to promoting social and digital inclusions in a country as culturally diverse, socioeconomically uneven, and geographically challenging as Brazil. As expressed by a local politician, the capturing and framing of the broadband being "turned on" in Pacaraima would give a hint to others across the nation of what is going to happen in regions of Brazil that still lack Internet connectivity. Discourses like this remain common among Brazilian politicians, and they continue to echo the social and digital inclusion narratives that other top-level government representatives had previously performed such as, "no Brazilian will be without broadband in our country, regardless of where they live…our satellite will bring connectivity to all corners of Brazil."[4] The SGDC-1 as a political artifact, rural schools as sites of exacerbated social and digital inequalities, and the government maneuvers in relating these two are the main objects of study of this thesis.

[4] Sabrina Craide, "Satélite vai Levar Banda Larga a Todos os Cantos do País, Diz Kassab." *Agência Brasil*, May 11, 2017, https://agenciabrasil.ebc.com.br/economia/noticia/2017-05/satelite-vai-levar-banda-larga-todos-os-cantos-do-pais-diz-kassab.

Background and Definitions

Launched on May 4th, 2017, from the European Spaceport Kourou launch facility in French Guinea, together with South Korean's KOREASAT-7 satellite, the SGDC-1 reached Earth's orbit onboard the rocket Ariane 5 ECA, a heavy-lift launch vehicle manufactured by Arianespace. Developed in a three-year period in Cannes, Frances by the Franco-Italian aerospace manufacturer Thales Alenia Space, under the auspices of Brazilian company Visiona Tecnologias Espacial S.A., the SGDC-1 emerges as the most expensive telecommunication project in 21st century Brazil, costing approximately 2.8 billion Reais (more than 660 million U.S. dollars)—about 12 times more expensive than a similar satellite project carried out by the Indian government from that same year.[5] The SGDC program emerged as a government-funded project with three chief objectives: I) to reduce Brazil's digital divide by providing high-quality Internet services to 100 percent of the country territory as part of the National Broadband Plan (PNBL); II) to provide sovereignty and secure means for the government's defense and strategic communications; III) and to acquire critical technologies for the Brazilian space industry as part of a technology transfer and absorption program, enabling the national industry to take increasingly essential roles in the future Brazilian space programs.[6] In a country of continental proportions, the SGDC-1 materializes the Brazilian government's long-standing political desire to achieve national sovereignty over its strategic communications.

Once in GEO orbit, the state-owned company Telecomunicações Brasileiras S. A. (Telebras) began to operate the satellite with on-ground support offered by Viasat as part of a costly partnership between the U.S. company and the Brazilian government. In conjunction with other existing policy frameworks such as the Broadband National Plan (PNBL) established in 2010 and e-government (GESAC) established in 2002, the SGDC-1 emerges in the public discourse as a high-capital savior of connectivity with the ambitious goal of connecting all schools to the broadband by 2024. Regardless of the nature of its duo civil-military role, the connectivity promises of SGDC-1's mission have brought significant attention to Brazil's geopolitical strategies as a nation engaging in space exploration while also

[5] Cláudio Humberto, "Satélite Mais Caro do Mundo," *Jornal O Dia*, accessed April 2, 2020, https://brazilianspace.blogspot.com/2017/05/claudio-humberto-satelite-mais-caro-do.html
[6] "Audiência Pública: Debater o Programa Espacial Brasileiro à Implantação do SGDC-1." *Telebras*, November 2014, http://legis.senado.leg.br/sdleg-getter/documento/download/779a5294-691a-429d-a2df-95c9259137cd

furthering social and digital inclusions through the building of a macro-scale telecom infrastructure.

However, the relationship between satellite technologies aimed at improving the public education in the Brazilian context existed before the emergence of the Internet itself. In fact, a Stanford University report titled Advanced System for Communications and Education in National Development (ASCEND) influenced those early moves in experimenting with satellite technologies for educational purposes in Brazil, which influenced how tele-education practices started to unfold in the country. The 1967 ASCEND report informed researchers and governments of a prototype design of communication and educational television satellite projects for Brazil, India, and Indonesia. In 1968, as Brazil was undergoing a violent military dictatorship, the country's National Institute for Space Research (*Instituto Nacional de Pesquisas Espaciais*—INPE) proposed the creation of the Advanced Interdisciplinary Communications Satellite (*Satélite Avançado de Comunicações Interdisciplinares*—SACI). The SACI project envisaged the construction of a telecommunications satellite for educational applications, which was undoubtedly a bold idea for a developing country like Brazil at that time, given that most of its citizens in rural areas barely had access to electricity, water, and education.

While the idea of building the satellite was unfeasible at the time and died out only a few years after, the federal government's vision of deploying its own satellite for educational matters helped pave the way for the SGDC-1 and its social and digital inclusion profile that came about decades later. That is to say that SACI opened a vast terrain of possibilities in experimenting with satellite technologies in the context of public education early on in Brazil's engagement with space, although that mostly implied partnerships with foreign firms that already possessed the scientific know-how and technological capability for manufacturing, launching, and operating satellite technologies. This way, with the broadcasting of radio and television programs to primary schools in the then-called remote areas, the use of satellite technologies in Brazil in the late 1960s gained traction and government attention for the need of establishing telecom policies focused on remote communities.

Figure 3. Collage of photos and illustrations about the SACI project by Brazil's National Institute for Space Research. This collage circulated on a printed publication by INPE on June 17th, 1974, showing school children and classroom settings and a sketch of NASA ATS-6 satellite. The title of the story was ATS-6 em Órbita: Via Satélite, o SACI Estará no Ar (ATS-6 in Orbit: Via Satellite SACI will be in the Air).

In its essence, the ASCEND report outlines how "educational television via a satellite be integrated into the nation's educational programs, and how satellite techniques can be phased into present and future communication systems."[7]Already in the 1970s, the government perceived the adoption of satellite education as a potential solution for national integration, given that the number of illiterate citizens in Brazil was considered an obstacle to the country's modernization, especially in the North and Northeast regions. As one of the poorest Brazilian states of the time, Rio Grande do Norte was chosen as part of SACI, and several public schools were benefited.[8]

If the dictatorial governments in Latin America were relying on other media infrastructures and practices to spread their extremist ideologies via radio and TV, the use of satellite-enabled tele-education was also perceived as a potential resource by the scientific community working in education-related issues. Thanks to an

[7] "Satellite Broadcasting: Implications for Foreign Policy, hearings before the Subcommittee on National Security Policy and Scientific Developments of the Committee on Foreign Affairs," In *91st Congress, May*, vol. 13, p. 15. 1969. Accessed March 25, 2020.
[8] Arnon A. M. de Andrade, "Política e Afeto na Produção de Identidades e Instituições: a Experiência Potiguar." *Revista Brasileira de Educação* (2005): 133-138, accessed March 19, 2020, https://doi.org/10.1590/S1413-24782005000300011

international partnership, INPE was capable of daily use of about 30 minutes of the capacity of ATS-6 (Applications Technology Satellite-6), frequently referred as the world's first educational satellite operated by the U.S. National Aeronautics and Space Administration (NASA) (fig. 3). In doing so, it enabled the SACI project to have about 1,241 radio and TV programs transmitted to 510 schools in 71 municipalities by 1976.[9] Despite its bold efforts for the time, the project was extinguished in 1978 due to the high maintenance costs of satellites and cultural differences in the profile of the programs produced in the interior of São Paulo, but transmitted in the Northeast region, without taking into account local specificities.[10] The technological legacies of SACI, however, paved the way for the development of educational programs in open TV that became popular throughout Brazil, such as *Telecurso* (1978), *TV Escola* (1995), and *Telecurso* 2000 (1995).[11]

In the following decades, Brazil established its own Space Agency (*Agência Espacial Brasileira*—AEB), designed the first graduate programs aimed at training the next generations of scientists and aerospace engineers, sent the first Brazilian national to the International Space Station (ISS), launched various satellites data-collecting and remote sensing satellites, cooperated in successful satellite projects with countries like China, and established significant on-ground infrastructures in the country such as the Alcantara Launch Center in the state of Maranhão. As of 2020, Brazilian firms—public and private—have launched about 17 satellites mostly Earth observation, as displayed in Table 1.

Satellite Name	International Code	Date Launched into Space
SGDC	2017-023B	May 4, 2017
STARONE D1	2016-082B	December 21, 2016
STAR ONE C4	2015-034B	July 15, 2015
NANOSAT C BR1	2014-033Q	June 19, 2014
STARONE C3	2012-062A	November 10, 2012
STAR ONE C2	2008-018B	April 18, 2008
STAR ONE C1	2007-056A	November 14, 2007
BRAZILSAT B4	2000-046A	August 17, 2000
SACI 1	1999-057B	October 14, 1999
SCD 2	1998-060A	October 23, 1998

[9] Terezinha Saraiva, "Educação a Distância no Brasil: Lições da História." *Em Aberto* 16, no. 70 (1996), 21, accessed March 23, 2020, https://pdfs.semanticscholar.org/dcae/3d099f2cffaceffb154064a98a5c5faefe07.pdf .
[10] Ibid.
[11] Vani Moreira, "O Desafio da Educação a Distância no Brasil." *Revista Educação em Foco* 7, no. 1 (2002): 1-13, acessed March 28, 2020, http://www.ufjf.br/revistaedufoco/files/2010/02/011.pdf

BRAZILSAT B3	1998-006A	February 4, 1998
BRAZILSAT B2	1995-016A	March 28, 1995
BRAZILSAT B1	1994-049A	August 10, 1994
SCD 1	1993-009B	February 9, 1993
OSCAR 17 (DOVE)	1990-005E	January 22, 1990
BRAZILSAT 2	1986-026B	March 28, 1986
BRAZILSAT 1	1985-015B	February 8, 1985

Table 1. List of satellites launched by Brazilian public and private entities. Most of these satellites can be classified as nanosatellites, and only 9 of them have been produced entirely in Brazil. In 2020, however, a new satellite manufactured in the country (Amazônia-1) should be added to the list. Amazônia-1 will be the first Earth observation satellite entirely developed by Brazil and it will be operated by INPE with a lifetime of approximately three years.[12]

Before turning the attention to the discussions of broadband access in rural schools as it pertains to the SGDC-1, however, it is important to define these terms in the Brazilian context. The definition of *broadband Internet* is quite fuzzy, which explains why it is nearly impossible to reach a global consensus of its meanings and implications in designing policy frameworks. If discussed decades ago, broadband access would likely mean anything faster than the basic rate integrated services digital network (ISDN), which offered speeds of up to 144 kbps.[13] However, the first designation of broadband Internet connectivity by the International Telecommunication Union's (ITU) encompassed any telecommunication network that had a minimum speed of 256 Kbps for downlink.[14] Many years later, the U.S. Federal Communications Commission (FCC) updated its term definitions to refer to broadband access anything that was 25 Mbps or beyond, which directly challenged previous definitions in place from as early as 1996.[15]

As these number variations demonstrate, the definition of broadband tends to not only vary from country to country, but also become obsolete in short periods of time, given that the access changes and the technology evolves. The Broadband Commission for Sustainable Development, formed by ITU and the United Nations Educational, Scientific and Cultural Organization (Unesco), considers a connection to

[12] Marília Marasciulo, "O que Falta para Termos Mais Satélites 100% Brasileiros no Espaço?" *Revista Galileu*, January 31, 2020, https://revistagalileu.globo.com/Tecnologia/noticia/2020/01/o-que-falta-para-termos-mais-satelites-100-brasileiros-no-espaco.html.
[13] "Birth of Broadband Executive Summary," *International Telecommunication Union*, September 2003, accessed March 10, 2020 https://www.itu.int/osg/spu/publications/sales/birthofbroadband/exec_summary.html
[14] Ibid.
[15] "2015 Broadband Progress Report," *U.S. Federal Communications Commission*, February 4, 2015, accessed March 10, 2020, https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2015-broadband-progress-report

be broadband when: I) it is always available (always on), with high capacity; II) it is able to transport large amounts of data per second and not at a particular speed; and III) it enables the combined delivery of voice, data and video simultaneously.[16] In Brazil, as it is the case for other developing countries, there is no single definition of what broadband Internet access is given that the concept widely varies depending on the available technologies as well as the user's needs and experiences in navigating the Internet. In this thesis, I rely on the definition the Brazilian government articulated in the Broadband National Plan (*Plano Nacional de Banda Larga*—PNBL), which is similar to ITU's. According to PNBL's base document, broadband access is characterized by "the provision of telecommunications infrastructure that enables continuous, uninterrupted information traffic with sufficient capacity for the use of data, voice, video applications as well as other socially relevant applications."[17] I find this concept useful for the thesis investigation because it is indifferent to the technology used and does not restrict mobility and portability—which are paramount in satellite Internet services.

Another fuzzy definition concerns the classification of what the government classifies as *rural schools*. In a country of highly diverse geographic conditions—complicated by the fast-evolving urbanization and that still reflects its colonial past—the typologies of "rural" and "urban" are highly controversial. Moreover, it is unquestionable that since the 1950s, the percentage of the rural population has been decreasing as cities are growing and sprouting in between, and people continue to migrate to other regions, although the number of people living in what the government characterizes as rural areas remains significant. One issue that emerges with that is the lack of a universal definition of rural schools. The relevant Ministry of Education classifies as rural schools those institutions that are in areas defined as non-urban by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*—IBGE), which varies drastically in terms of levels of "rurality." In fact, such an official definition of rural and urban is based on the laws that disregard the measurement of characteristics such as population size, occupation,

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[16] Eduardo Tude, "Fixed and Mobile Broadband: What is the Future of the Market," in *Broadband In Brazil: Past, Present, and Future,* ed. Peter Knight, Flavio Feferman, Nathalia Foditsch. Barueri: Novo Século Editora LTDA, 2016, 5.

[17] "Programa Nacional de Banda Larga," *Comitê Gestor do Programa de Inclusão Digital*. November 10, 2010, accessed February 10, 2020, 18, http://bibliotecadigital.seplan.planejamento.gov.br/bitstream/handle/iditem/225/documento-base-do-programa-nacional-de-banda-larga.pdf.

income, infrastructure, services, and others. As analyzed by geographer Eduardo Girardi (2008), the classification in Brazil is based solely on the areas whose population is classified as rural or urban according to the location of their domicile when responding to the census.[18] Therefore, the definition of rural and urban is materialized within the geographic boundaries of municipalities and their residents as they live, study, or work. In other words, the IBGE defines a rural population those located in zones beyond the urban areas that are characterized by "urban things" such as building, city infrastructure, intense human occupation, and other features possible due to urbanization.[19] For the purpose of this thesis, however, I refer to rural schools as institutions located in rural areas, and that responded as such as in the census provided by the Ministry of Education.

According to the latest dataset provided by the Ministry of Education, there are approximately 56 thousand schools in Brazil that are located in rural areas enrolling nearly 5.5 million students.[20] Out of these schools spread out in the country's five regions, only about 21 percent have access to broadband.[21] According to ITU, however, 67.47 percent percent of Brazilians had access to the Internet in 2017—in 2007, that percentage was around 30 percent, and in 2000 only 2.87 percent.[22] The same data also show that Chile and Argentina had higher Internet penetration rates in 2017, at 82.33 and 75.81 percent respectively, while Colombia, Peru, Venezuela, Ecuador, and Mexico scored below Brazil's.[23] As argued by media scholars in the past, digital inclusion is essential for economic development and enriching access to information, and it can be achieved through public policies and incentives on democratizing the Internet alongside policies for teaching and learning new media literacies.[24] It is based on this that I attempt to locate the SGDC-1 in

[18] Eduardo Paulon Girardi, "Capítulo: O Rural e o Urbano: É Possível uma Tipologia?" In *Proposição Teórico-metodológica de uma Cartografia Geográfica Crítica e sua Aplicação no Desenvolvimento do Atlas da Questão Agrária Brasileira.* (PhD diss., Universidade Estadual Paulista "Júlio de Mesquita Filho," 2008), 167, https://repositorio.unesp.br/handle/11449/105064
[19] Ibid.
[20] Ideb, 2018.
[21] Ideb, 2018.
[22] "Percentage of Individuals Using the Internet. Statistics." *International Telecommunication Union*, Accessed March 10, 2019, https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
[23] While these recent data point to significant improvement in the overall country's access to Internet services and overall good position in relation to other countries in South America, they fail to account for detailed profiling of the levels of domestic digital inequalities that one finds in the dichotomies around urban-rural schools.
[24] Henry Jenkins, *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century*. Cambridge: MIT Press, 2009, 2-23.

relation to other rural public schools similar to the one in Pacaraima, often characterized as "dark spots of information" in the eyes of the government and public policies.

Satellites Through the Lenses of Media Studies

From a media studies and communication point of view, there is no doubt that satellites have historically played a decisive role in the expansion of the mediascapes in the United States and beyond. Communication studies scholar James Schowch (2009) argues that during the Cold War, especially in the 1960s, satellites were mainly representatives of two vast realms: one of the "global military power" and one of the "big science."[25] These two realms essentially capture the geopolitical conditions of the time, whose technical and non-technical conditions helped pave the way for the events of the Space Race, and, most importantly, by the struggles over the ideological circumstances post World War II. From analyzing visual media content associated with space technologies during the Cold War to critically assessing how media industries are responding to "big tech" companies expanding their power via Internet satellites while attempting to "connect the unconnected," media scholars provide useful critiques to these technologies in a wide variety of ways. By dealing with representation and semiotics, rhetoric and persuasion, media industries and political economy, governance and regulation, among many others, new cultural understandings are possible, and thus novel futures are imagined through interdisciplinary lenses one finds in the field of media studies.

To critically assess the relationship between satellites and the critical and interdisciplinary lenses of media studies, it is essential to briefly sketch the origins of the communication satellites and their immediate cultural response in the form of political propaganda. That is to say that, considering the lengthy debates over the nature of movements (from Aristotle's idea of a natural place to Newton's *Principia*), it was not until the Space Race that the idea of an artificial satellite moved from matters of science fiction to reality. Many consider the prominent British science fiction Arthur C. Clark as one of the most influential proponents of the objectification that a human-made object can be put into orbit, though not necessarily the inventor of

[25] James Schwoch, *Global TV: new media and the Cold War, 1946-69*. University of Illinois Press, 2009, passim.

the concept itself.[26] In a published article in the *Wireless World* magazine in 1945, Clarke proposed a geostationary satellite communication that would allow world-wide radio coverage for long-distance communication (fig. 4). In turn, these satellites would become emblematic to in helping advance what later came to be famously known as McLuhan's notion of a "global village," where "time has ceased," "space has vanished" and where the feeling of a "simultaneous happening"[27] is prevalent—characteristics that one could arguably be associated with the global Internet as we experience it today.

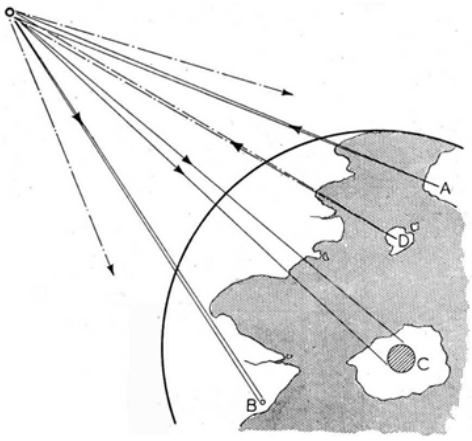

Figure 4. Communication satellite illustration by Arthur C. Clarke in 1945. With transmission from A being relayed to point B and area C; transmission from D being relayed to whole hemisphere, Clarke refers to the system as a "typical extra-terrestrial relay services"

While referring to his pioneering idea as "an immediate post-war research project," Clarke predicted that when achieving enough speed in flight outside the Earth's atmosphere, a rocket would never return to Earth, becoming an "artificial satellite, circling the world forever with no expenditure of power—a second Moon."[28] With the launch of the Sputnik 1 after more than a decade later as a "space-age icon," the first artificial Earth satellite, the Soviets showed that the technology of war could also assume a peaceful use. However, one could argue that their intentions were different.[29] Given the technological impact of the Cold War in an ideologically

[26] Walter A. McDougall, "Heavens and the Earth: A Political History of the Space Age." Baltimore: Johns Hopkins University Press, 1997, 352.
[27] Quentin Fiore and Marshall McLuhan, *The Medium is the Message*, New York: Random House, 1967, 63.
[28] Arthur C. Clarke, *Greetings, Carbon-based Bipeds!: Collected Essays, 1934-1998*. Macmillan, 2001, 21.
[29] Kim Mcquaid, "Sputnik Reconsidered: Image and Reality in the Early Space Age." *Canadian Review of American Studies* 37, no. 3 (2007): 371-401, https://doi.org/10.3138/cras.37.3.371

polarized world, the cultural symbolism enacted by space-enabled technologies illustrates the idea of a sense of exceptionalism that is later exploited in the form of propaganda through several media technologies of the time: postcard, radio, TV, posters, and many others (fig. 5).

Figure 5. A USSR postcard celebrating Sputnik's launch on October 4th, 1957 as the Earth's first artificial satellite followed by a Sputnik 2, launched on November 3rd, 1957. (Source: NASA)

Fast forward a few decades since Clark's fictional visions of the communication satellite, various other questions continue to swiftly shape the conventional view on what these technologies are becoming representatives of in our contemporary imaginaries, such as: what are the major implications as the private sector continues to advance in satellite research and development? How does the growing participation of developing countries in the satellite industry impact the local, regional, and global contexts? What are the appropriate uses and opportunities in using satellites to help foster sustainable development? While I do not offer answers to these questions in this thesis, they increasingly deserve more attention and critical analysis by media and communication scholars.

As shown in the extensive work of media scholar Lisa Parks on the relationship between media infrastructures, global circulation of information, and social power, the exacerbated academic focus—and, consequently, overemphasis—on questions appurtenant to the radio, television, and the Internet might lead media and

communication scholars to overlook the real importance of satellites as cultural objects—artifacts that largely remains obscure or unintelligible to the general public, media industries, researchers, or policymakers.[30] Hence, a humanistic approach in rethinking satellite technologies may help us shed light on questions that are often obscured by engineers, governments, and other institutions of power. Relevant to the context of media technologies and the sociocultural protocols around their different uses and domestications, scholars have written on a myriad of non-technical dimensions of the satellite that covered, among other things: the emergence of satellite TV networks and "offshore democracies" across the Arab-speaking world;[31] the advance of media apparatuses in outer space and their connection with cosmobiopolitical projections and accumulation of capital;[32] the intricate relationship between public interest and safeguarding in the era of satellite industry and the digital age;[33] the satellite broadcasting and television news exchange system in Africa;[34] the burgeoning of a new media ecology with the development of satellites in Asia;[35] the early efforts to develop a regional Andean satellite;[36] the ongoing industry efforts to bring Internet connectivity to the most remote regions of Africa, Latin, America and Asia via the deployment of satellites in LEO orbit;[37] and many others.

Of vital inspiration for guiding my critical analysis in this thesis has been the book *Down To Earth: Satellite Industries, Technologies, and Cultures* (2012) edited

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[30] Lisa Parks, *Cultures in Orbit: Satellites and the Televisual.* Durham/London: Duke University Press, 2005, passim.
[31] Naomi Sakr. *Satellite Realms: Transnational Television, Globalization, and the Middle East*. London: I.B. Tauris, 2002.
[32] Katarina Damjanov, "The Matter of Media in Outer Space: Technologies of Cosmobiopolitics." *Environment and Planning D: Society and Space* 33, no. 5 (2015): 889-906. https://doi.org/10.1177/0263775815604920
[33] Christian Bovet and Pranvera Kellezi. "Satellite industry and the digital age." *Global Media and Communication* 4, no. 3 (2008): 261-275, https://doi.org/10.1177/1742766508096081
[34] Patricia A. Holmes, "URTNA, AFROVISION, and satellite broadcasting: The birth of a television news exchange system in Africa." *Howard Journal of Communications* 7, no. 2 (1996): 139-149, https://doi.org/10.1080/10646179609361720
[35] SN Lee Paul and Georgette Wang, "Satellite TV in Asia: Forming a new ecology," *Telecommunications Policy* 19, no. 2 (1995): 135-149, https://doi.org/10.1016/0308-5961(94)00014-j
[36] Sylvia Ospina, "Project Condor: An Analysis of the Feasibility of a Regional Satellite System for the Andean Pact Countries." Unpublished Dissertation (1988) Montreal: McGill University.
[37] Matthew Graydon and Lisa Parks, "'Connecting the unconnected': a Critical Assessment of US Satellite Internet Services." *Media, Culture & Society* 42, no. 2 (2020): 260-276. https://doi.org/10.1177/0163443719861835

by Lisa Parks and James Schwoch.[38] In other words, such an approach of critical analysis of the satellite as technological, political and cultural artifact has heavily impacted my attention to this field, drawing my interests especially to the new forms of scholarships and research methods that are needed to better understand the historical and cultural moment in globalization as developing nations continue to engage in space exploration in order to build macro-scale telecommunication projects that drastically shape the future of globalization and conditions of modernization in different parts of the globe. Therefore, as a cultural and political artifact, a critical media studies assessment the SGDC-1 beyond its technicality is also an attempt to unravel its relationship to other prevailing societal challenges such as social and digital inclusions, helping yield a deeper and nuanced understanding of the undergirding political economy tactics that makes its manufacturing, launching, and operation possible as part of a Brazil's political strategies.

Communication Satellites in the Context of the Global South

Aside from being motivational questions that drive my goal in scrutinizing the satellite both as a cultural and political object, rather than solely a technical artifact, these are some of the many questions that are continuing to swiftly evolve as satellites occupy increased political participation in human activities: from private satellite manufacturing to government-funded projects of broadband inclusion. Especially in the context of developing nations, this discussion gains an extra layer of significance. In her scholarly analysis in building technological capability within satellite programs in the Global South, engineer and international development scholar Danielle Wood (2011) proposes a framework of analysis that considers the objective, technically rational motivations for the development of satellites in regions beyond the U.S. and Western Europe, demonstrating their powerful potentials to help nations achieve the United Nations Development Goals (SGDs). Particularly in the

[38] In this volume, interdisciplinary scholars from fields as diverse as communication, media studies, geography, and public policy explore the relevance of satellite technologies in relation to a number of issues, articulating concepts belonging to the organization of territories, the restructuring of mediascapes in face of the current developments in the satellite industry, and the issues surrounding orbital domains as we continue to extend our presence beyond Earth's planetary boundaries. To be more precise, the scholarly work of that volume "focuses on the material effects and functions of satellites, the countries, and companies that develop them, the cultures they generate, the orbital paths they occupy and the industries of which they are part."

discussion of why developing countries are developing satellite programs, Wood acknowledges that, in addition to the technical capability, "national governments are influenced by many non-technical factors when they consider space policy decisions, including factors such as geopolitical relationships, regional status, military postures, and national pride."[39] Correspondingly, "subjective, political factors such as national pride, geopolitical relationships and regional competition do shape decisions about whether and how to invest in space."[40] It is in relation to such interdisciplinary discussions that new scholarly attention gains special importance to account for the ongoing satellite programs now taking place worldwide: from government-led research efforts in South America to new ambitious regional satellite programs in Africa. Therefore, it is precisely within the contentious, subjective, and highly politically charged context of non-technical factors that this thesis develops.

If in the Cold War the ultimate means of global destruction became discursively intertwined with the ultimate means of global communication, what is the relevance of analyzing government satellite programs that promise to increase social welfare and democratize, among other things, broadband Internet access for those in remote areas? These questions are oriented mainly by the conundrum that links technological progress to economic and political agendas. This, in turn, is heavily influenced by subjective forces that go beyond the satellite as a technologically functional object; hence, involving social, ideological, economic, and cultural dimensions that are often infused in telecom projects but strategically hidden from the publics. Furthermore, in a creative analogy to ancient trade routes of goods around the world, communication scholar Monroe Price (2002) writes that today's improvements in satellites technologies "add further complexities, just as changing shipping technologies did in seventeenth- and eighteenth-century trade routes."[41] The critical analysis of satellite technologies in the context of the Global South is, therefore, valuable as it helps provide a richer comprehension of the geopolitical, economic, and technological factors that determine the entities accessing space and re-writing matters on the ground with deep societal implications. From rolling out

[39] Danielle Wood and Annalisa Weigel, "Building Technological Capability within Satellite Programs in Developing Countries." *Acta Astronautica* 69, no. 11-12 (2011): 1110-1122. https://doi.org/10.1016/j.actaastro.2011.06.008
[40] Ibid., 1115.
[41] Monroe Edwin Price, "Satellite Broadcasting as Trade Routes in the Sky." *Public Culture* 11, no. 2 (1999): 387-403, https://doi.org/10.1215/08992363-11-2-387

telecommunication systems to reshaping cultural epistemologies to the use of media technologies, a closer look into the development and uses of communication satellites may help scholars to closely examine structures of power and better contextualize the government's maneuvers in advancing some idealized notions of social welfare and modernization.

Communication satellites are frequently intertwined with such discourses as they reconfigure the diffusion of media information on a global scale while re-shaping economic and territorial practices. In fact, satellites are used for communication anytime they transmit a signal from one location to another. Wood (2011) writes that this information "may be in the form of a phone call, radio broadcast, Internet link or video or other data stream."[42] In addition to providing distance phone and internet connections, satellite communications in developing countries include telemedicine and tele-education, which is enabling "helps connect local health care workers with support from information and personnel in other areas"[43] and "students connect with teachers, curricula and course assignments from a distance."[44] Despite the potentials associated with tele-education and telemedicine, access to the Internet remains an enormous problem that private companies and governments are addressing, often under the rhetoric of "connecting the unconnected." In relation to international development, satellite communication helps supports many of the UN SDGs, such as goal #9, Industry Innovation, and Infrastructure,[45] helping connect rural or remote communities that lack telecom infrastructure.

Additionally, communication satellites are the most commercially successful out of the four satellite applications and frequently make it to global news headlines, insofar aero and outer space are being explored by private companies such as O3b, SpaceX, Telesat, Facebook, Amazon, and Google—companies that have a tendency of elevating public personalities such as Elon Musk and Jeff Bezos to the status of visionary leaders.[46] Especially starting in 2015, there has been a new wave of proposals of Low Earth Orbit (LEO) mega-constellations to provide broadband

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[42] Wood and Weigel, "Building Technological Capability," 1111.
[43] Ibid., 1112.
[44] Ibid.
[45] Danielle Wood and K. J. Stober, "Small Satellites Contribute to the United Nations Sustainable Development Goals." AIAA/USU Small Satellite Conference, Logan, Utah, 2018.
[46] Áine Cain, "We compared Elon Musk and Jeff Bezos to find out who's the more successful visionary," *Business Insider*. Accessed December 10, 2019, https://www.businessinsider.in/we-compared-elon-musk-and-jeff-bezos-to-find-out-whos-the-more-successful-visionary-heres-the-verdict/articleshow/62748214.cms.

Internet connectivity. Of great global media coverage have been SpaceX's Ku and Ka-band systems called Starlink Project (fig. 6 and 7). Networked System scholar Mark Handley (2018) presented a visual simulation based on the available FCC documents, which predicted 4,425 satellites as part of Starlink's constellation and SpaceX's goal of delivering the "world's most advanced broadband Internet system" to locations where access remains unreliable, expensive or completely unavailable.[47]

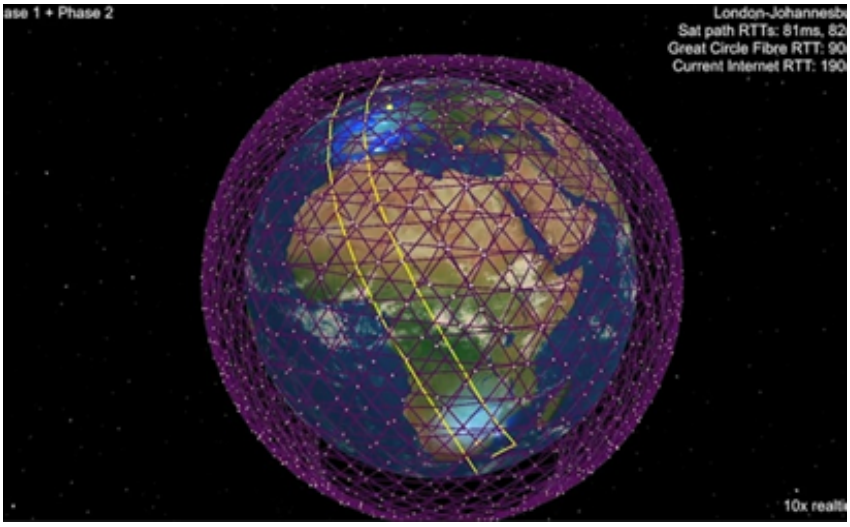

Figure 6. SpaceX's constellation illustration for the Starlink Project. The illustration displays the potential orbital paths of the 4,425 satellites as showed in a simulation by Handley, which was based on the FCC documents. (Source: New Scientist)

Figure 7. Photo of 60 Starlink satellites stacked together upon launching on May 24th, 2019, with a view of the Earth in the background. (Source: New York Times)

[47] Douglas Heaven. "The First Detailed Look at How Elon Musk's Space Internet Could Work." *New Scientist*, November 7, 2018, https://www.newscientist.com/article/mg24032033-300-the-first-detailed-look-at-how-elon-musks-space-internet-could-work/.

Aside from the connectivity potentialities these projects may bring to remote regions in the Global South, scholars also point to the many problems that they may cause, such as the privation and monopolization of space and commercial space imperialism, as well as questions of light pollution that might negatively impact scientific research by on-ground telescopes, which led astronomers to express fear surrounding the possibility that Starlink satellites may outnumber all visible stars in the near future (fig. 8).[48]

Figure 8. Photo of the Startlink Project's satellite constellation as seen in the night sky over the Netherlands, nearly 24 hours after being launched by SpaceX in May 2019. (Source: The New York Times)

The advancement of these Internet satellite projects over the past two decades has captured the attention of scholars such as engineering and computer scientists Gorry Fairhurst, Luca Caviglione, and Bernhard Collini-Nocker (2008), who identified satellite technology as playing a fundamental role in Internet systems of the future, particularly in places that lack the infrastructure to support broadband and that are still overcoming the colonial impacts from previous centuries.[49] Additionally, these multi-billionaire companies profoundly rely on delivering high-profile media events campaigns under the rhetoric that satellite constellations are the next big leap forward before sending humans to Mars or that space-enabled technologies hold developmental promises for all nations. Such a "connecting the

[48] Shannon Hall,"After SpaceX Starlink Launch, a Fear of Satellites That Outnumber All Visible Stars." *The New York Times*, June 1, 2019. https://www.nytimes.com/2019/06/01/science/starlink-spacex-astronomers.html.
[49] Gorry Fairhurst, Luca Caviglione, and Bernhard Collini-Nocker, "FIRST: Future Internet—A Role for Satellite Technology." In *2008 IEEE International Workshop on Satellite and Space Communications*, pp. 160-164. IEEE, 2008, https://doi.org/10.1109/iwssc.2008.4656774

unconnected" narrative, coupled with technological determinism, largely helps drive the shiny publicity behind these private companies, making their brands and commercial models gain increased news media coverage and public attention. Regardless of these being achievable or utopic commercial projects, they tend to persuade the publics to believe that their ambition, high level of investment, and arguably social welfare commitment are capable of serving the most underserved communities across the world via the deployment of satellite of constellations and other macro and meso infrastructures.

Therefore, it is safe to argue that the "connecting the unconnected" discourse has direct implications on how we think of the "global village." In his early writings articulating about the term in the 1960s, Canadian philosopher Marshall McLuhan contended that it is through the "electronics that we have discovered that we live in a global village."[50] That is because with electronics, "any marginal area can become center, and marginal experiences can be had at any center."[51] Such a perspective has intriguing insights within the context of using satellites for providing broadband connectivity to rural areas, as they may help nations to leapfrog stages in development by promoting access to information and helping members of the public to participate in decision-making processes.[52] Particularly in the context of government satellites, those that are fully or partially funded by ordinary taxpayers, satellites are also emblematic of "a complex institutional history and imperceptible signal traffic."[53] When scrutinizing such sets of signal trafficking, thus, it is critical to pay attention to the "financial, temporal, regulatory, and intermedial dimensions of the satellite economy and to recognize that this part of the culture industry synthesizes and alternates between scientific, military, entertainment, and educational modalities."[54] In turn, these alternations of discourse is closely intertwined with the social and digital inclusions I tackle in scrutinizing the SGDC-1 within the rural public school context in Brazil.

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[50] McLuhan, letter to J. Tyrwhitt (23 December 1960), in *Letters of Marshall McLuhan*, ed. M. Molinaro, C. McLuhan and W. Toye (Toronto: Oxford University Press, 1987), p. 277–8
[51] Ibid.
[52] "Space Solutions for the World's Problems: How the United Nations Family Uses Space Technology for Achieving Development Goals." *United Nations Office for Outer Space Affairs*, 2005. Accessed on April 5, 2020, https://www.unoosa.org/pdf/publications/IAM2005E.pdf
[53] Lisa Parks, "Obscure Objects of Media Studies: Echo, Hotbird and Ikonos." In *Strange Spaces*, pp. 113-128. Routledge, 2016, https://doi.org/10.1093/fs/58.4.572.
[54] Ibid.

When I refer to connecting rural schools to the "global village" instead of just "the Internet," I precisely refer to this encompassing notion of belonging and not merely access, as rural areas have often been understood as regionally, culturally, economically disconnected from the rest of Brazil and what is beyond the country's political borders. The sense of "every-where" is "now-here"[55] is an attempt to think of the "rural" as increasingly part of the "urban" as media technologies and Internet permeates the fabric of everyday life in a multitude of ways, thus changing the citizens' perspective and notions of the local, regional, national, and global. As discussed by other scholars in the past, the understanding of what constitutes the "global village" is much more about the "dynamic relationship between a mediated sense of the 'local' and an equally mediated sense of the 'global', with neither term a stable demarcator for the other."[56] The SGDC-1, thus, demands to be understood as part of a political system operated by institutions of power that often avoid being accountable for their actions. As illustrated through the words of Brazilian geographer Milton Santos,

> When the political system formed by governments and companies utilizes the contemporary technical systems and their imaginaries in order to produce the present globalization, it points to relentless forms of economic relationships that present themselves as being unquestionable and requiring blind obedience. The actors who refuse this obedience are thrown off the stage or remain as slaves of a logic that is indispensable to the functioning of the system as a whole.[57]

Here, unraveling the understanding of the rural in relation to the satellite provides interesting insights that are often overlooked by scholars focusing on centers of power or those that dictate the *modus operandi* of the "global village."

Having said that, it is crucial that new forms of the scholarship are at play so we can better apprehend the contentious social, ideological, economic, and cultural implications of satellite development over time and across different points of view and disciplines. Such a scholarly exercise may help increase our understanding of how nation-states and companies enact or hinder new forms of power in space and how, in return, the technologies they create might impact life on Earth. Grounded on a

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[55] M. McLuhan and B. Nevitt, *Take Today: The Executive as Dropout* (Don Mills: Longman, 1972), 297.
[56] Richard Cavell, "In-Corporating the Global Village," In *McLuhan's Global Village Today*, pp. 21-28. Routledge, 2015.
[57] Milton Santos*, Por Uma Outra Globalização: do Pensamento Único ao Pensamento Universal*. Rio de Janeiro: Record, 2002, 20.

research approach that emphasizes and addresses the non-technical dimensions of satellites, it is my hope to expand the terrain of inquiry to encompass not only questions of technology capacitation or potentialities linked to sustainable development—which often remains confined in STEM-related fields and/or public policy domains—but also to shed light on the non-technical that is certainly as influential in the unfolding of space-enabled technologies as the technical dimensions. As highly sophisticated space-enabled technologies, satelleite emerge as significant political objects for such a critical approach.

To summarize, my approach to contextualize the SGDC-1 and its footprints within the political boundaries of the vast Brazilian territory is guided by my interest in locating such technology in relation to primarily existing political, social, and cultural configurations. As recommended by other media and communication scholars in the past, I consider "the satellite" not only as a highly complex assemblage of electronic-based technology that orbits a celestial body to achieve a predetermined set of tasks. Instead, I start this research endeavor by evoking the fact that satellites are also political objects that is deeply bonded to a myriad of human systems that enable its existence, operation, and maintenance from afar—both physically and temporally. All of this to say that I undermine the importance of elucidating the conditions that the satellite technologies are predicated on: the preexisting histories around it; the societal and cultural conditions that justify its civic importance or economic progress; the development of scientific and technical know-how; the transnational and local technology transfer as part of building domestic technological capability; the political economy conditions that paved the way for its manufacturing, launching, and operation; the several uses it can help promote social and digital inclusion. Hence, this thesis critically examines media cartographies and discourses surrounding the SGDC-1 and points out how Brazil's strategic agendas and modernization campaigns were channeled into connectivity initiatives in rural schools.

Research Questions, Methods, and Outline

Based on the discussion of the satellite as critical objects of media infrastructures that are interwoven with fast-evolving processes of globalization,

media and information flows, geopolitical strategies, social welfare possibilities, and expansion of power, this thesis is an investigation of the following research questions.

1. What is the relationship between the SGDC-1's civil capacity and rural schools?
2. What does the government's orchestration of the televisual reveal about the SGDC-1 and its collective image as a savior of broadband connectivity?
3. What are the main hidden points of contention that might hinder the continuity of the SGDC project to serve the "unconnected" in the foreseeable future?

No single research method can tackle all these questions simultaneously. In other words, the amplitude of these research questions reaches much beyond the makings of the satellite as a technological object engineered for pre-defined tasks, which requires interdisciplinary methodological approaches. To answer the research questions, I rely on a triangulation of three different methods: I) historical and data analysis; II) a critical and close-reading analysis of televisual texts; and III) government reports, news media, and footprint analysis.

The triangulation of methods I propose is useful not only because it sheds light on the socio-technical aspects of the SGDC-1 but also because it allows for a temporal analysis spanning from the past, going through the present, extrapolating onto the future. It also helps us scrutinize the satellite beyond its black-box nature of highly complex technicality, thus revealing their media discourses, power struggles, and narrative framing as part of a much larger and complex media ecosystem. From discussing rural school students to influential political figures in the federal government, this thesis is also an exercise to contextualize what are often framed as opposing realities: the poor vs. the rich; the connected vs. the unconnected; the information-haves vs. the information have-nots; and the high-capital technology vs. the remote rural.

Given the long-duration of the satellite as a macro-scale infrastructure and its nation-wide reach in connecting Brazil's "the dark spots of information," I believe that a media studies approach holds power to enrich and complicate the understanding of government-funded projects. Consequently, such a humanistic approach also offers valuable insights when it comes to potential policy frameworks for generations to come. Therefore, it is my hope that this thesis will help pave the way for future research questions involving ownership, public-private partnerships, control,

financing, regulation, and socioeconomic development for future Internet satellite projects in Brazil.

To elaborate on each research question proposed in the triangulation of methods, I organize this thesis into three chapters. I start out each chapter with relevant images, maps, illustrations, and parallel anecdotes to prepare the reader for the intended discussion within the Brazilian context. As I contextualize the major points in each chapter, I also rely heavily on the facts, situations, and provocations posed by reliable coverage of Brazilian news media.

In Chapter 1, I contextualize the historical concept of the digital divide in the United States in relation to rural public schools and relevant government-led telecom infrastructure policies in Brazil to map out the current state and conditions of broadband connectivity. Through historical and data analysis, I set up the discussion to investigate the contention points at which the conditions of broadband access, rurality, and telecom policy intersect within the context of the SGDC-1. By locating the term digital divide and its expansion, I demonstrate how the government's categorization of rural schools as "dark spots of information" speak to the development of two extremely relevant policies aimed at connecting the unconnected: GESAC (e-government) and PNBL (National Broadband Plan). Although a great deal of these policies has failed on so many levels, I argue that these two policy frameworks in particular helped pave the way for the need of a government-owned communication satellite to connect Brazil. Then, I further articulate some of the most recent data on public schools in Brazil to provide a contextual glimpse of the urban-rural dichotomies faced by students in rural areas. The so-called "digital divide" or "dark spots of information," as a consequence, appears as naturally fixed according to the positioning of prominent government figures like Brazil's Minister of Science, Technology, Innovation and Communication Marcos Pontes. Nevertheless, I argue new modes of scholarly engagement to guide policy framework that takes into account local, regional, global cultural, economic, and technological specificities are needed.

In Chapter 2, I explore the relationship between the government's orchestration of the televisual as well as the framing of the satellite as a savior of connectivity for the so-called "dark spots of information" that Chapter 1 investigates. Using critical and close-reading analysis language drawn from film studies, I analyze a documentary broadcasted in a Discovery Brasil's TV series, *Brasil Ciência*, that was

commissioned by MCTIC to demonstrate how the SGDC's civil-military nature is intertwined with the "voice of the documentary," reiterating the social inclusion mission of rural school connectivity and national pride. Then, I proceed to examine how the dialectics of distance plays out in Brazil via satellite-enabled videoconferencing between top politicians from the federal government and those in rural schools who are perceived as the "unconnected." These televisual media texts are crucial because they allow for an exploration of their representation and framing in the conditions of creation and their relationship to government entities mediated by the SGDC-1. I argue these two case studies are characterized as high-profile media events that are worth studying because they are provocative on how the use of specific televisual codes constitute what I later suggest as a "space-telecom propaganda" orchestrated by the Brazilian government. Therefore, the televisual orchestration of the SGDC-1 reveals the Brazilian government's idealized narrative that connect the apparent growing investments related to science and technology as a way to distract the publics from the reality that remains in place for those in rural areas.

In Chapter 3, I turn my focus to SGDC-1's sociotechnical relations on the ground. Through the critical method of document and satellite footprint analysis, I explore the extent to which such a "space-telecom propaganda" narrative plays out in relation to the sociotechnical systems that enable the satellite's functionalities in "connecting the unconnected." By analyzing government reports, congress hearings/presentations, and news media coverage, I argue that while the government desires to propagate a domestic branding of social and digital inclusion by connecting rural schools to the SGDC-enabled broadband, it fails to acknowledge three critical shortcomings that hinder such a vision. First, the reliance on a single, public, high-capital, and complex object with a limited lifetime operated by a company that could be, at any time, be fully privatized (as it was in 1997), or that has no-redundancy built-in. Second, the issue of reaching the satellite's total transponders capacity in the Ka-band in the next years if the on-ground installation rates continue as it is. Third, the issues regarding government uncertainty and recent budget cuts that recently suspended the process of acquiring SGDC-2 and SGDC-3 (which the original legislation predicted that the second satellite would start its manufacturing by 2020). These three issues point to a potential infrastructural and connectivity breakdown that rural schools may face in the future if actions are not taken seriously by the responsible entities.

As a mixed-method qualitative research project, this thesis examines not only the content of visual media and government documents, but also their provenance, motivation, and context to the realities of rural schools. Together, these chapters expose the political maneuvers of representation of the SGDC-1 and its hidden footprints to propagate the collective sense of the satellite as a motif for national pride, territorial integration, and social and digital inclusions. Each chapter help construct a media cartography of the satellite as a cultural and political object—one that is orchestrated by the government but also made felt by the publics as media infrastructures are put in place, and the "unconnected" become full participants in the global media economy. I demonstrate how the SGDC-1 project functions not only as a high-technological artifact but also as a political tool interwoven with the government's efforts to shape how citizens engage with notions of the "global village" and "digital divide."

Based on that, I argue that the government characterization of public rural schools as "dark spot of information" fall into the problematic narratives of the term digital divide. Moreover, by selling the image of the SGDC-1 as a savior of connectivity through the orchestration of the televisual, the Brazilian government utilizes the project as kind of space-telecom propaganda, showing how the current infrastructural developments funded by the government are helping leverage social and digital inclusion as well as forge national integration and domestic pride.

Through a critical media studies approach, I describe how the satellite's sociotechnical relations reveal what remains largely obscure to Brazilian publics. From questions pertinent to militarization, governance, and public-private partnerships to issues of long-term strategies, sustainability, and potential infrastructural disruptions, I argue these issues deserve public scrutiny as the SGDC project might be at stake in the foreseeable future given the current political conditions. To mitigate those potential shortcomings, I suggest the creation of a National Internet Satellite Plan to undertake some of these questions and orient future policy frameworks that may rely on the SGDC's constellation for broadband-enabled inclusion, national integration, community development, and socioeconomic progress.

Before proceeding, however, there are two things that I would like to emphasize. First, such a critical cultural studies approach of the satellite as a political and cultural object might appear, for some, as an inefficient strategy for proposing policies or guidelines aimed at solving specific problems. For others, it may also seem

as somewhat imprecise (or mistakenly understood as useless by researchers in STEM fields) in offering pragmatic, measurable predictions for foreseeing events. Alongside other engineering-oriented approaches such as systems architecture, the critical analysis through the lenses of media studies could work alongside other analytical frameworks. In this thesis project, my main goal in is to propose a more in-depth humanistic analysis. Accordingly, it is my goal to locate such a critical discussion within the broader fields of humanities and the social sciences, thus following Jerome B. Wiesner's recommendation (1980) regarding the importance of scientists and engineers to be steeped in humanistic learning, and the growing need for humanists to be educated with a deep appreciation of modern science. In face of the technological transformations we are currently undergoing, Wiesner suggests that "all learning must be linked with a broad concern for the complex effects of technology on our evolving culture."[58] Hence, the interdisciplinary approach for this thesis is what drives my research interests in critically mapping the use of a government program satellite in promoting inclusion.

Second, my observation of the SGDC-1 as part of a larger social system is also guided by the notion that as enigmatic, remote, and imperceptible objects of study for most social scientists, humanists, non-engineers, and the civil society more broadly, satellites demand interdisciplinary approaches, methodological experimentation, and creativity to appropriately locate its relationship to life on Earth and, potentially, advance justice and support sustainable development for generations to come. As recommended by Parks and Schwoch (2012), it is of growing importance for "researchers to further consider satellites as an important component of many disciplines and fields of scholarships."[59] Within the field of media and communication studies, they also point to the fact that satellites demand nuanced and varied ways of reflecting on media production, consumption, and distribution in the globalization era. Along those lines, the authors suggest that "satellite also require a critical approach that sets broadcasting and telecommunication into play with such issues as migration/displacement, geopolitics, natural resources development, and cultural

[58] "Innovation Management Essentials: Impactful Demos." *Innovarista*, April 30, 2016. https://innovarista.org/2016/04/29/innovation-management-essentials-impactful-demos/.
[59] Lisa Parks and James Schwoch, eds. *Down to Earth: Satellite Technologies, Industries, and Cultures*. Rutgers University Press, 2012, 3.

translation."[60] All in all, I attempt to undergo a similar analysis but with a focus on Brazilian rural public schools as sites of exacerbated social and digital inequalities.

[60] Ibid., 6.

Chapter 1: Examining the "Dark Spots of Information"

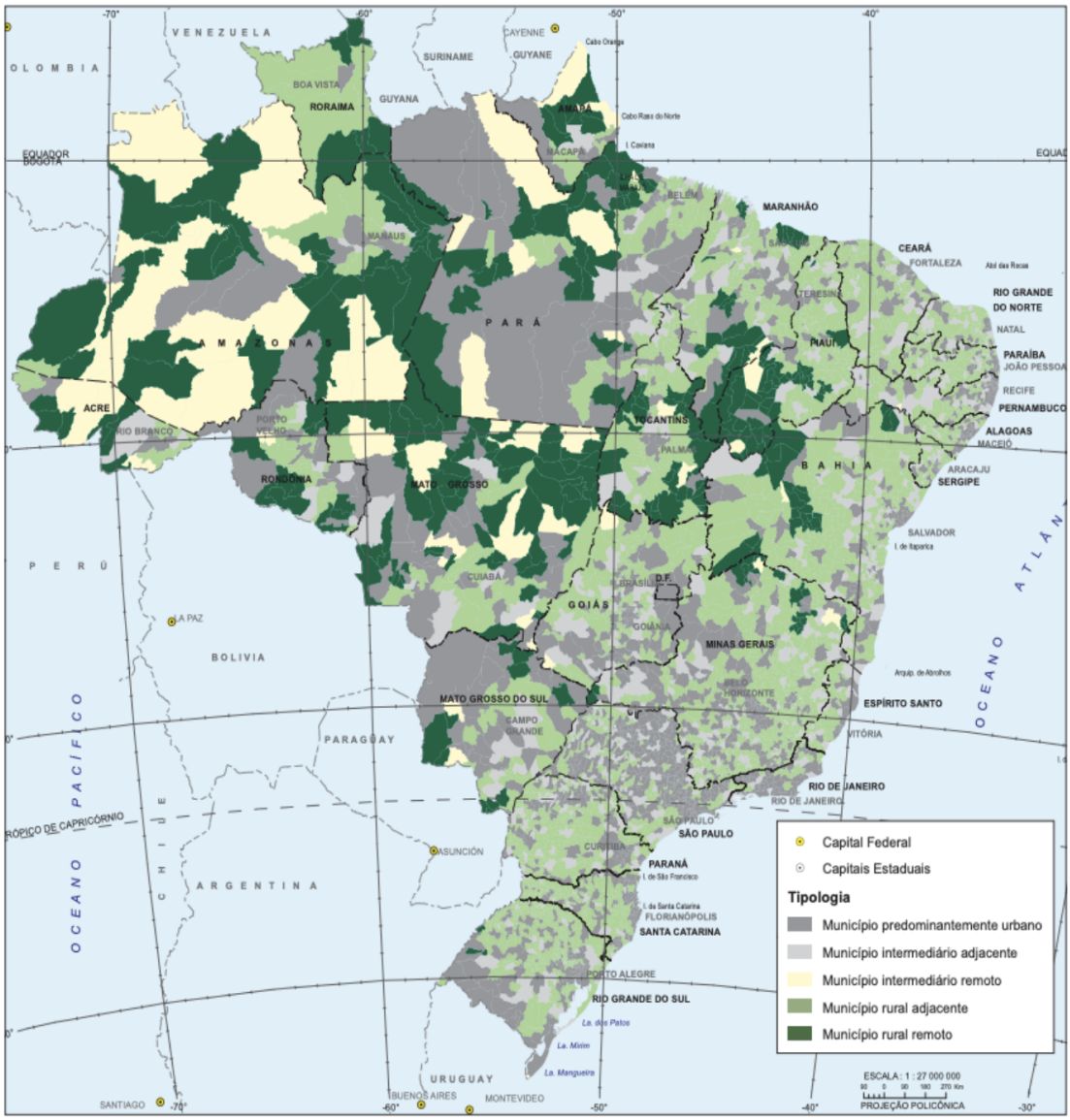

Figure 9. Map of the Brazilian territory displaying the rural-urban typology of municipalities as defined in the 2010 census by the Brazilian Institute of Geography and Statistics. (Source: IBGE)

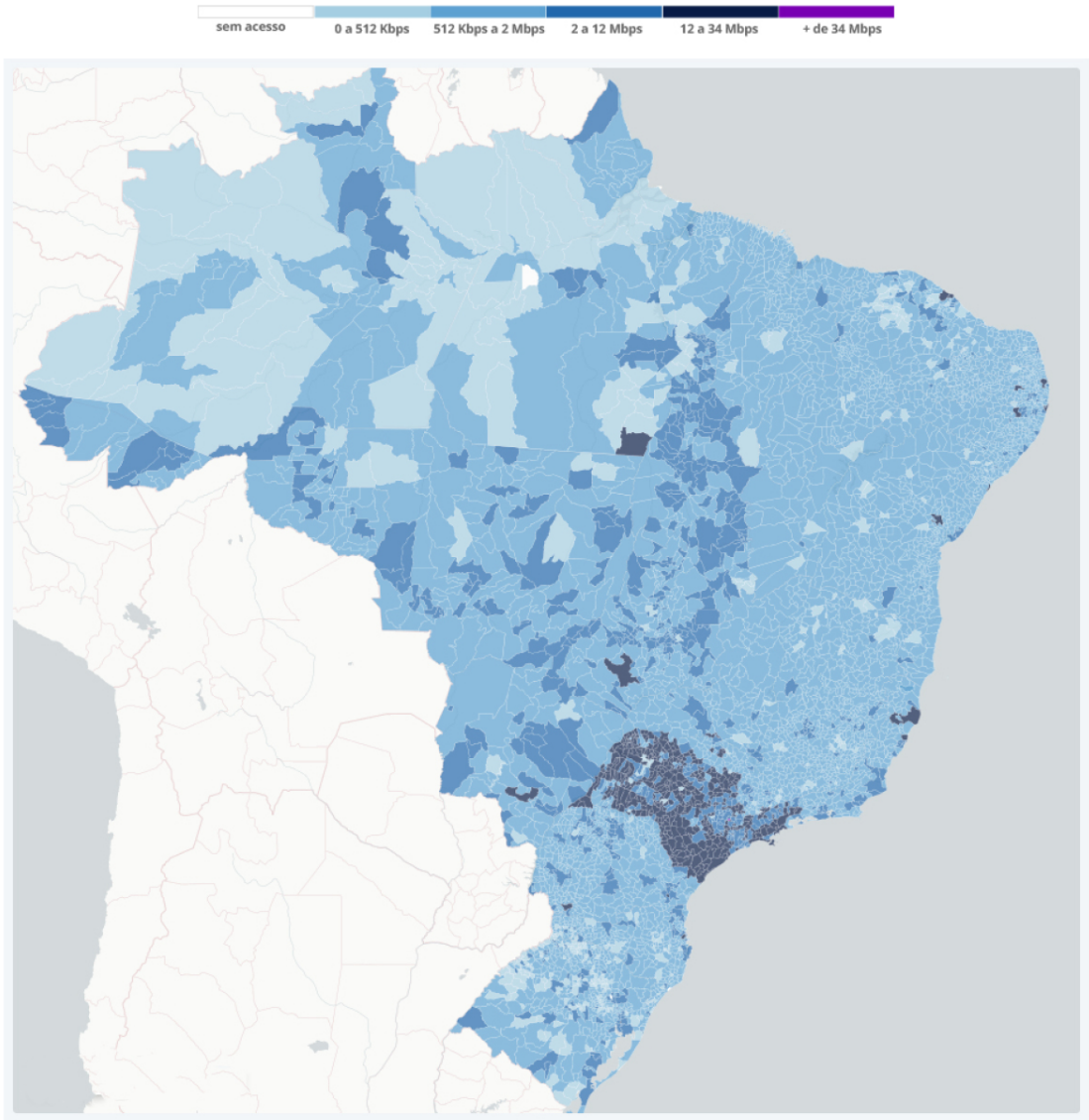

Figure 10. Map showing the average Internet connectivity speed through the Brazilian territory based on the available connectivity points in each municipality, as defined by Brazil's National Telecommunications Agency. (Source: ANATEL)

In 2018, during a press conference with high officials from the federal government and journalists, the Minister Science, Technology, Innovation and Communication Marcos Pontes, Brazil's first astronaut to go to space in 2006 as part of a multi-millionaire consortium with NASA, used the term "dark spots of information" to refer to rural public schools as institutions that often lack Internet connectivity. His speech sets out to position, in the public's imaginary, the civil capacity of the SGDC-1 as a broadband connector to rural schools. Consequently, the view of the satellite as such has direct implications on the ways in which teachers implement novel pedagogies while benefiting from the magical potentials of the broadband to connect students to the "global village." Broadband access is, therefore,

seen as a powerful strategy to help leverage social and digital inclusions in regions that long lacked telecom infrastructures. By intertwining the civil mission of the SGDC-1 with the discussion of the "dark spots of information," the multi-millionaire costs of satellite as a politically pushed project becomes completely justified. After all, it is presumably thanks to a national communication satellite that Brazilian nationals would have technological sovereignty to not only cover the country's territory in its totality, but also to provide means for modernization and the "unconnected." If in the U.S. "the Internet [represents] one of the most widespread and rapid innovations in the history of public-school education,"[61] in the Brazilian context one could argue that it also represents one of the major innovations that requires more public understanding. In so doing, the benefits it may bring about can expand beyond the school as an institution and, thus, permeate the outside-school conditions that are as relevant for learning and inclusion as formal education itself. However, the discussions concerning modernity, urban-rural configurations, or broadband access in a country like Brazil is exceptionally challenging.

According to Brazil's National Telecommunications Agency (Anatel), 85 percent of the urban population in Brazil occupy less than 1 percent of the Brazilian territory.[62] Hence, the maps above complicate the complexity of considering rural communities as "dark spots of information" or "unconnected," showing that although remote rural areas are mostly in the north, northeast and other regional pockets throughout the country (fig. 9), most of the country's regions have some kind of Internet connectivity, with the State of São Paulo having the fastest speed. While the most developed, urban, and well-off states can show higher coverage and faster broadband speed, they also show inequality levels of Internet speed, challenging the notion that only the north and northeast regions as unconnected (fig. 10). Therefore, referring to rural schools as "dark spots of information" only propagates already-existent segregations between urban-rural schools and does not take into account local

[61] Reed Hundt, "Hundt: Nader Should Back Gore," *WIRED News*, October 12, 2000, accessed April 20, 2020, https://web.archive.org/web/20040513041153/http://www.wired.com/news/politics/0,1283,39294,00.html?tw=wn_story_page_prev2

[62] "CDUST: Revisao do Modelo de Concessão," *Agência Nacional de Telecomunicações*, May 2017, accessed November 20, 2019, https://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=347056&assuntoPublicacao=null&caminhoRel=null&filtro=1&documentoPath=347056.pdf

complexities or circumstances that could help inform the development of new policy frameworks for democratizing broadband access.

Minister Pontes' framing of these hard-to-reach, non-industrial communities as "dark spots of information" points to the widespread notion of the "digital divide," a highly loaded term that emerged in the mid-1990s to refer to those who have access to the Internet ("the information-haves") and those who do not ("the information-have nots"). In fact, the "dark spots of information" and the "unconnected" classifications frequently overlap with other kinds of "have-nots" in terms of infrastructure, social welfare, education, and economic development. Nevertheless, the relationship between urban-rural and connected-unconnected is much more nuanced, complex, and intricate than the binary definitions of information-haves or have-nots. This way, the rural constitutes the complex, diverse geographic regions that have long been forgotten in terms of inclusion policies, but that have recently become the central focus of the SGDC-1 as a publicly-funded, high-technological artifact capable of arguably reducing the social and digital inequalities in Brazil.

The discussion of the "dark spots of Information" is the focus of this chapter. To accomplish that, I propose the following exploratory questions: What is the brief history of the term digital divide? What is the current state of broadband in Brazilian rural public schools? How can this discussion challenge the government notion of "dark spots of information" often associated with these underfunded and ostracized institutions? As an attempt to explore these issues further and contrast them with the growing literature on media and communication studies as well as with the most recent data on urban and public schools, I briefly discuss how the Brazilian government adopted the problematic notion of the term "digital divide" by framing rural schools as "dark spots of information." The discussion will then shift to contextualize two relevant nation-wide policies—PNBL and GESAC—that provide a more nuanced understanding for the SGDC-1 and its connections to rural schools. These represent government-led initiatives that paved the way for emerging programs such as the 2008 School Broadband Plan (*Programa Banda Larga nas Escolas*—PBLE) and the 2017 Connected Education Innovation Program (*Programa de Inovação Educação Conectada*—PIEC).[63]

[63] PBLE and PIEC are left out of the scope of this thesis as they do not represent the most relevant policy frameworks relating the SGDC-1 to rural schools. Instead, I decided to focus on PNBL and GESAC because they provide a more critical look over the association between broadband and rural

Given that the "digital divide" is part of the "connecting the unconnected" conundrum that I later explore in Chapter 2 when discussing the televisual tactics of the Brazilian government in framing the SGDC-1 as a space-telecom propaganda, my goal in this Chapter is to scrutinize some of the term's points of contention in relation to the country's geographic and infrastructural conditions as they pertain to rural schools. In so doing, it is my goal to contribute to other growing pieces of scholarship suggesting that terms as vague as the "digital divide" and "dark spots of information" are insufficient to account for the broadband challenges and policy frameworks needed to critically assess the development of democratizing broadband access at the school environment and beyond.

Ascribing a brief history of the term Digital Divide

Considering that corporations based in the United States have dominated the means of Information and Communication Technology (ICT) research, production, and diffusion since World War II, it comes as no surprise that it is also the most influential nation in popularizing the term "digital divide" among policy-makers in the Global South. While the precise origins of the term are difficult to trace, it is easy to locate its underpinning discourses—rooted in technology determinism and predicated on a liberal policy of inclusion. Therefore, it is essential that we step back to reflect on its relationships with government branding, propaganda, and political economy.

Historical analysis of news media coverage and policy pieces shows that it was mostly thanks to U.S. public figures such as former Presidents Bill Clinton and Al Gore, U.S. Department of Commerce's Larry Irving, and the *Los Angeles Times* reporter Amy Harmon, that the "digital divide" gained importance and salience in the public discourse in the U.S. and beyond.[64] Often regarded as the main coiners of the term, these U.S. figures were crucial in the parentage of such a notion of "divide" in the realm of digital technologies. However, what kind of divides did each person refer to?

areas on a federal level. However, PBLE and PIEC are also important frameworks for school connectivity in Brazil.

[64] Aaron Schwabach, *Internet and the Law: Technology, Society, and Compromises, Second Edition.* Santa Barbara, CA: ABC-CLIO, 2014, 75.

The earliest use of the term digital divide occurred in the mid-1990s. In a 1995 *Los Angeles Times* essay, reporter Amy Harmon wrote an engaging story about the digital divide that mounted attention in the United States. In her writing, she used the term digital divide to refer to what she first called "the split between a husband who spent a great deal of time online and the wife who felt alienated from him because of his obsession with computers."[65] The imminent question that gains relevance when unraveling the underlying structures of Harmon's journalistic piece is that of the semantic nature of the noun *divide*—"a difference or separation."[66] As arguably one of the first available recorded references of the term digital divide, it is misleading to suppose that the 1995 *LA Times* story alluded to the same kind of "divide" that is now increasingly relevant in the era of broadband Internet and ubiquitous mobile media. At first, one may wonder to which extent the account of a husband addicted to computers who makes his wife feel alienated is linked to the public and private initiatives in place to "connect the unconnected"—from Sub-Saharan Africa to the Amazon basin region. Despite all, it was around 1995 that the unequal access to the Internet started to become a preoccupation by social scientists and policymakers.[67]

In May 1996, only one year after the *LA Times* story came out, vice-U.S. President Al-Gore alluded to the example of a Cyber-Ed truck initiative as a "bookmobile for the digital age." On that occasion, Gore used the term "divide" to refer to the gap between "information haves" and "have-nots" in K-12 education, exemplifying that "[cyber-Ed trucks are] rolling into communities, connecting schools in our poorest neighborhoods and paving over the digital divide."[68] While his speech included education and the potential of the emerging digital technologies within marginal geographic locations, the reality is that the "connecting the unconnected" narrative was far from only targeting U.S. schools. One could argue that the government's emphasis on the "divide" played a significant role in shaping the public opinion to the direction of what the technological market was producing, insofar new

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[65] Anna Everett, *Learning Race and Ethnicity: Youth and Digital Media*. Cambridge, MA: MIT Press, 2008, 3.
[66] "Divide: Definition." Cambridge Dictionary. Accessed April 5, 2020. https://dictionary.cambridge.org/us/dictionary/english/divide?q=Divide.
[67] Robert H. Anderson, Tora K. Bikson, Sally Ann Law, and Bridger M. Mitchell, *Universal Access to E-Mail-feasibility and Societal Implications. Santa Monica, CA, RAND*. MR-650-MF, 1995.
[68] Judith Burnett, Peter Senker, and Kathy Walker. *The Myths of Technology: Innovation and Inequality*, 2009, New York, NY: Peter Lang, 31.

Internet-based technologies proliferated and penetrated daily life, re-organizing the economy at all levels.

An example of that occurred when President Clinton addressed the people of Knoxville, Tennessee contending that, "if we don't broadly share the knowledge and the technology that is developing, it could work to promote inequality, frictions, anxieties among people. But if we do it right, it can be a great force to help us meet our challenges and protect our values together."[69] Such sense of unity, hope, and prosperity behind the expansion of ICTs as a viable set of tools in tackling societal challenges aligns to the industry priorities, technological developments, and geopolitical strategies that the U.S. underwent in the Cold War years, with technological advancements spanning from communication technologies to the high-capital equipment for the defense industry. Particularly when in connection with welfare-related topics for those who have been historically categorized as marginalized, the term digital divide received notoriety and earned widespread attention as a domestic priority that would guarantee participation in the technological world they foresaw and the U.S. values that they deemed valuable.

After years of research, investments, and deployments of novel media infrastructures that enable the expansion of the Internet and global media flows (e.g., subaquatic fiber-optics networks, satellite constellations, data centers, cellphone towers, among others[70]), it is clear that the 1995 *LA Times* did not carry the same priorities or development values as the ones driving the "digital divide" premise that the Bill Clinton and Al-Gore's administration helped popularize in the 1990s. After all, only 14 percent of U.S. adults had Internet access at home when that story came out,[71] which implies that Harmon was likely referring to a household that was wealthy enough to have at least one personal computer connected to the Internet, a different scenario that we observe today when inclusion-oriented initiatives emerge to bring modernity to the unconnected so that they can be part of the "global village" and benefit from the access of 21st-century information.

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[69] Bill Clinton and Al Gore, "Remarks by the President and the Vice President to the people of Knoxville," *NTIA*, 1996. Accessed December 10, 2019, https://www.ntia.doc.gov/legacy/ntiahome/101096clinton.htm

[70] For more on Media Infrastructure, see: Lisa Parks and Nicole Starosielski, eds. *Signal Traffic: Critical Studies of Media Infrastructures*. University of Illinois Press, 2015.

[71] "Online Use." *Pew Research Center - U.S. Politics & Policy*, December 31, 2019. https://www.people-press.org/1996/12/16/online-use/.

Nonetheless, Harmon and Gore's observations point to some of the problematic issues that are embedded in the rationale of the term digital divide due to its intrinsic binary, broad, and lose structures and, to a less extent, its somewhat limited premise rooted on technology determinism; that is, the view of technology as the significant catalyzer for solving societal problems. While I am not arguing against the urgent need of addressing social and digital inequalities across regions when it comes to schools and other aspects of human development, my goal in this Chapter is to engage with some of its nuances to adequately explore the implications of government-funded projects with the promises to bring Internet connectivity to rural schools in a country that is as large, diverse, and unequal as Brazil. If the access and deliberate use of ICTs across different social realities operate in a complex array of factors that encompass physical, digital, human, and social resources and relationships,[72] we must be as specific and context oriented as possible when exploring different case studies.

Of critical relevance to the current discussion of Internet connectivity for socioeconomically marginalized communities first unfolded through the "Falling Through the Net: Defining the Digital Divide," a third report from the U.S. National Telecommunications and Information Administration (NTIA) series whose goals was to examine which American households had access to telephones, computers, and the Internet, and which did not.[73] It was the NTIA report series that expanded the term digital divide and provided more concrete orientations to encompass those socioeconomically located at margins of society—something that the *LA Times* did not account for in its 1995 story. Based on census data on U.S. households, this particular NTIA report not only provided a national picture of the then-current state of Internet connectivity but also offered insights for potential challenges that the U.S. population would face regarding the promotion and competition of possible universal Internet service; the expansion of Community Access Centers (CACs); ICTs awareness by the civil society as well as engagement related to content creation and public policy.

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[72] Mark Warschauer, *Technology and Social Inclusion: Rethinking the Digital Divide*. Cambridge: MIT Press, 2004, passim.

[73] "Falling through the net: Defining the digital divide: A report on the telecommunications and information technology gap in America," 1999, U*.S. National Telecommunications and Information Administration*, Accessed December 2019, https://www.ntia.doc.gov/legacy/ntiahome/fttn99/contents.html

Indeed, at that time, ICTs for education did not carry the same emphasis as it does today in the face of the widespread use of EdTech, learning management systems (LMS), and other computer-based assessments aimed at facilitating the teachers' exploration of their subjects. Larry Irving, former Assistant Secretary for Communications and Information at the U.S. Department of Commerce, wrote in the report that the digital divide was "one of America's leading economic and civil rights issues."[74] He also contended that "determining who has access to these resources is a critical first step towards closing the digital divide and ensuring that no group continues to fall through the Net."[75] It did not take long until the observations pointed out in the report incited additional concerns for communities that long have been ostracized and subjugated to previous historical events.

At that time, Henry Louis Gates wrote a story for the *New York Times* titled "One Internet, Two Nations" (1999), where he referred the data from NTIA's "Falling Through the Net" report to predict that African-americans would face a form of cyber-segregation. He made the case that new information technology would exacerbate existing forms of inequality that history had already eroded—and that income alone was not enough to explain why African-Americans and Hispanics in the U.S. were slower to acquire computers and surf the Internet.[76] The use of a democratized Internet in formal education was, once again, rarely explored. Although Irving later that "the fairest thing to say [was] that no one at NTIA invented the term, digital divide,"[77] it is also fair to contend that NTIA indeed played a pivotal role in shifting the term's semantics for the broader public as it expanded to encompass questions of economic, social, and digital inclusion in the U.S. and beyond. News stories like Gates's sprouted throughout the U.S. at the turn of the century, thereby paving the way for what later became a priority for governmental policies worldwide.

The new crux is that, in order to participate in the fast-evolving informational technology context, we must connect students to the Internet in the formation of the "global village." Followed by the NTIA reports and by an increased media salience as the term's coverage skyrocketed beyond the U.S. borders, the "digital divide" became

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[74] Ibid.
[75] Ibid.
[76] Henry Louis Gates, "One Internet, Two Nations," *The New York Times*, 1999. Retrieved from https://www.nytimes.com/1999/10/31/opinion/one-internet-two-nations.html.
[77] Paolo Guerrieri and Sara Bentivegna, eds. *The Economic Impact of Digital Technologies: Measuring Inclusion and Diffusion in Europe*. Edward Elgar Publishing, 2011, 40.

a powerful slogan for governments, non-profit organizations, and corporations producing high-tech hardware and software products with the goal to democratize the personal computer (PC) and Internet access for all: from school to households to public libraries. While the NTIA reports may have catalyzed the early notions of the "digital divide" for domestic and global popularity, ubiquity, and adaptation of the term's semantics to account for those who may fall into the "information have-not" category, it is worth underscoring that such divisions were by no means something entirely new.

From a media studies point of view, one could argue that its parallel origins are deeply entrenched to the broader technological development insofar new inventions penetrated households and was domesticated by its ordinary users in a variety of the contexts: the telephone throughout the transitioning years from the 19th century into the 20th century; the radio between 1920 and 1950; television between 1940 through the 1980s; and the PCs and the Internet from 1980s onwards. The work by Paul DiMaggio, Eszter Hargittai, Coral Celeste, and Steven Shafer (2004) gives a historical dimension to this discussion. They argue that the notion of the digital divide—as a gap between those with or without Internet—"was natural at the onset of diffusion."[78] One of the major implications of this claim is that that the "Internet was viewed through the lens of a decades-old policy commitment of the principal of universal telephone service."[79] If the 1934 Communications Act considered the spread of telephony as a positive endeavor to connect the U.S. population, the "country's almost century-long commitment to universal service" therefore played an essential role in shaping such a narrative of "divide."[80]

In other words, the analytical categorization grounded on a binary biased classification—between have and have-nots—is an extension of other aspects related to the rise of media technology and how institutions and users domesticate, appropriate, and, most importantly, regulate them. Enlightened by the term's historical background in the U.S., it comes as no surprise that the same loose, binary

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[78] Paul DiMaggio, Eszter Hargittai, Coral Celeste, and Steven Shafer, "From Unequal Access to Differentiated use: A Literature Review and Agenda for Research on Digital Inequality." *Social Inequality* 1 (2004): 355-400.
[79] Ibid.
[80] Kate Williams, "What is the Digital Divide?" In *d3: Proceedings of the Digital Divide Doctoral Students Workshop, 2001. University of Michigan School of Information: Ann Arbor, MI*. Accessed December 1, 2019, https://katewill.web.ischool.illinois.edu/work/33-williams-2001-d3-proceedings-not-complete.pdf

rationale is being used by Brazil's government when insisting on classifying rural schools as "dark spots of information." It is also the reality of other nations and powerful institutions that insist on merely access and ignore what to do now that more citizens are increasingly accessing the Internet in a variety of interesting ways under distinct socioeconomic, cultural, and infrastructural conditions.

Urban-Rural Dichotomies in Brazilian Public Schools

As the Clinton-Gore administration exercised the trope of the digital divide to base its educational initiatives, policies, and other kinds of government branding in the U.S.,[81] Brazil was at the early stages of structuring new guidelines that would turn education a civil right for its citizens. Internet, if asked by ordinary Brazilians of the mid-1990s period, would likely sound like a completely foreign word, something that only developed nations like Japan was technologically able to produce. From its very first connectivity point in September 1988 via the co-operative U.S. university computer network BITNET (Because It's Time Network), connecting the National Laboratory for Scientific Computing in Rio de Janeiro to the University of Maryland in Baltimore, until the mid-1990s, the Internet was primarily a matter of connecting academic institutions in the country.[82] Fast forward a few years, and we have a radically new scenario, with nearly 79.8 percent of Brazil now connected to the Internet,[83] although the disparities are growing in the context of the public rural and urban schools.[84] Therefore, in order to explore the most recent data on Internet access across Brazilian rural schools, I briefly sketch the history that led up to that point and how relevant government bodies organize public education in the country. My goal in this section is to provide a nation-wide picture of the levels of social inequalities when it comes to Internet access in the context of public education and its urban and rural dichotomies.

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[81] David J Gunkel, "Second Thoughts: Toward a Critique of the Digital Divide." *New Media & Society* 5, no. 4 (2003): 499-522, https://doi.org/10.1177/1461444480354003

[82] Érico Marui Guizzo, *Internet, o que é, o que oferece, como conectar-se*. São Paulo: Editora Atica, 1999, passim.

[83] Daniela Amorim and Vinicius Neder, "IBGE: 35,7% dos Brasileiros Vivem sem Esgoto, mas 79,9% da População já tem Acesso à Internet." *Estadão*, November 6, 2019. https://economia.estadao.com.br/noticias/geral,ibge-35-7-dos-brasileiros-vive-sem-esgoto-mas-79-9-da-populacao-ja-tem-acesso-a-internet,70003077941.

[84] Lívia Julyana Gomes Vasconcelos Lira, "Desigualdades Entre Escolas Rurais e Urbanas: Análise do Período 2000-2015." Master's thesis, Universidade Federal do Ceará, 2008, http://www.repositorio.ufc.br/handle/riufc/22669.

At the national level, the first legislation created to organize the various roles of government, states, and municipalities in guaranteeing a public educational system in Brazil occurred through the law number LDB 4.024 in December 1961 under the presidency of João Goulart. Such a national milestone occurred nearly thirteen years after heated debates concerning the legislation as well as the rights and duties in which that presumed. The Brazilian Constitution of 1934 had already briefly introduced the need for a national plan for education, though it was not until 1961 that the Congress passed the National Education Guidelines and Framework Law (*Lei de Diretrizes e Bases da Educação*). Among other things, this legislation guaranteed the right to education for all Brazilians and mandated an annual investment of at least 12 percent of the country's tax income for education.[85]After 1985, in the awakening of the re-democratization process upon the end of the military regime in the country, followed by Brazil's new Federative Republic Constitution of 1988, the first National Education Guidelines and Framework Law of 1961 became obsolete, which later engendered new discussions concerning the role of the state in regulating the new educational system for the entire nation.

A few years after 1988, the federal government faced highly tricky challenges in the face of several internal and external factors such as economic uncertainty, the opening to international markets, the high levels of inflation that reached nearly 5.000 percent percent between 1993 and 1994, [86] the impeachment of the first popularly elected President Fernando Collor after twenty-nine years of military rule, [87] the privatization of banks and other national companies such as Telebras, and many others.[88] Thus, it was only in 1996 that a new National Education Guidelines and Framework Law was promulgated (LDB 9394/96), thereby reinforcing the right to education guaranteed by the 1988 Constitution. Table 2 summarizes the current organization of the Brazilian Basic Levels of Education.

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[85] "Lei Nº 4.024, de 20 de Dezembro de 1961." *Portal da Câmara dos Deputados*. Accessed January 20, 2020. https://www2.camara.leg.br/legin/fed/lei/1960-1969/lei-4024-20-dezembro-1961-353722-publicacaooriginal-1-pl.html.

[86] Argelina Cheibub Figueiredo, "The Collor Impeachment and Presidential Government in Brazil." In *Presidential Breakdowns in Latin America*, pp. 111-127. New York: Palgrave Macmillan, 2010.

[87] Ricardo Borges Gama Neto, "Plano real, Privatização dos Bancos Estaduais e Reeleição*." Revista Brasileira de Ciências Sociais 26*, no. 77 (2011): 129-150, https://doi.org/10.1590/s0102-69092011000300012

[88] Florinda Antelo Pastoriza, "Privatização na Indústria de Telecomunicações: Antecedentes e Lições para o Caso Brasileiro." *Banco Nacional de Desenvolvimento (BNDES)*, 1996, accessed October 2019, http://web.bndes.gov.br/bib/jspui/handle/1408/14094

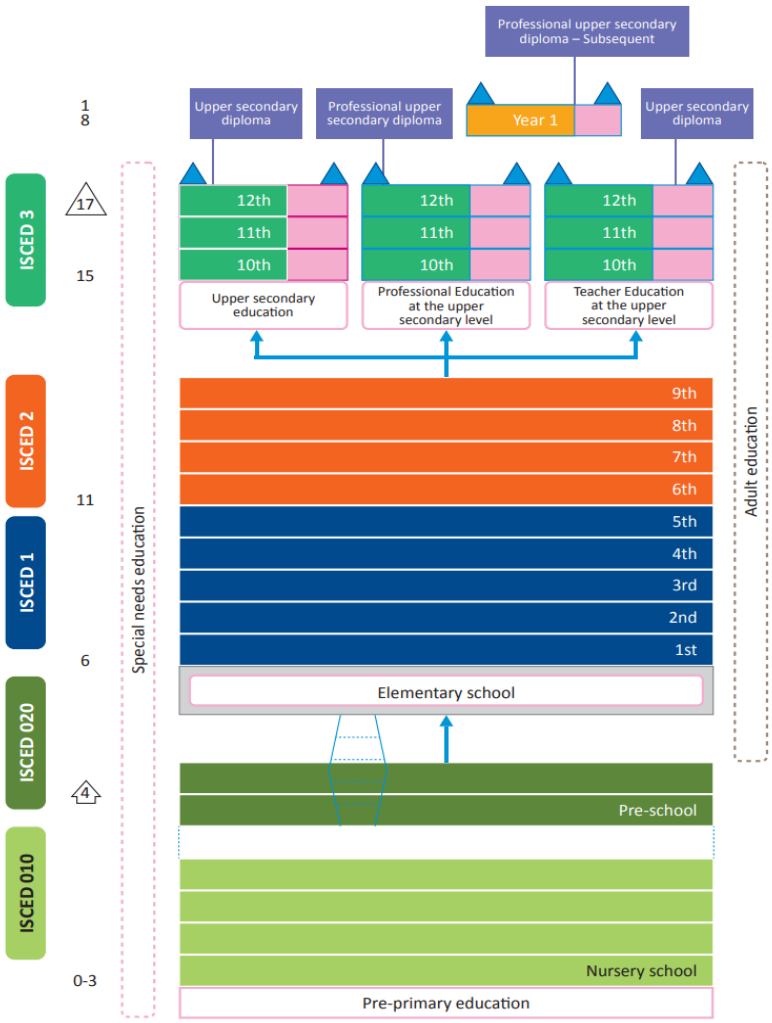

Table 2. Chart summarizing the Brazil's Basic Levels of Education by EducationGPS. [89]

With refined legislation organizing national guidelines for education as a right available to every Brazilian citizen, new forms of monitoring and evaluations become crucial in measuring progress and the achievement of goals and public policies. Every year, the National Institute for Educational Studies and Research "Anísio Teixeira"

[89] As dictated by the new legislation, coupled with a few amendments that came later, the Brazilian educational system organizes itself into two general levels: *Educação Básica* (basic education) and *Ensino Superior* (higher education). In this first level, the legislation breaks it down into three categories: i) *Educação Infantil*: nursery schools for kids between 0-3 years old, and kindergarten for kids between 4-5 years old (which is free of charge, not mandatory, and it is of responsibility of local municipalities); ii) *Ensino Fundamental*: mandatory primary schools and free of charge at public institutions (Part I: students the ages of 6-10 years old attend the 1st through 5th grade and move on to Part II between 11-14 years old: from 6th to 9th grade); and iii) Ensino Médio: mandatory secondary school for students between the ages of 15-17 years old, free of charge at public institutions, and served by the state where the schools are located (it consists of three years of high school that are referred as from 1st through 3rd grade, and it may have a focus on technical educational, but not necessarily). Source: Ministry of Education, Overview of the Brazilian Education System, October 2016, http://download.inep.gov.br/acoes_internacionais/pisa/documentos/2016/pisa_overview_of_the_brazilian_education_system.pdf

(*Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira*—INEP) conducts the School Census on Basic Education across Brazilian schools, known as the *Censo Escolar da Educação Básica*, which collects information on all levels of basic education discussed above as part of the 1996 National Education Guidelines and Framework Law. INEP was founded in 1937 as a research agency linked to the Ministry of Education and ever since carries out educational statistics that help assess basic and higher education across Brazil. Its data-oriented approach is a fundamental activity that helps policymakers and the civil society to evaluate the current conditions and needs of schools.[90] Moreover, it also helps better planning, implementation, monitoring, and policy evaluation on local, state, and national levels that will ultimately benefit schools and their human constituents—teachers, staff, and, most importantly, students.[91]

According to the 2018 census, there are 181,939 schools throughout Brazil—including private, public, urban, and rural schools operating under the basic education scope previously discussed.[92] Of all of these, 56,954 schools are public institutions located in areas that the government classifies as "rural."[93] As in many other countries, the disparity between rural and urban schools is significant not only in terms of physical infrastructure but also in the availability of media technologies at these places of learning. For example, 92 percent of public schools in urban areas of Brazil had at least one TV set versus 57 percent (32.619 schools) in rural areas. While 81 percent (68.040 schools) of public urban schools had at least one DVD player versus 51 percent (28.941 schools) in rural public schools.[94] This uneven pattern between public rural and schools is worrisome since public and educational policies often fail to acknowledge the complex local nuances that shape the use of media technologies and pedagogies around them, which reveals part of the issue in thinking

[90] The data from INEP is also of extreme importance for planning and deploying tech-related projects in public schools as it enables researchers, think tanks, and government representatives and other education enthusiasts to understand the reality of a particular school in relation to their local infrastructure, food access, equipment, accessibility, services, among others.
[91] "Overview of the Brazilian Education System," *Ministério da Educação*, October 2016, accessed November 2019 http://download.inep.gov.br/acoes_internacionais/pisa/documentos/2016/pisa_overview_of_the_brazilian_education_system.pdf
[92] "Censo Escolar 2018: Resultados e Resumos," *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira*, (data analysis via *QEdu – Fundação Lemann*), accessed November 1, 2019, https://www.qedu.org.br/brasil/censo-escolar?year=2018&dependence=0&localization=0&education_stage=0&item=
[93] Ibid.
[94] Ibid.

of rural schools through the "dark spots of information" rationale. Moreover, despite the staggering number, very little research has been done to understand the reality of these students in accessing the Internet, and the forces that shape the access and appropriate domain of digital skills to do so.

At first glimpse, INEP indicates that only less than one-third of public schools are in rural areas. However, these institutions enroll about 5,465,894 students according to the 2018 census, which accounts for more than the estimated population of Norway.[95] For further quantitative comparison, the number of enrolled students in Brazilian public rural schools equals the number of people in Slovenia and Mongolia combined.[96] In terms of computer and Internet access, about 51 percent of public urban schools had a computer lab versus 18 percent of rural public schools. Despite all, food distribution at these schools in forms of meals is one factor that nearly reaches 99 percent, as part of the government efforts in the past decades to ensure that every child gets enough nutrition when attending school. However, when it comes to Internet access in public versus rural contexts, we do not see as positive indicators. According to the same census, 89 percent of urban public schools had access to the Internet—76 percent of schools had access to broadband Internet. However, only 34 percent of schools have access to the Internet in rural public schools—only about 21 percent of schools have access to broadband Internet.[97]

Besides the data found in INEP's 2018 School Census on Basic Education, another useful statistical information comes from the Regional Center for Studies on the Development of the Information Society (*Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação*—Cetic.br), whose goal is to monitor the adoption of ICT—access to computers, Internet, and mobile devices across various segments of society such as education, health, governance, and others. Operated under the auspices Unesco and as a part of the Brazilian Internet Steering Committee, the Cetic.br has provided since 2005 surveys grounded on methods and practices similar to the ones conducted by the ITU and European Statistical Office

[95] "Norway's Population Projections." *National Statistical Institute of Norway*. Accessed October 24, 2019. https://www.ssb.no/en/befolkning/statistikker/folkfram/aar.
[96] "Population, Total - Mongolia, Slovenia." *Data. World Bank.* Accessed October 24, 2019. https://data.worldbank.org/indicator/SP.POP.TOTL?locations=MN-SI.
[97] "Censo Escolar 2018: Resultados e Resumos*", QEdu – Fundação Lemann*. Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, Accessed October 10, 2019. https://www.qedu.org.br/brasil/censo-escolar?year=2018&dependence=0&localization=0&education_stage=0&item=

(EUROSTAT).[98] In its most report on ICT and education, Cetic.br's data reveals two significant reasons that help explain the current unequal ICT configuration we see in public urban and rural schools: local infrastructure in regions schools are located and the high price of connectivity. For the correspondents of the research, the majority of schools informed that the Internet speed at their facilities ranged between 1 and 2 Mbps, making it difficult to access, for example, HD-quality video streaming and other types of multimedia.[99] Aligned with the data discussed above from INEP, the research sample of Cetic.br also reveals than more than half of schoolteachers bring their own laptops to develop activities with students. According to one of the researchers of this study, "the use of technology only happens when a teacher brings his or her personal device to schools, be it a smartphone, tablet, or a computer."[100] When referring to the means of connectivity, the research informs that "these teachers also have to use his or her own mobile data, even to communicate with students' parents or the government staff."[101]

However, as it is the case for all other technology-relation discussions in the humanities and social sciences, a historical and contextual framework of analysis is needed to understand the underlying non-technical reasons that help shed light on the current configuration. An empirical study using individual and household-level data from the Brazilian government correspondent to 2005-2013 provides some useful insights into the the evolution of Brazil's digital inequalities in terms of Internet access at schools. Research by Marislei Nishijima, Terry Macedo Ivanauskas, and Flavia Mori Sarti (2016) showed that "education accounts for the majority of inequalities in personal skills for ICT utilization."[102]Arguably a period of intense transition in terms of ICT, the findings within the 2005-2013 period reflect the rapid increase of personal devices such as mobile phones and personal computers coupled

[98] In other words, Cetic.br's data are useful because their indicators allow for comparison with other countries when it comes to of research and development of public policies that account for the local specificities, including ICT needs and opportunities.
[99] "TIC Educação 2018 - Coletiva De Imprensa." *Cetic.br - Centro Regional para o Desenvolvimento da Sociedade da Informação, UNESCO.* Accessed October 22, 2019. https://cetic.br/media/analises/tic_educacao_2018_coletiva_de_imprensa.pdf.
[100] Ibid.
[101] Daniel Popov, "Pesquisa: Boa Parte Das Escolas Rurais Não Têm Computadores e Internet." *Canal Rural*, July 20, 2019. https://canalrural.uol.com.br/agronegocio/pesquisa-boa-parte-escolas-rurais-nao-tem-computadores-internet/.
[102] Marislei Nishijima, Terry Macedo Ivanauskas, and Flavia Mori Sarti, "Evolution and Determinants of Digital Divide in Brazil (2005–2013)." *Telecommunications Policy* 41, no. 1 (2017): 12-24, https://doi.org/10.1016/j.telpol.2016.10.004

an increased price reduction followed by market-driven digital convergence. While "income, employment, and a number of household members are major barriers to access ICT,"[103] it is the education level that represents the primary determinant of the capacity of utilization and the digital skills necessary to use ICTs effectively. Researchers of that study also suggest that "improvements in education policy represent an effective strategy to reduce the digital divide among individuals of the Brazilian population in the long run by reducing barriers related to digital illiteracy."[104] Thus, the digital divide per se shall be more about digital skills and not so much about access to the Internet or devices that enable one to connect to it anymore, which challenges the government's general characterization of rural schools as "dark spots of information." In a country where the "educational level and quality are still low, it is reasonable to pose that it accounts for the major part of difficulties in digital literacy yet."[105]

An earlier study by the Brazilian Institute for Applied Economic Research (*Instituto de Pesquisa Econômica Aplicada*—IPEA) (2007) described that although school infrastructures dramatically improved since the 1990s and that nearly all schools now have libraries and computers, the gap in learning outcomes and student performance between rural and urban schools remain enormous.[106] One of the hypotheses that may explain such uneven educational performance between these students is the fact that rural schools lack essential material infrastructures and human capital that enable good teaching practices and positive learning experiences. Some of these may include access to well-trained and motivated teachers, equipped classrooms, facilities, community-oriented programs, semester-long projects, structured curriculum and lesson plans, and many others.

Nevertheless, unlike the first decade of the 21st century, students in rural areas are now increasingly connected via smartphones and mobile Internet. Therefore, we must think of not only ICT access—as it has been the core of government rhetoric on various occasions—but also the different dimensions of needs and opportunities brought about by such moments of media transition in the school environment and

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[103] Ibid.
[104] Ibid.
[105] Ibid.
[106] Natália Sátyro and Sergei Soares, "A Infra-estrutura das Escolas Brasileiras de Ensino Fundamental: um Estudo com Base nos Censos Escolares de 1997 a 2005." *Instituto de Pesquisa Econômica Aplicada* (IPEA), 2007, acessed December 2, 2019, http://ipea.gov.br/portal/images/stories/PDFs/TDs/td_1267.pdf

beyond. In so doing, scholarly work should focus on helping inform public policy while paying critical attention to the different school realities and teachers' needs in using their pedagogical apparatuses to teach students the complex possibilities that the Internet enables and, therefore, reducing the digital inequalities between rural and urban.

Up until this point, it must be clear that the Internet access inequality in the urban-rural contexts of public schools must be a point of concern for future public policies and government-led initiatives, but it should not be the ending goal. While statistics help illustrate the enormous gap between ICT access in public urban and rural schools in Brazil, although they do not offer a complete perspective of the local dynamics that shape ICT use in the lives of students at school—which could include the nuances between rural versus urban realities in a country as unequal as Brazil. Although there is not much statistics or qualitative studies examining how students in rural public schools in Brazil learn in comparison to urban students, previous research and statistics performances have demonstrated that schools with precarious infrastructures tend to perform poorly in the Brazilian Education Quality Index (*Índice de Desenvolvimento da Educação Básica*—IDEB).[107]

Additionally, research shows that students from rural schools performed nearly 50 percent below the national average.[108] In addition to that, previous research has also shown that students in rural areas have lower attendance rates, face more challenges with transportation to get to their schools (mostly in the North and Northeast regions), and are the ones in more precarious socio-economic living conditions.[109] Therefore, when it comes to the discussion of providing Internet connectivity in rural areas, more attention must be given to that particular group as changes are undergoing and the state and its several stakeholders develop programs

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[107] Fernanda Canofre, "Escolas Com Infraestrutura Ruim Têm Pior Desempenho No Ideb." *Folha de S. Paulo*, July 31, 2019. Accessed October 21, 2019. https://www1.folha.uol.com.br/educacao/2019/07/escolas-com-infraestrutura-ruim-tem-pior-desempenho-no-ideb.shtml.

[108] Ana Carolina Moreno, "Escolas Rurais Têm Resultados Até 50% Mais Baixos Que Média Brasileira." *G1*, November 29, 2012. Accessed October 21, 2019. http://g1.globo.com/educacao/noticia/2012/11/escolas-rurais-tem-resultados-ate-50-mais-baixos-que-media-brasileira.html.

[109] Miguel Poggi Amorim Zinet, "Nos Últimos 11 Anos, 277 Escolas Rurais Foram Fechadas Por Mês No Brasil." *Centro de Referências em Educação Integral*. Accessed October 24, 2019. https://educacaointegral.org.br/reportagens/nos-ultimos-11-anos-277-escolas-rurais-foram-fechadas-por-mes-brasil/.

aimed at bridging the Internet access gap that prevails between public schools between rural and urban areas.

PNBL and GESAC: policies of telecom infrastructure for the "unconnected"

To connect the erroneously characterized "dark spots of information" to the "global village" and allow the "unconnected" to take advantage of what the Internet has to offer, the Brazilian federal government has financed many projects related to broadband infrastructures over first two decades of the 21st century. Despite the various government-funded programs in different municipalities and states, there are mainly two that emerge as very important for the context of "dark spots of information": The National Broadband Plan (PNBL), and the e-government (GESAC). From laying out thousands of kilometers of fiber-optics networks underground across the country to deploying a high-capita satellite in GEO orbit, these two sets of government-led projects are intertwined not only by the goal of democratizing the broadband in rural areas but also by the economic potential of digital and social inclusions. Furthermore, both of these large and ambitious policy frameworks are of extreme importance for connecting rural public schools and, despite the constant changes they undergone over the past years, they exemplify the extent to which domestic telecom infrastructure gets strengthened through public funding—as it is often the case for other countries in Latin America and other parts of the Global South.

Despite its rich diversity of possibilities, it is often unquestionable the fact that the access to broadband—and the multitude of infrastructures that make it possible—is economically positive for countries, as revealed by a 2009 groundbreaking study by the World Bank.[110] The study showed the remarkable impact of broadband connectivity in the economy: between 1980 and 2006, for low and middle-income countries, it was estimated that each 10 percent growth in broadband penetration resulted in a 1.38% growth in GDP per capita.[111] Nonetheless, not always the public

[110] Christine Zhen-Wei Qiang, Carlo M. Rossotto, and Kaoru Kimura. "Economic impacts of broadband." *Information and Communications for Development 2009: Extending Reach and Increasing Impact* 3 (2009): 35-50, https://doi.org/10.1596/978-0-8213-7605-8.
[111] Ibid.

funding targets minorities or communities that have been historically at the margins of society, such as the ones living, working, and studying in rural public schools.

In May 2010, the Brazilian government established the National Broadband Plan (*Programa Nacional de Banda Larga*—PNBL) with the broader mission of "overcoming the enormous social abyss of the Brazilian society" through high-speed Internet connectivity.[112] With an initial focus of building fiber-optics networks, the federal government set up PNBL around the central premise that the access to the broadband implicates the insertion of the ordinary citizen in the society and that, as a result, those who are connected would have more job opportunities, education, culture, and increased democratic participation. Such a kind of social uplift and access to the "global village" via the access of broadband Internet and ICTs more broadly would be impossible to be carried out entirely by market forces alone, which justifies the Brazilian government intervention as a provider of universal, telecom services. Despite PNBL's initial focus on the development of nation-wide broadband infrastructure, it also had the ambitious goal of providing digital content coupled and e-services, as shown:

> Providing broadband infrastructure that allows high-speed access is essential. However, it is not enough. It is necessary to ensure that this broadband available translates into access to information through relevant content, regardless of the geographic location or income level of the population, which, when adding value to the information, such a process will bear fruit for those who need it most.[113]

A thought-provoking observation here lies in the government's recognition that the questions pertinent to social issues cannot be the marginal result of Brazil's telecom policy. Instead, it must be the first and last objective, its *raison d'être* and its leading targeted destination. As pointed in the same document, digital inclusion will only serve the country if it is thought, planned and executed as a means of social inclusion, and not just as an end in itself.[114] In its targeted goal of connecting 35 million Brazilian households to the Internet by 2014, the program ended up not achieving not even a number close to that.

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[112] "O Brasil Conectado: Programa Nacional de Banda Larga (PNBL)." *Secretaria Executiva do Comitê Gestor do Programa de Inclusão Digital,* Brasília, 2010, https://www.siteal.iiep.unesco.org/sites/default/files/sit_accion_files/br_4029.pdf
[113] Ibid., 7.
[114] Ibid., passim.

As the first concrete nation-state-led initiative of digital inclusion with a focus on broadband, the PNBL was rooted in three main pillars: price, coverage, and speed. As attested by the development of the PNBL in its initial stages, the held assumptions implicated that by focusing on these three pillars, citizens would be able to not only participate in the national and global economy but also utilize relevant applications, public services, information, as well as access entertainment for free. The PNBL's pillars implied that a reduction price of broadband access is the fastest way to increase service penetration; coverage amplification is the necessary path so that a given user's geographic location does not determine access to telecom; and that an increase in broadband speed is needed in order to place Brazil at the same connectivity levels as found in other countries. The emphasis on the "free" as a way of captivating the public perceptions reflect the overall government vision that the access to technology may function as a social lever, despite the prevailing historical inequalities across the country.

The article 1 of Decree No. 7.175 (2010), which establish the PNBL as a nationwide policy framework, dictates the objective of promoting and disseminating the use and supply of ICTs goods and services in order to: I) broaden access to broadband Internet connection services; II) accelerate economic and social development; III) promote digital inclusion; IV) reduce social and regional inequalities; V) promote the generation of employment and income; VI) expand e-government services and to facilitate the citizens' uses of State services; VII) promote the training of the population for the use of information technologies; and VIII) increase Brazilian technological autonomy and competitiveness.[115] Accordingly,

> Building the way to overcome the social divide that divides Brazilian society is the main goal of the National Broadband Program. Social inclusion today has a new and important dimension: digital inclusion. Social stratification and accumulation of wealth are increasingly due to the ability to access, produce and circulate knowledge. Digital inclusion is a matter of citizenship: a new right in itself and a means to secure other rights to the population.[116]

In its foundation, it is possible to observe the government's recognition that digital inclusion is not only a matter of competitiveness in the 21st century but rather a civil

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[115] "Decreto Nº 7.175, De 12 De Maio De 2010," *Presidência da República - Casa Civil Subchefia para Assuntos Jurídicos*, Accessed February 10, 2020, http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7175.htm

[116] Ibid., 6.

right that demands to be guaranteed by the government in collaboration with other private and non-private entities. As pointed out in the PNBL's base document, "the widespread use of broadband should be seen as an instrument to enforce the rights of citizens in the digital age."[117] Besides the civil right of being connected to the Internet, the PNBL also points to the fact that a broadband expansion nationwide would hinder the possibilities of deepening even more the already-existing socioeconomic inequalities across the country's five regions. While it is true that increased access to broadband holds the potential for more economical, cultural, and social progress, it does not guarantee that technology alone would provide substantial changes. This view on broadband as the unique lever of social change is problematic for several reasons, as shown in the important scholarly work of media scholar Jan van Dijk[118] and others.

The preliminary observations of researchers Moren Falch and Emerson Iaskio (2019) provide a useful summary of this government mindset and telecom configuration in terms of broadband connectivity, suggesting that when in comparison to the U.S. and Western Europe, Brazil has still a significant challenge concerning coverage of a vast area within a single nation-state operated under the same federal legislation.[119] According to the authors, that of the factor of territorial coverage implicates how telecom policies are implemented, suggesting within this regional context that "policy objective of universal service becomes more important."[120] This factor has direct implications concerning the underlying reasons that justify more focus on infrastructure expansion than on infrastructure competition. Table 3 assembles the major policies and instruments of PNBL as articulated by Falch and Iaskio.

[117] Ibid., 7.
[118] Jan AGM Van Dijk, *The Deepening Divide: Inequality in the Information Society*. Sage Publications, 2005, passim.
[119] Morten Falch and Emerson Leonardo Schmidt Iaskio, "National Broadband Strategies: The Case of Brazil." In *The 2nd Regional African Conference of the International Telecommunications Society*. 2019, Accessed November 30, https://vbn.aau.dk/en/publications/national-broadband-strategies-the-case-of-brazil
[120] Ibid.

Instrument	Action	Target	Beneficiary	Executor
Infrastructure Regulation	Implantation of pipelines and fibres jointly to the execution of infrastructure works	To bring broadband to remote areas	Operators	Federal Government
	Induce and strengthen unbundling networks	Improve competition	Entrant companies	Anatel
	Take advantage of the installed capacity in the domain area of federal highways.	Increase public network capacity	End users	Federal Government
Service Regulation	Expand backhaul capacity and coverage	All cities with backhaul coverage	End users	Anatel
	Detail rules and conditions for network and data interconnection	Universalization of class V interconnection	End users	Anatel
	Radio spectrum management	Expansion of mobile broadband offer	Entrant companies	Anatel
	Expand and optimize mobile broadband access network	Coverage of the 3G network throughout the national territory	End users	Anatel
	Increase competition and service alternatives with innovative business	Enable new business models	Companies	Anatel
Funding and taxes incentives	Increasing access to credit by small and micro-providers	Increase competition	Entrant companies	BNDES
	Digital Cities Projects	Increase internet access	City Halls and public schools	Federal Government
	Tax exemption for the end user (modems)	Price reduce for end users	Modems manufacturers	Federal Government
Productive and technology policy	National Content Policy	Protection to the national manufacturer	Modems Manufacturers and Application Developers	Federal Government and BNDES
Building of a national network	Infrastructure building	Network in 4.278 municipalities	Building Contractors	Federal Government

Table 3. Summary of the major dimensions of PNBL's policies and instruments articulated by Falch and Iaskio (2019) after adapting from the one produced by the Comitê Gestor do Programa de Inclusão Digital (2010).

As an ambitious plan for democratizing the broadband access on a nation-wide scale, the telecom infrastructure for the PNBL predicted the establishment of a National Network (*Rede Nacional*). With 5.7 billion Reais (nearly 1.03 billion USD) of investments and 3.2 billion Reais (577.4 million USD) of government capitalization, the plan for such a nation-wide broadband public network prescribed the creation and operation of a massive telecom infrastructure operated by Telebras. With most of its fiber networking consisting of Optical Ground Wire (OPGW) cables, leased from companies in the *Centrais Elétricas Brasileiras S.A.* (Eletrobras)'s system, the operation of the National Network was organized in three levels as shown in Table 4: National Level – optical backbone; Regional Level – backhaul, the interlink between the municipalities to the optical backbone; Local Level – the local infrastructure that connects the connection between backhaul to the end user.

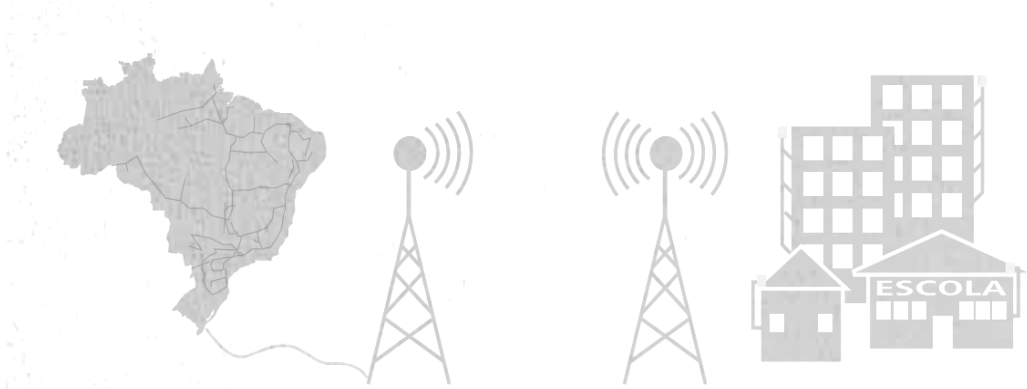

Table 4. Simplified illustration of the three levels of infrastructure of the National Broadband Program showing the overall division into the optical backbone, backhaul and local infrastructure.

There is no doubt that the building of a National Network is a difficult task in a country as large and geographically diverse as Brazil. Upon the launching of the program, the government's plans included using the National Network to connect Brazil both in terms of geography as in terms of population capacity by 2014. More specifically, it was mandated that the Telebras' National Network would reach 4.278 municipalities with its fiber-optics network by 2014. However, as shown in the evaluation of the PNBL by Brazilian senator Anibal Diniz, Telebras managed to connect only 612 municipalities—being 360 by direct supply and 252 through partners.[121] As reported by Knight (2016), the last available analysis by the Ministry of Communications[122] shows Telebras' coverage data from 2013 and plans for deployment in 2014 (fig. 11).

[121] Peter Knight, "O Papel da Banda Larga no Desenvolvimento do Brasil." In Peter Knight, Flavio Feferman, and Nathalia Foditsch (Eds.), *Banda Larga no Brasil: Passado, Presente e Futuro* (pp. 19-53). Sao Paulo: Novo Século Editora Ltda.
[122] In 2016 the Ministry of Communications had its name changed to Ministry of Science, Technology, Innovation, and Communication (MCTIC).

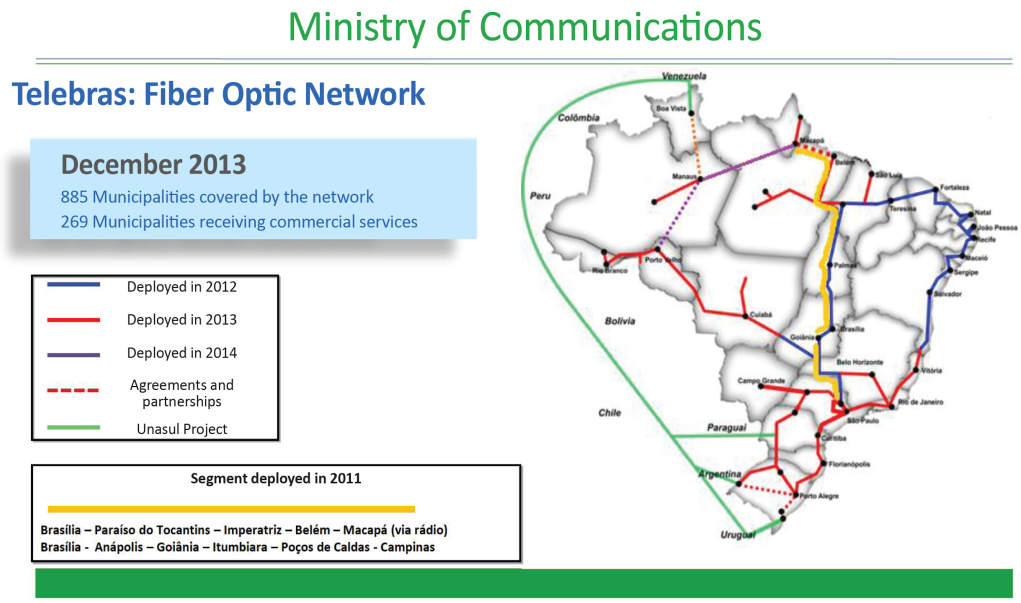

Figure 11. Map of the Telebras's Fiber Optic Network as of 2014. According to PNBL, the National Network (Rede Nacional) had as a priority focus the establishment of a federal corporate network in Brazil's capitals, serving points of government and public interest and offering capacity in locations without communication service providers, with high prices or low economic attractiveness, as well as in areas of low metropolitan regions. The Network will be operated by Telebras and aimed to reach 4,278 municipalities by 2014. However, the targeted goal was never accomplished. (Source: Knight, 2016 adapted from MCTIC)

It is worth observing that this kind of information and data are highly scarce and opaque, which makes transparency and data-driven projects challenging to pursue. As of 2020, the Telebras' website informs that its fiber-optic network was 32,000 kilometers long.[123] The same pattern of the illustration above remains essentially the same, which means a relatively high concentration of networks in the southeast region—the country's most developed region—and a lack of network coverage in the hinterland areas of the north and northeast regions.

In the face of the infrastructural difficulties in achieving the set goals for the PNBL, the satellite solution gained more attention once it became intertwined with the Electronic Government – Citizen Assistance Service (*Governo Eletrônico – Serviço de Atendimento ao Cidadão—GESAC*). GESAC was originally established in 2002 under the presidency of Fernando Henrique Cardoso (1998-2002) and it is currently under the coordination of the Digital Inclusion Secretariat of the Ministry of Science, Technology, Innovation and Communication (MCTIC). Its goal is to provide free

[123] "Institucional." *Telebras*, February 4, 2020. https://www.telebras.com.br/acesso-a-informacao/institucional/.

Internet connectivity to remote regions of Brazil via land and via the SGDC-1. Today, GESAC is known for being the most extensive digital inclusion program funded on a federal level and the program that remains at the forefront of bridging digital inequalities under the premise of universalization of the Internet and other ICTs such as computers and laptops, web-based services, mobile applications, telecenters, and others. As many government-led programs that operate on a federal level, the development of the GESAC is characterized by a long and winding path that included different phases, priorities, challenges, and opportunities. Although GESAC does not explicitly target rural schools, its objectives have been and continue to be interlinked with other Internet connectivity policies on municipal, state, regional, and national levels such as the National Broadband Plan (PNBL). Such a focus on education has been evident since the beginning, when the GESAC's targeted goals intended to connect 3,200 terminal points, out of which 3,100 were either based in school, public libraries, and telecenters.[124] Identified in the piece of legislation nº 7.437, 2017, the GESAC goals are:

> I) to promote digital inclusion by providing broadband Internet connection, including locations where there is no adequate Internet connection offers;
> II) to support communities in state of social vulnerability that are located in agricultural, remote and urban peripheries by providing access to Internet connection services while promoting digital and social inclusion and encouraging electronic government actions;
> III) to expand broadband Internet access for public institutions, with priority for remote and border regions;
> IV) to support administrative bodies in electronic government actions; and
> V) to contribute to the expansion of Internet access aligned with other government programs, in particular with the National Broadband Plan - PNBL.[125]

Accordingly, the priority of the program lies in connecting communities that have been historically unconnected: remote education centers, rural schools, public libraries, health care centers, indigenous villages, border crossings, and quilombos

[124] Ângela MG Carvalho and Juliano Maurício Carvalho, "Alfabetização Digital: Análise do GESAC e da Construção da Cidadania nas Redes de Informação e Comunicação." In *XXX Congresso Brasileiro de Ciências da Comunicação. Intercom–Sociedade Brasileira de Estudos Interdisciplinares da Comunicação, Santos*, vol. 29. 2007.
[125] "Portaria MCTIC Nº 7.154, De 06.12.2017." Ministry of Science, Technology, Innovation and Communication. Accessed September 20, 2019. http://www.mctic.gov.br/mctic/opencms/legislacao/portarias/Portaria_mctic_n_7154_de_06122017.html#Art. 3º.

(communities organized by fugitive slaves that are often located in inaccessible areas).[126] In other words, GESAC primarily targets socioeconomically-vulnerable communities that have no other means of entering the world of information and communication technologies.

Not only these communities lack access to reliable broadband Internet access in schools, but they are also the ones that often happen to be low-income and with low levels of literacy. After all, as I explored before, rural areas are often not covered by telecom operators because the economic potential for revenue in these areas are low in comparison to more populated, urban areas that already have enough infrastructure.[127] Therefore, it is precisely for this kind of "unconnected" communities that GESAC is designed for.[128] In GESAC's early years, the government had already signaled its desire to expand the program, which implicated the need for more funding and a centralized strategic vision to expand on-ground GESAC points throughout the country. In the Geneva Declaration of Principles, signed in 2003, participating countries, including Brazil, agreed on the potential of information and communication technologies to promote the United Nations Millennium Development Goals. The Geneva Declaration also ratified the Universal Declaration of Human Rights and proposed the use of ICTs as a means of guaranteeing such rights while also recognizing that it should be considered not as an end in themselves but as a means to achieve them.[129]

If PNBL focuses on providing a national public network of fiber-optic cables, GESAC represents the welfare program that most significantly relies on the potential of satellite technologies for broadband connectivity in rural, remote areas. In the early

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[126] Knight, "O Papel da Banda Larga no Desenvolvimento do Brasil," passim.
[127] Bernardo Sorj, *A Luta Contra a Desigualdade na Sociedade da Informação*. Brasília: UNESCO, 2003.
[128] During the following presidencies of Luiz Inácio Lula da Silva and Dilma Rousseff, GESAC was widely expanded and took new directions, which enabled the partnerships with other ministries with the goal of expanding broadband connectivity via land and satellite technologies. With the revamp of the GESAC program, it started to value aspects that had not been considered in its original version, assuming that promoting digital inclusion would implicated in a stronger need of working with the communities that have benefited from the GESAC ICT-intensive programs; the focus on digital content production; the cooperative and distance content development with other communities; the interaction with the Free Software movement; and in fostering local cultural and economic development (Tramontin & Borges, 2007).
[129] Since the Brazilian government has signed and ratified the document at the two meetings of the World Summit on the Information Society in Geneva, Switzerland in 2002, and Tunis, Tunisia in 2005 it is assumed that it agreed with all items and believed in the use of ICTs to promote human rights, which comes handy in discussions of the growing importance of providing Internet in places like public schools.

phases of the GESAC program, Brazil did not operate its own domestic, government-owned communication satellites. It demanded the use of foreign satellites for communication, and the coordination of this phase of the program was characterized by the levels of partnerships established among the federal, state, municipal governments, as well as the public and private sectors. An example of that is the contracts with the Gilat do Brasil, a subsidiary of Israeli Gilat Satellite Networks, which presented a proposal for a satellite connection to all early locations of GESAC, in the amount of 77 million Brazilian Reais (13.2 million USD).[130] The satellite-enabled solution *by* Gilat do Brasil included the development of a local infrastructure based on a ground dish antenna station (very small aperture terminal—VSAT), a modem that connected the user with the satellite data, the Israeli satellite in orbit, and a center called "teleport" based in the city of Belo Horizonte, Minas Gerais, which functioned as a network hub.

Despite the technological limitations of the time, researchers Adriane Tramontin and Djalma Borges (2007) wrote about the use of the Israeli satellite to serve the then-stated goals of GESAC, showing the promising results that satellite Internet service in Brazil could reach up to 256 Kbps per each GESAC connectivity point on the ground.[131] On the other hand, the use of ADSL technology, the modality that is primarily concentrated in cities, would rely on a dial-up connection and would reach about 56 kbps per second. Via Gilasat's Skystar 360 E VSAT, the GESAC's early goals also included the provision of Internet satellite services to 3,100 remote schools,[132] which can be seen today as one of the earliest attempts of using satellite technologies for connecting Brazilian rural schools to the Internet. Between June 2003 and March 2004, 3,200 GESAC points were installed throughout the Brazilian territory, whose access to the Internet was possible via satellite technologies.[133] In this sense, the GESAC program aimed at what the government referred to as a "public Internet" by relying, among other things, on satellite technologies:

> The GESAC Program provides a communication space that is open and available throughout the Brazilian society, allowing access to

[130] Adriane Tramontin and Djalma Freire Borges, "Um Caminho para a Inclusão Digital: o Programa GESAC." *Organizações & Sociedade* 14, no. 42 (2007): 171, https://doi.org/10.1590/s1984-92302007000300010
[131] Ibid.
[132] "Satellite-Based Distance Learning: The 21st Century Solution." *Via Satellite*, August 20, 2013. https://www.satellitetoday.com/telecom/2004/10/04/satellite-based-distance-learning-the-21st-century-solution/.
[133] Carvalho and Carvalho, "Alfabetização digital," passim.

> information and services provided by the federal, state, municipal, legislative and judiciary levels. All of this information is then available on the Internet (via the World Wide Web), thus promoting the universalization of access and maintaining the permanent presence of the public power close to the citizen. In addition to government services, GESAC allows access to a kind of public Internet.[134]

Aside from major the critiques of the program, often associated with the mismanagement of technical and financial resources as well as the lack of institutional communication between the telecom providers, the government, and the civil society, GESAC remains the most extended government program to provide access to the Internet and ICTs more broadly to communities that often do not get to participate in the domestic and global media economies. The social and digital inclusion aspects, which are the core of the GESAC program via Internet connectivity, remain relevant and hold the potential to provide digital media literacies for those perceived as "excluded" or "unconnected."[135] However, new improvements are always needed to cope with the fast-evolving digital media landscape. With more than 11,000 connectivity points throughout Brazil today, GESAC is one of the leading government programs benefiting from the SGDC-1.

Figure 12. Photo of a satellite dish installed in a school in the city of Monte Alegre, in the Brazilian northern state of Para. (Source: Prefeitura Municipal de Monte Alegre)

[134] Tramontin and Borges, "Um Caminho para a Inclusão Digital," 174.
[135] Benedito Medeiros Neto and Antonio Miranda, "Uso da Tecnologia e Acesso à Informação pelos Usuários do Programa GESAC e de Ações de Inclusão Digital do Governo Brasileiro." *Inclusão Social* 3, no. 2 (2010), https://repositorio.unb.br/handle/10482/12786

Figure 13. Photo of an in-site router installed as part of the GESAC program (Source: Prefeitura Municipal de Monte Alegre).

In the face of the growing scholarly critiques of globalization and the unequal access and unexplored potential of a truly "global" exchange of information, cultural, and technological capital,[136] many media scholars in Brazil are tempted to accept that the burgeoning of the Internet remains the ultimate state of what Canadian philosopher Marshall McLuhan referred to in the 1960s as the "global village." As we extend "our central nervous system itself in a global embrace," we are likely to change our perspectives of both space and time, supposedly giving new dimensions of mediation on a global scale via electronic-based communication that it is open, participatory, neutral, and collaborative. As shown in this chapter, the so-called "dark spots of information" propagated by the federal government is grounded in the binary, loose, confusing, and limiting definitions that came from the "digital divide" and is predicated on a liberal policy of social and digital inclusion.

Furthermore, the complexity of dealing with questions of rurality in a country as complex as Brazil is indeed a challenge for both academics, policymakers, and the civil society, as cities continue to grow and the flow of population between regions is increasing. The number of schools that remain unconnected is high, but that does not necessarily mean that students are completely unconnected or in "dark spots of information"; after all, the rise of mobile Internet in Brazil is increasing, and smartphone penetration is also significant. Upon the government's relative failure of providing a nationwide broadband public fiber-optics network through PNBL, the

[136] Milton Santos, *Por Uma Outra Globalização: do Pensamento Único ao Pensamento Universal*. Rio de Janeiro: Record, 2002, passim.

deployment of a satellite into the GEO orbit emerges as a savior of connectivity supported that not only would help elevate Brazil national pride in owning its communication satellites but also promote digital and social inclusion through GESAC for communities at societal margins. After years of failed policies and other initiatives focused on financing nationwide telecom infrastructures, PNBL and GESAC paved the way for the rise of welfare importance of satellite Internet, helping solidify the view of satellite broadband connectivity as a human right in Brazil—regardless of one's geographic location or socioeconomic class. In other words, the policy frameworks of PNBL and GESAC materialize the extension to which the government's initiatives in exerting power through the building of macro-scale telecom infrastructure and enacting persuasive discourse for the publics through it occurs.

On the one hand, it is safe to argue that these policies also contribute to the studies of national integration in a country as large as Brazil. That is to say that we can trace a parallel to a long-held goal of geographic integration that started way before the emergence of the Internet upon many years of building interstate highways and railways to offer a transportation network within a country of such continental dimensions. While some of these programs failed at achieving the ambitious goal of providing "Internet for those who need they most," they all point to the government's desire to provide broadband Internet connectivity even amid political turmoil, economic instability, and changes in overall government ideologies.

On the other hand, the so-called "digital divide" or "dark spots of information," as a rhetorical consequence, appears as naturally fixed according to the positioning of government figures like Minister Pontes, although I firmly believe that new modes of scholarly engagement to guide policy framework that takes into account local, regional, global cultural, economic, and technological specificities. In other words, it is becoming increasingly apparent for the academic community and the civil society that the early view of the Internet in forging a truly "global village" is not really the ultimate state of connectivity. With the emergence of the Internet in matters of public life on a global scale, coupled with ambitious public-private initiatives swiping across countries in the Global South, it is vital that we rethink our relationship to institutions and one another in shaping our understanding of what it means to live in a connected "global village." Accordingly, it is possible to critically reflect on the role of everyday citizens in participating in an increasingly complex

global media ecosystem—regardless of their geographic location in whatever ways that can shape the rural-urban typologies and define (or not) the telecom infrastructure as sole instruments of social and digital inclusions.

Chapter 2: Framing a Space-telecom Propaganda via the Televisual

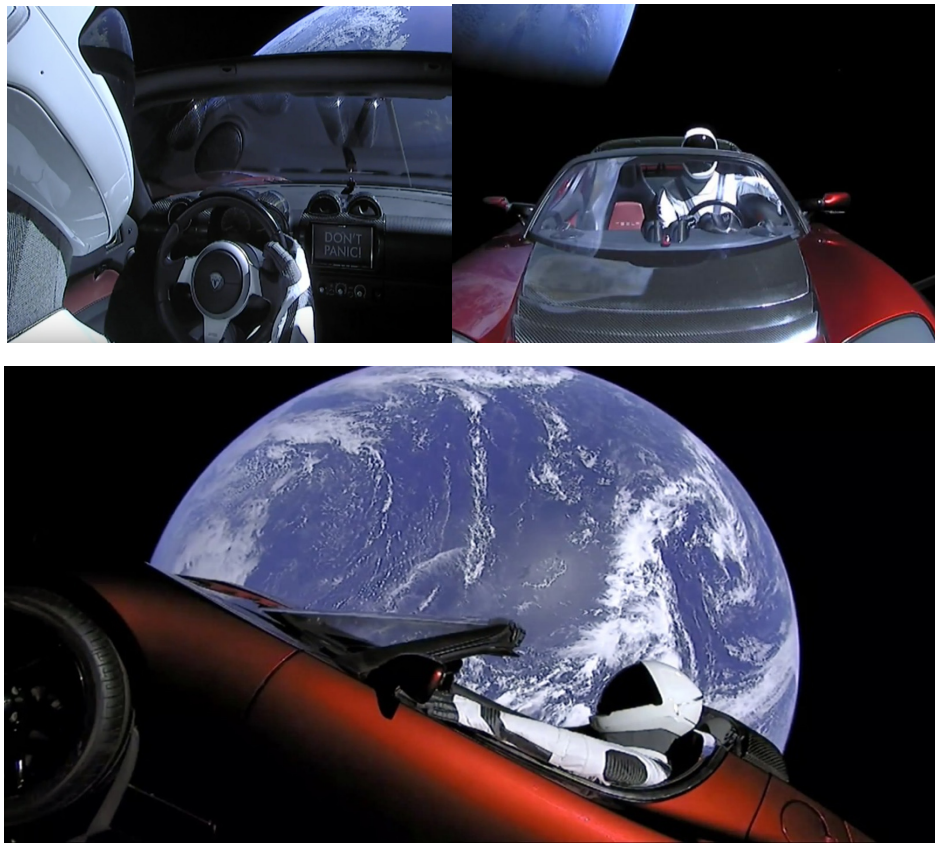

Figure 14. Orbital photos of a Tesla Roadster car and a "Starman" mannequin launched into space by U.S. company SpaceX in 2018. Thanks to cameras placed inside and outside the car, on booms attached to the vehicle's custom adaptor atop the upper stage, it is possible to see portions of the Earth in the background. When questioned about the underlying reasons for placing a Tesla car in orbit, Elon Musk (2018) wrote on Twitter, "I love the thought of a car drifting apparently endlessly through space and perhaps being discovered by an alien race millions of years in the future."

On February 6th, 2018, the U.S.-based company SpaceX launched a one-hundred-thousand dollars Tesla Roadster electric sports car and a mannequin named "Starman" dressed in a spacesuit into orbit. Founded by South African-born billionaire technology entrepreneur Elon Musk, the technological product of both companies—SpaceX and Tesla—became seamlessly intertwined as they left Earth in what is arguably an unprecedented high-profile media event. While these two objects––a 2008 electric car and an astronaut-like mannequin—majorly characterized the event as a high-profile media event due to its global repercussion, it was the successful experimentation of the Falcon Heavy Test flight that deserved equal, if not more, recognition from the public, as it epitomized the triumphant launch and operation of the most powerful rocket in the world. After all, it is the powerful,

reusable rockets that represented the "real star of the show…that could revolutionize spaceflight,"[137] and not ordinary objects of everyday life that are now set to live on for millions of years in unreachable outer space. Taking off from the same launch pad as NASA lunar mission Apollo 11 in 1969, and onboard a second-stage capsule in Falcon Heavy Test flight, the SpaceX Roadster and "Starman" reached orbit within a matter of minutes. As it swiftly navigated through the skies, the world watched the high-profile media unfold via live stream, reaching a global audience of more than 2.3 million concurrent viewers on YouTube and making it the second most-watched live stream ever on the platform.[138]

While the mapping of the "dark spots of information" and the categorization of the "unconnected" may be arbitrary, so are how the SGDC-1 gets framed through powerful and compelling images orchestrated by the Brazilian government. This chapter closely examines two sets of high-profile media events performed by the Brazilian government that provides a view on its political intentions in framing the SGDC-1 via televisual strategies. Before jumping into these two events in detail, however, I propose a brief parallel anecdote with SpaceX to exemplify how the televisual holds power to create a sense of media spectacle for diverse audiences in occasions when technology, science, brand strategies, and media discourses intersect. In other words, a critical look into the orchestration of the televisual in the forms of high-profile media events is the focus of this chapter.

As exposed in the Introduction, the growing privatization of space and the rise of developing countries in engaging with space-enabled technologies implicate new forms of communication strategies in order to persuasively branding their own projects: from military surveillance to tele-education and from climate analysis to telemedicine. From a cultural studies point of view, space archeologist Alice Gorman (2018) contends that "every object humans have launched into the solar system is a statement."[139] While the statement of the SGDC-1 is to connect the unconnected by providing broadband for the so-called "dark spots of information," the reliance of

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[137] Jason Davis, "Let's Talk about Elon Musk Launching His Tesla into Space ..." *The Planetary Society*. Accessed April 5, 2020, https://www.planetary.org/blogs/jason-davis/2018/20180205-space-tesla.html.

[138] Micah Singleton, "SpaceX's Falcon Heavy Launch Was YouTube's Second Biggest Live Stream Ever." *The Verge*, February 6, 2018. https://www.theverge.com/2018/2/6/16981730/spacex-falcon-heavy-launch-youtube-live-stream-record.

[139] Ceridwen Dovey and Elizabeth Kolbert, "Elon Musk and the Failure of Our Imagination in Space." The New Yorker. Accessed April 5, 2020. https://www.newyorker.com/books/under-review/elon-musk-and-the-failure-of-our-imagination-in-space.

expensive space or telecom projects by private companies also holds comparative importance when thinking about the relationship between governments, macro-scale infrastructures, and inclusion. These discourses increased salience when they rely on powerful televisual texts or other media strategies in order to spread their message and convince their targeted audiences of the company's role of either advancing sustainable development or overcoming of prevailing inequalities, all while accumulating financial capital on a global scale. The orchestration of the televisual, therefore, plays a pivotal role in how Musk's company brands get advertised to global audiences, and how we can understand the Brazilian government's orchestration of the televisual to frame SGDC-1 as a savior of rural broadband connectivity.

As exemplified in the examples above (fig. 14), SpaceX's branding strategy was much more than just showing the power of the new rockets. It also constituted a high-profile media event bolstered by a performative orchestration of images that had direct implications on the reputation of Elon Musk as a so-called "technology visionary." Such a high-profile media event relied on the televisual to explore what is being defined as the New Space Race insofar private companies such as SpaceX, Amazon, Facebook, Blue Origins continue to expand their operations and investments in LEO satellites.[140] With the news media coverage circulating worldwide as the Falcon Heavy Test Flight completed its flight up to Earth's orbit and back to the ground, it was clear that the SpaceX's high-profile media event was not only about a technological achievement of producing the most operational rocket in the world, but also a well-thought, expensive, and performative orchestration of the televisual in framing objects of everyday life to increase the public trust, justify the high investment, and thus achieve brand pride as well as public's respect. As it must be clear by now, such an orchestration of the televisual played a pivotal role in forging a sense of spectacle as millions of people watched as it drifted away more than 29,000 kilometers per second from Kennedy Space Center in Cape Canaveral, Florida.

Nevertheless, unlike the SGDC-1, SpaceX Roadster and "Starman" have no immediate operational function to promote social and digital inclusion. Also, they are not part of a public-funded project made possible by the money collected from ordinary taxpayers. Despite that, both embody elements of popular culture that are

[140] Tim Fernholz, *Rocket billionaires: Elon Musk, Jeff Bezos, and the New Space Race*. Boston, MA: Houghton Mifflin Harcourt, 2018.

common to ordinary citizens on Earth: the everyday design of the car; the use of film and photo techniques showing the objects and the Planet Earth; the placement of a small data storage inside the car containing a copy of Isaac Asimov's *Foundation* novels; a dashboard with the tagline from Douglas Adams' *The Hitchhiker's Guide to the Galaxy* saying "Don't Panic;" and a generous tribute to the influential popular culture figure of David Bowie, who composed successful songs such as "Life on Mars" (1971), "Starman" (1972), and whose death surprised the world in 2016. As the car floated in zero gravity, its sound system was set before launch to continuously loop the Bowie's song "Space Oddity." In articulating the technological achievements through Falcon Heavy Test flight, the Tesla Roadster, and "Starman," SpaceX was therefore no longer seen as another aerospace company. It also became known for its powerful orchestration of media to celebrate its achievements via propaganda-like televisual techniques of film, imagery, sound, and elements popular culture and science fiction—constituting, thus, a clear and powerful orchestration for the news media, which, in turn, helped grab the attention of diverse global audiences, and achieve corporate pride and trust.[141] As such, it had the power to convincingly persuade the publics on the collective importance of the company's "ultimate goal of enabling people to live on other planets."[142] It is based on this discussion of the interplay between techno-scientific achievements and the power of the televisual in forging a sense of the spectacle that I now locate the discussion of the SGDC-1.

More specifically, this chapter investigates how the government's use of the televisual connects to the framing of the satellite as a savior of connectivity for the so-called and previously contextualized "dark spots of information." To accomplish that, I ask the following exploratory questions: what are the main televisual techniques utilized or commissioned by the Brazilian government to frame the SGDC-1 as a savior of connectivity? What is the dialectical role of videoconferencing in portraying

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[141] Media outlets also reported that the use of the Tesla Roadster was also the "greatest publicity stunt of our time" (Savov, 2018). Despite the critiques of space debris that the launch has received from space policy specialists and Internet users through memes, other commented on the propaganda maneuvering of SpaceX in using the Tesla Roadster and the mannequin as a symbolic communication (Gorman, 2018) as well as a "Readymade" work of art such as Marcel Duchamp's 1817 piece *Fountain*, which was created by placing an everyday object in an unusual position, context and orientation (Chayka, 2018). Other specialists justified by saying that "the enthusiasm and interest that [Musk] generates more than offsets the infinitesimally small 'littering' of the cosmos" (David, 2018).

[142] "SpaceX: Space Exploration with the Aim of Enabling Life on Other Planets." *American Geography Society.* Accessed April 5, 2020. https://ubique.americangeo.org/company-and-not-for-profit-spotlights/spacex-space-exploration-with-the-aim-of-enabling-life-on-other-planets/.

those perceived as "the unconnected"? What do these televisual strategies reveal about the framing of the satellite for the general public?

I ground this chapter on two foundational premises. Firstly, I suggest that the televisual holds power to function as an aesthetic and persuasive text in the construction of reality in a country with low levels of formal readership as in Brazil. Secondly, I contend that the government's orchestration of propaganda-like televisual elements distracts the general public from critically assessing the nitty-gritty details that characterize the satellite as a high-capital object that is purposefully built in the public's imaginaries as a savior of connectivity. These two premises are crucial because they provide collective visibility into the construction of the satellite in the publics' imaginaries, thus providing critical understanding to what Parks (2013) calls "an entire orbital assemblage that is shrouded in secrecy yet paid by for by publics, and that is culturally pervasive and yet heavily laden with risks."[143] In examining how the government's maneuvers its meta visual narratives on the SGDC-1 as a savior of connectivity, I analyze two instances when the use of the image-based media provide interesting insights on the government's interest in spreading the word about the satellite to the general public in relation to regions considered "dark spots of information" and public rural schools students perceived as "the unconnected."

The analysis firstly focuses in a documentary film broadcasted via a Discovery Brasil's TV series, *Brasil Ciência*, that was commissioned by MCTIC to demonstrate how the SGDC-1's civil-military nature is intertwined with the voice of the documentary, which reiterates the social inclusion mission of rural school connectivity and national pride. Second, I look at how the dialectics of distance plays out in Brazil via satellite-enabled videoconferencing between the federal government and those in rural schools who are perceived as the "unconnected." These two case studies are characterized as high-profile media events that are worth studying because they suggest how the use of specific televisual codes constitute what I suggest as a kind of "space-telecom propaganda" orchestrated by the Brazilian government. Similar to SpaceX's orchestration of the televisual to reiterate the company's technological boldness in exploring orbital realms, the televisual maneuver of the SGDC-1 reveals the Brazilian government idealized narrative capable of distracting

[143] Lisa Parks, "When Satellites Fall: On the Trails of Cosmos 954 and USA193." In *Down to Earth: Satellite Technologies, Industries, and Cultures*, Ed. Lisa Parks and James Schwoch, 2012, New Brunswick, NJ: Rutgers University Press, 234.

the public from growing investments related to science, technology, and social and digital inclusion. These two high-profile media events exemplify how communication is established and negotiated, which is aligned with James Carey's (1989) observation of the televisual text as "a symbolic process whereby reality is produced, maintained, repaired and transformed."[144] However, such televisual tactics also play a critical role in overshadowing key issues pertinent to public-private partnerships, militarization, national sovereignty, and others that remain invisible to the publics.

In this chapter, I rely on the definition articulated in the previous works of other media scholars to refer to televisual as ways of seeing and knowing the world around us that are not necessarily bound by commercial television or industries. As an epistemological system, the televisual can be considered a "set of critical discourses that define and attribute properties to the medium,"[145] which can be included—but not limited to—a sense of liveness, physicality, flow, remote control, coverage, vision, surveillance, as well as social and digital inclusions. In defining and attributing properties to the SGDC-1 to the general public via high-profile media events, the Brazilian government's orchestration of the televisual reveals a great deal of information that demands scrutiny for a nuanced and contextual understanding of not only how nation-states brand their telecom strategies but understand how technologies become intertwined with a sense of media spectacle to the publics they serve: be it via commissioning a well-known commercial TV channel or by playing with the dialectics of distance through videoconferencing.

Forging National Pride Through via Discovery Channel's *Brasil Ciência*

One year before the launching of the SGDC-1, the MCTIC commissioned Discovery Brasil, a branch of the American pay television channel owned by Discovery, Inc., to produce a TV series called *Brasil Ciência.*[146] Conceived initially to inform the public on the current developments unfolding in poorly-funded areas as diverse as particle physics and astronautics, *Brasil Ciência* managed to deliver to the public, in a highly sensationalist tone typical of Discovery's style in documentary

[144] James Carey, *A Cultural Approach to Communication*. New York, NY: Routledge, 1989, 23.
[145] Parks, *Cultures in Orbit,* 12.
[146] In the English language, "Brazil's Science" would be an approximate translation for the Discovery Channel series discussed in this chapter.

films, a portrayal of Brazil that is often overshadowed by other cultural phenomena such as soccer and telenovela. With the prime goal of framing the national achievements in science and technology, the series expanded the view that the government is conducting massive investments on complex and cutting-edge infrastructures capable of not only increasing Brazil's competitiveness on a global scale, but also persuading domestic audiences on how they relate to social and digital inclusion as well as economic progress. As a government-funded audiovisual production, *Brasil Ciência* exposes five scientific and engineering projects: the Brazilian Synchrotron Light Laboratory, Santos Dumont Super-computer, Hydro-Oceanographic Research Ship Vital de Oliveira, Amazon Tall Tower Observatory, and, finally, the Geostationary Defense and Strategic Communications Satellite, which is the focus of this section. Separately, each episode corroborates to the selling view of Brazil as a competitive nation in science and technology.

Produced in partnership with a São Paulo-based film production company, Trator Filmes, Discovery Brasil broadcasted each 50-minute episode between December 12th and December 16th, 2016,[147] although the publics continued to access the series in online versions available on platforms such as YouTube, Vimeo, and even for sale on DVD (fig. 15).

Figure 15. Discovery Channel's Brasil Ciência DVD bundle for sale on Argentine-based platform Mercado Livre. While the logo of Discovery is found on the top part of the DVD cover, the bottom part shows the logos of the Federal Government and the MCTIC. (Source: Mercado Livre)

[147] "Canal Discovery Lança a Série 'Brasil Ciência.'" *Agência FAPESP*, December 12, 2016, http://agencia.fapesp.br/canal-discovery-lanca-a-serie-brasil-ciencia/24485/.

While detailed information on the audience reception or financial investment made by the MCTIC toward the TV series remains unavailable, the underlying message behind the televisual orchestration is clear: *Brasil Ciência*'s main goal was to portray "the Brazilian scientific research at the frontiers of global knowledge."[148] Not only does the televisual coverage of these apparently high-capital projects aim to reflect a growing commitment to the development of building domestic technological capabilities, but it also sheds light on the social, scientific, political, cultural, and economic possibilities that each one of these ambitious projects holds for the publics.

The coverage of each of these projects via televisual strategies was mainly possible through techniques often deployed in expository documentaries Discovery Channel is known for. As a result, the documentary played a vital role in praising the apparent techno-scientific progress being carried out by the Brazilian government. In other words, one could argue that the use of the televisual also works to reiterate the government's attempt in branding its investments in hard science and engineering progress as means of collective persuasion, mostly for a population that lacks literacy and scientific knowledge to assess technology-related projects. When placing the complexities of technology in relation to the goals, orientations, and needs of nation-states, the televisual and its varied and potential rhetoric discourses gain an extra layer of complexity that demands critical analysis as it touches other relevant subjects such as accountability, financing, propaganda, and military tactics.

The 50-minute length Discovery's TV series *Brasil Ciência* covering the pre-launching achievements of the SGDC-1 was first premiered on December 17th, 2016, months before the satellite was put into orbit in 2017. As a blended runaway production, the filming locations of this episode spanned from military-protected satellite facilities in Brazil to technologically advanced clean rooms at Thales Alenia Space in Cannes, France.

[148] Viviane Celente, "Documentários do Discovery Channel Destacam Ciência Brasileira." *CNPEM*, December 16, 2016, http://cnpem.br/documentarios-do-discovery-channel-destacam-ciencia-brasileira/.

Figure 16. Computer-generated illustration of the beam's coverage of the SGDC throughout the Brazilian territory found on the TV series Brasil Ciência. Alongside the MCTIC, other media outlets have picked up this illustration and incorporated it in their news coverage and social media reactions of the satellite. Consequently, many new stories used the illustration while covering the development of the SGDC-1 once it reached Earth's orbit. (Source: Discovery Brasil)

Given that the project occurred thanks to an MCTIC sponsorship, the orchestration of the televisual is, therefore, one likely of political partisanship. In other words, such a strategy of playing with the televisual as a captivating way to coerce the masses is evident immediately from the opening of the film. It is through a drone flyby over a rural area in Brasília's outskirt that the documentary film's engagement with the subjects of the "satellite" and "rural school students" starts the overall tone of the SGDC-1 as a savior of connectivity. Organized in conjunction with dramatic suspense-like audio, there are three major aspects that capture the way the televisual plays out in the film: I) the building of technological capacity through technology transfer and absorption programs discursively validated by foreign engineers; II) the personal and professional lives of Brazilian engineers and officials behind the building and future on-ground operations of the satellite; III) and rural school students who had their pedagogical experiences transformed upon the arrival of the SGDC-enabled broadband. With each of these aspects playing a role in the branding of the satellite, I briefly discuss frames from a few scenes to shed light on some of these televisual strategies.

Based on the existing film studies scholarship, it is safe to argue that the timeline of scenes, ranging from showing a rural area in Brazil's central region to the high-end satellite laboratories in France, as well as from approaching the Brazil-

France transfer and absorption of technology to the prospects of the military-civil use of the satellite, constitutes the film's *fabula* (or chronological order of the raw material). However, the *syuzhet*, that is, how the story of the documentary is organized, is founded mostly on the relationship between Brazil as a growing influential nation-state in the building of large-scale technological infrastructures—as such, this a view is materialized early on to show the future possibilities of the country in owning its own communications satellite. While I do not focus on the detailed analysis of the film's narrative sequence, a brief delineation of both fabula and the *syuzhet* is helpful to contextualize the relevance of the televisual in framing the SGDC for the general public. As the brief comments on the fabula and *syuzhet* suggest, one could think of this film as an expository documentary with a persuasive voice aimed at informing audiences on a given topic.

In the third chapter of his book *Introduction to Documentary* (2001), film critic Bill Nichols explores the constituents of what he considers "the voice of a documentary film" or, in other words, the specific manners in which an argument or perspective is materialized in the televisual format.[149] Grounded in concepts drawn from the art of rhetoric, Nichols writes about the role of the documentary filmmaker in revealing a portion of reality that may require social, cultural consensus, or solution. Based on the premise that documentary films are a representation of reality embedded in a series of assumptions, biases, and histories—and not a mere nor an accurate reproduction of reality—Nichols argues that a documentary's voice (a voice of its own) is a question of how the film is conveyed to a given audience via the articulation of a set of logical storylines, arguments, viewpoints, and ideologies. Nichols argues that, in every documentary, there are at least three stories that intertwine: the filmmaker's, the film's, and the audience's, constating what he defines as the "triangle of communication."[150]

Given that the documentary's voice speaks with all the means available to its maker, each voice retains a uniqueness which "stems from the specific utilization of forms and modes of techniques and style in a given film and from the specific pattern of encounter that takes place between the filmmaker and the subject."[151] This implies that the documentary format is not rooted entirely on artistic expression, but also

[149] Bill Nichols, *Introduction to Documentary*, Bloomington: Indiana University Press: 2001, passim.
[150] Ibid.
[151] Ibid., 46.

biased framings of social realities. Such framing is, consequently, also profoundly conditioned by the ideals and political orientations of those funding entities that make the televisual possible in the first place, which in this case is the MCTIC. As a government-funded initiative, the televisual text surrounding the SGDC is through *Brasil Ciência*, therefore, used as a strategically and politically oriented initiative to communicate its workings in a way that is captivating for those who may otherwise not grasp its intentions or impact solely by looking at government reports or reading newspapers. In one of his reflections of the "voice of the documentary," Nichols writes,

> By "voice" I mean something narrower than style: that which conveys to us a sense of a text's social point of view, of how it is speaking to us and how it is organizing the materials it is presenting to us. In this sense "voice" is not restricted to any one code or feature such as dialogue or spoken commentary. Voice is perhaps akin to that intangible, more-like pattern formed by the unique interaction of all a film's codes, and it applies to all modes of documentary.[152]

Through a series of techniques of film, the documentary framing the SGDC-1 suggests an intriguing rendering of the televisual coercion tool toward recognizing the importance of funding an object as complex and expensive as a communication satellite.

A critical analysis of the voice of the documentary films also reveals an interesting approach aimed at validating the strategic importance of the SGDC as a government-funded project. In many parts of the film, the camera turns to French engineers responsible for the technology transfer and absorption program that provided a three-year training to representatives of Visiona, the Brazilian company responsible for the building of the satellite, as well as other representatives from Telebras, INPE and the Brazil's Space Agency (*Agência Espacial Brasileira*—AEB). The opinions expressed by the French engineers provide an outside view, giving the Brazilian audience the validation of a foreign and respectable aerospace company as Thales Alenia Space. As pointed out by the president of AEB in the film, the technology absorption possible through a partnership with France emerges as a fundamental strategy that follows the technology transfer and, frequently, displays itself as much more relevant. In his own words, "the combination of both is important;

[152] Bill Nichols, "The Voice of Documentary." *Film Quarterly* 36, no. 3, 1983, 18, https://doi.org/10.2307/3697347

both the technology directly transferred to companies, as well as the absorption that is done for our young engineers who are working in the Brazilian space program."[153] While the focus on building national capability is reoccurring in the film, it is the commentaries by foreign engineers that serves as a validation of that mindset, as a manager from Thales Alenia Space positively points out in the film:

> This Project of the SGDC satellite is very important for the country of Brazil. Because, in fact, there are very few countries that have access to space and Brazil is one of them. And it is a several-steps strategy. It started many years ago with the first building of a space community in Brazil which went to work with different entities and especially there was in the past partnerships of Brazil with China, for instance, for some satellites. But these were partnerships. With the SGDC, Brazil is getting its own autonomy and sovereignty with access to space with having their own satellites. And it is only the first step, which means that the next steps will have SGDC-2 and so on. So, really, Brazil has a very strategic view of enhancement, access and control of space for the sovereignty of the country, which makes Brazil comes in force in relation to other countries that have their own autonomy of space.[154]

The foreign-voice validation on what is arguably a domestic's macro-scale infrastructure tactic over the government's strategic communication and nationwide broadband connectivity is compelling because it provides the audience with a supposedly detached viewpoint from national political partisanship that so commonly dictates the developments of technology and welfare programs in a democracy like Brazil (fig. 17). Moreover, it also points to the fact that Brazil is following the steps of developed nations while building its national technological capability. That is reinforced later in the film when the same engineer says that, "this experience of partnership with Brazil was very positive for Thales Alenia Space because [they] had the opportunity, first of all, to teach people of already very good education level, and who were willing to learn everything about space."[155]

[153] *Brasil Ciência*: *SGDC*, directed by *Discovery Brasil* (2016) and commissioned by the MCTIC, DVD, TV, and YouTube.
[154] Ibid.
[155] Ibid.

Figure 17. Frames of a scene sequence showing the hardware development of the SGDC-1 by French and Brazilian engineers and scientists at Thales Alenia Space in Cannes, France. The indoor scenes in clean rooms are put together with interviews of French engineers providing their opinions of the SGDC's importance for Brazil's sovereignty in space. Rather than portraying Brazilian nationals as users of foreign technology, the film does an active job of showing how active they are in collaborating with a prominent aerospace company in France.

Not only this emphasizes the overarching argument of Brazil having technical space-telecom know-how, but also pave the way to connect how that relates to nationalization, insofar the Thales Alenia representative writes that "[the partnership] was a success because we know that these people now are fully capable of returning back to Brazil and build[ing] satellites in the future."[156] Technology transfer and absorption is, therefore, justified as a means of leveraging domestic sovereignty. The image of the satellite is thus sold not only as a strategic macro infrastructure for defense and sovereignty but also as means for enabling future projects in Brazil to be carried out "by Brazilians for the Brazilians."

Another strategy used has to do with the way the documentary film depicts the work of trained Brazilian engineers and relevant military officials (fig. 18). As it is clear from the series' underlying goal of telling the stories of unknown lives of Brazilian scientists and their technological creations, the voice of the documentary sets out to locate the satellite in relation to certain nationals who, despite having to work in France, still managed to bring back home the know-how to apply in Brazil. After all, the SGDC-1, as described in the interview of one of the engineers, "is much more than [just] delivering a satellite."[157] The reference made was that by building ground control stations in the cities of Brasília and Rio de Janeiro, the country would be capable of delivering other satellites as part of the SGDC's planned constellation. Therefore, the personal and professional lives of Brazilian engineers and officials behind the future operations of the satellite is of extreme importance.

Throughout the film, it is evident that the music adds dramatic tension to the interviews as well as establishing, medium, and detailed shots. The use of dramatic high-pitched sounds frequently comes in conjunction with computer-generated images (CGIs) (fig. 16), scenes of individuals interacting with one another, and establishing shots of SGDC's militarily protected ground-segments such as giant parabolic antennas, wide electronic panels, computer screens, and small prototype of payload-like instruments.

[156] Ibid.
[157] Ibid.

Figure 18. Frames of the documentary film showing national engineers working in Brazil. In portraying mostly white-looking, young, male figures, the film blends their personal lives into the building of the satellite's mission. This strategy is interesting because it sets out to show that Brazilian higher education can equip staff competitively enough to help advance the technological landscape in Brazil.

The scenes depicting these engineers vary from the AEB's headquarters in Brasília to clean rooms in Cannes, France, but their televisual work together to present the audience on how the personal and professional commitments of these engineers are not only related to the development of Brazil's satellite capabilities, but also in achieving national sovereignty and, consequently, forging national pride. For instance, the film shows how the manufacturing of new payload materials using domestic technologies that are essential for the SGDC-1 to accomplish its civil-military mission. It also frames such achieved national capacity as the conditions necessary for the government to continue enacting its power in space exploration—be it for the common good, for military intelligence, or secret communication.

If owning a satellite constellation is often associated as an established capacity of developed countries, the portrayal of Brazil's competitiveness through the televisual is, therefore, achievable—at least in the eyes of those who otherwise remain at the margins of government funding. Additionally, the editing follows that logic of often juxtaposing an interviewee's personal and professional life story with the building of the satellite. These televisual features suggest an imprint of a national identity that directly speaks to a sense of national pride—one that sells the idea of Brazilian technology designed, built, and operated by Brazilians to serve other Brazilians. The national pride is, therefore, intertwined through the personal and professional lives of engineers who now will be able to carry on other macro-scale infrastructures.

In addition to the view of the national building capability through technology transfer and absorption, the voice of the documentary also explores the civil potentials of the SGDC-1 in connecting rural schools. Through a series of drone shots, interviews with rural schoolteachers and students, the documentary tells the story of the role of the broadband Internet in changing pedagogical practices in schools that are connected. There is one specific reason that helps unpack such a strategy: the theatrical and apparent use of infrastructure yet-to-be "turned on." When the film was shot, the satellite had not been delivered to Brazil and was only programmed to launch many months after. However, that is not the immediate impression when watching the film; quite the contrary, it leads the audience to believe that the SGDC-1 was already in orbit and responsible for connecting that school to the broadband (fig. 19). This can be seen in the theatrical ways in which engineers interact with one another, the images of the SGDC-1 in the control room, how the students and teachers

from the rural school comment on the changes brought up by the broadband, among others.

In portraying the student life of a group of students, the documentary film shows the importance of the Internet when working on homework, as well as the pedagogical possibilities. However, the film does not explore much of the use of smartphones that are possibly connected to 3G or 4G networks, making it seem like connectivity was not at all possible. Based on the shots, it is also possible to observer that the school where the filming takes place is a much above-the-average school—it has computers, sports courts, and interactive blackboards. Most schools in Brazil's rural areas are not like that, as I discussed in Chapter 1. The reality as being portrayed, in this case, suggests an overly exaggerated sense of technology determinism that does not match with the reality found in Brazilian rural public schools.

Figure 19. Frames of the scene sequences show the movement of a group of students commuting from a neighborhood in a rural area to the local school that is now changing its pedagogies while embracing the benefits of broadband for learning.

On top of the discussed techniques of film to convey the documentary's message about the much-touted building of a domestic communications satellite, it is also crucial to address how the usage of music functions in relation to three specific aspects related to the *mise-en-scène* support the MCTIC's branding of the SGDC's mission: the color palette, dynamic cuts, and the effective use of aerial and panoramic images as cutaways between locations. The song enhances the filmmaker's sensationalist view of the issue of high-capital technologies and the role of the satellite as part of a macro-scale infrastructure that places Brazil as a pioneer in the exploration of Earth's orbit. The overall color pallet provides the audience with a sense of a phenomenon that is secretive, hidden, and obscure, but with positive social consequences enabled by the social and digital discourses attached to the satellite. Additionally, the combination of the color palette adds an essential layer of meaning-making, as it leads the audience to experience the secrets that happen to be underlying and often invisible forces in the building of domestic technological capability.

As demonstrated by other influential literary works drawn from science fiction authors—such as Isaac Asimov, Arthur C. Clarke, H. G. Wells, or really any heavy science-related work that involves space-enabled technologies, artificial intelligence, the future of humanity, among many others—there is a pungent level of "imaginary world" or "social imagination." When coupled with persuasive tone of what information studies scholar Morgan Ames (2019) conceptualizes as "charismatic technology," we can think of the SGDC-1 as a powerful political instrument capable of materializing the achievements of the government to the masses. While charism might "not inherently [be] good or bad," it also demonstrates how power gets encapsulated in a multitude of ways by powerful institutions that get to shape the public discourse. Moreover, such a charismatic trait "is present when a technology's promises outstrip its actual capabilities and capture the social imagination,"[158] but whose "appeal likewise confirms the value of existing stereotype, institutions, and power relations."[159] The SGDC-1, therefore, functions as a powerful discursive tool for the Brazilian government.

By now, growing media studies scholarship shows that although technology can indeed be used for the advancement of sustainable development, the betterment of

[158] Morgan G Ames, *The Charisma Machine: The Life, Death, and Legacy of One Laptop per Child.* Cambridge: MIT Press, 2019, 25.
[159] Ibid., 23.

society, and the promotion of peace and understanding, it can also be used to profile marginalized individuals, to profit from user's data, promote violation of human rights, denigrate the natural environment, among others. Technology is, therefore, political and as such demands more nuanced, interdisciplinary understanding to account not only for what is being sold as a technical-enabled social and digital inclusion program of a nation-state but also to cultivate more participatory understanding on the implications of who is in control, how it is designed, operated, repaired as well as for whom and for which purposes it serves.

These techniques of film in *Brasil Ciência* as presented in the Discovery Brasil TV series commissioned by the federal government, clearly communicate MCTIC's goal to sell the SGDC-1 savior role of providing broadband connectivity to rural schools. While the documentary also exposes the duo-function of the satellite for broadband connectivity (civil) and a reliable apparatus for strategic communication (military), it is clear that the voice of the documentary sets the tone for the inclusivity mission of the SGDC-1 as a state-funded project with revolutionary implications for connecting those who historically lack access to broadband. That is to say that the satellite is not only a metal-base, complex, high-capital object in orbit. Instead, its televisuality is orchestrated by the government, via a branch of a well-known American pay-TV network, to the masses to sell the government's commitment to science and technology in the turn of a post-impeachment scenario followed by the fast-rising of a right-wing government that prioritizes privatization over investments in long-term projects in higher education, science, and technology.

It is within this context that the documentary's voice—discussed above in relation to the emphasis on the people, their technological training, their relationships to one another, and visually appealing infrastructures objects of clean and flight control rooms—help reiterate the social inclusion mission of rural school connectivity. By structuring the narrative in these major elements, the Discovery Brasil documentary creates enough tension to position the possibilities of the satellite for social and digital inclusion while also emphasizing the capacity of Brazil as a nation-state that is increasingly becoming more competitive as it explores the edges of science and technology, and that deserves a sense of collective pride by its nationals.

Videoconferencing the "unconnected" and the Dialectics of Distance

On May 9th, 2019, the MCTIC gathered journalists and other representatives of the Brazilian government to officially announce a milestone pertinent to the civil capacity of the SGDC deployed to connect the unconnected in rural schools. Amid a general climate of public discontentment that permeated the federal government in light of the multi-millionaire cuts in basic education, this meeting to discuss the civil milestones of the SGDC-1 can be characterized as a high-profile media orchestrated to self-promote the achievements in telecommunication, space, and digital inclusion by the federal government. If PNBL and GESAC paved the way for establishing ambitious policy frameworks that would benefit from the SGDC-1's civil capacity, a new partnership boosted, even more, the investments for enabling expanded broadband connectivity in rural public schools, with the overarching goal of connecting all public schools to the broadband by 2024.

Known as Connected Education Innovation Program (*Programa de Inovação Educação Conectada*—PIEC), this new initiative by the Ministry of Education originated with the primary goal of supporting the universalization of broadband access and the pedagogic use of digital technologies in basic education. When working in consonance with policy frameworks, PIEC and GESAC today represent the two programs that largely designate the civil use of the SGDC-1 in connecting rural public schools throughout the country, although PNBL continue to hold importance as the overarching document for national broadband. The justification for this high-profile media event was the celebration of the milestone of connecting 1 million rural public-school students to the broadband. Out of these connected points on the ground, there were 2,000 connected schools located in the north and northeastern portions of Brazil, regions that for long had been characterized by "dark spots of information" and "unconnected" communities, as I discussed in Chapter 1.

Speaking from Palácio do Planalto, the executive palace of the presidency, alongside other relevant politicians, Brazilian far-right President Jair Bolsonaro performed a videoconference with students and teachers from Escola Estadual Calunga I, a hard-to-reach rural institution located in the city of Cavalcante, Goiás (figs. 20 and 21). If not even a basic Wikipedia search was impossible before due to lack of local telecom infrastructure and Internet coverage, the SGDC-1—in consonance with the policy frameworks of GESAC and PIEC—enabled the practice of videoconferencing, which was used by the government to emphasize its milestones

in connecting institutions that other programs such as PNBL failed to do in past public-funded initiatives. The moment of "turning on" the broadband is thus explored through the televisual and celebrated in the form of videoconferencing. In turning the gaze to those located in the "dark spots of information," I argue that an intriguing dialectics of distance takes place.

Nonetheless, the satellite alone was not the only object acknowledged in the event. As framed in a promotional video that was also publicized in that occasion, Telebras technicians and on-ground infrastructure providers took about two days to complete the installation required to establish the broadband connectivity at the school, which required the use of 4x4 vehicles, technical human labor, and satellite-related paraphernalia such as cables, modems, and satellite dishes. Similarly to the MCTIC's commissioning of Discovery Brasil in producing a TV documentary film, the intended message revealed by the dialectics of distance is possible: the government's framing of the installation process reflects its intention of putting forth the idea that domestic projects of national media infrastructure built and operated "by Brazilians for Brazilians." As a high-profile media event, regional and national media representatives reported from that occasion, filling up the conference room with cameras, microphones, and live streaming, and generating a trove of news stories, social media engagement, and TV coverage throughout the country.

Figure 20. Photo of the public event that gathered Brazilian President Jair Bolsonaro and Minister Marcos Pontes (Ministry of Science, Technology, Innovation and Communication), Abraham Weintraub (Ministry of Education), Waldemar Goncalves (Telebras), and Augusto Heleno (Institutional Security Office of Brazil), holding a videoconference with students and teachers from Escola Estadual Calunga I in Cavalcante, Goiás.

Figure 21. View of the screen framing the students and teachers from Escola Estadual Calunga I in Cavalcante, Goiás, as seen by the government representatives in Brasília.

Traveling from GEO orbit and through the on-ground segments in the hinterland of the Brazilian territory, the signals enacted in space enabled the data transmission that connected two highly distinctively groups with disproportionate power. Such distinct groups were featured not only on the videoconference screens set up in the conference room but also stamped on news media websites throughout the country. While apart from each other by only hundreds of kilometers, it took the broadband signals thousands of kilometers back and forth through the orbital paths to connect these two vastly different communities in a videoconference, making the distance and time collapse in an unprecedented and apparent motion of "turning on" the Internet or achieving what I previously discussed as the "global village."

On one side, in Brazil's center of political power, it is possible to see white-looking politicians wearing suits and fancy clothes, ties, and expensive accessories. On the other side, we see what appears to be a community of low-income, darker-skin students from a rural area in the state of Goiás (fig. 22). Ironically, the polarized views of the unconnected with politicians, possible by SGDC-enabled broadband, epitomizes a strong representation of inequality while the government propagates a social and digital narrative. By striving to showcase the technological leap-forward through the framing of the "unconnected" as now users of the Internet and active participants of global media economy, thanks to the deployment of a sophisticated domestic space-telecom infrastructure, the emphasis shifted from the President's and

other ministers' observations to the framing of students and teachers who were approximately 320 kilometers away from the national capital of Brasília. Wearing simple school uniforms and expressing confusing faces, students ranging from 12 to 15-years old stared at the webcam to communicate with those who, most likely in their viewpoints, were the most powerful politicians in the country and whom they probably only heard on the news and other media outlets.

In other words, such a strategic way of playing with the logic of the televisual aimed to humanize those perceived as the "unconnected" generates an intriguing dialectics of distance. In turn, the dialectics of distance does not necessarily give voice to those who have long been at the margins of society. Instead, one could argue that the maneuvering of the televisual in placing the "unconnected" at the center of attention for the gaze of those in power via videoconferences reiterates the government's branding the satellite as not only a savior for domestic broadband connectivity but also a sophisticated apparatus of national integration. Arbitrarily speaking, those as perceived as the "unconnected"—or the turned subject of the gaze—are framed in a position of apparent privilege. As now active participants of the global media economy, these students have access to modernity and the benefits of 21st-century technology. The "unconnected" thus gain a status of knowledgeable possessors of the digital skills required to navigate the Internet and learn from what it has to offer.

Later picked up and re-circulated by other newspapers and TV channels, the photographs, and snippets of videos of the videoconference depicting rural school students could be found on the Internet and the government's social media, all of which contributed to the propaganda of the growing capacity of the SGDC-1 as a sophisticated apparatus of broadband and national integration. As a result, hundreds of comments on the MCTIC's social media channels show opinions along the lines of "this is something that the big and rotten media will not show."[160] Others expressed opinions by locating the satellite at the intersection of the right-left wing partisanship: "this is something that the previous left-wing governments never did,"[161] which sparked a reply comment saying, "but it was in which government that the satellite

[160] "Banda Larga via Satélite Chega a Mais De 1 Milhão De Alunos Pelo Programa Gesac." *Facebook, Ministério Da Ciência, Tecnologia, Inovações e Comunicações,* 17 May 2019, www.facebook.com/MCTIC/videos/651805465266989/.
[161] Ibid.

actually started, huh?"[162] Despite the government's tactics of portraying the benefits of the SGDC-1 as a public good via images through video conferencing, comments responding to the satellite continue to reflect the satellite also as a point of political tension.

Similar to the Discovery Brasil documentary, the celebration involving the 1 million students connected to the broadband via the SGDC-1 also represented an opportunity to spur a sense of national pride through the televisual. With the inauguration of a satellite link connecting 453 students in the school in Cavalcante at a speed of 10 Mbps, Bolsonaro recognized that access to broadband is not enough, as ongoing policy frameworks such as PNBL and GESAC had indicated. Regardless, he expressed his opinion by suggesting that access to the global Internet will not only have students to have a better life but also help, in his own words, "our beloved Brazil."[163] The technological determinism and lack of strategic view of structural social problems are apparent in his convictions during this high-profile media event. Along similar lines were the participation of a teacher in the videoconference who expressed to the top government representatives,

> "Firstly, I would like to thank God for this moment and on behalf of our team in the school we would like to thank you for bringing this program to us. With this Internet, we see it like a door that is opening to us. It will be a very important library that will help us guide our students on what to access the Internet and how to access it. Given that our school lacks pedagogical materials and it is located in a region of difficult access, we believe that broadband Internet will facilitate the lives of students, teachers and other members of the community."[164]

While she was expressing, the video later published on MCTIC's Facebook showed her looking at a TV screen displaying the government representatives in Brasília.

[162] Ibid.
[163] Ibid.
[164] Ibid.

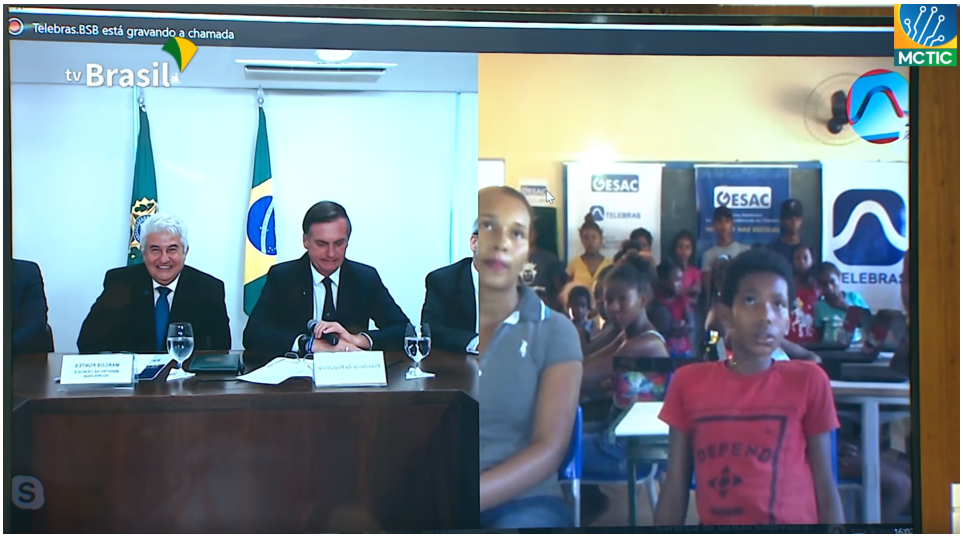

Figure 22. Screenshot of the videoconference showing Minister Marcos Pontos (left) and President Bolsonaro (right) talking to a teacher from Escola Estadual Calunga I in Cavalcante, Goiás, who is accompanied by to one of her students next to her as well as other technicians from Telebras.

Once again, the dialectics of distance emphasizes the interplay between not only physically distant and diverse geographic diverse locations but also brings down to the ground the meta understanding of satellite Internet as a "door" that the teacher had empathetically shared with the government representatives during the videoconference. The framing of such a videoconference, transitioning between Brasília and Cavalcante, through the viewing of the government representatives and the "unconnected" rural school students respectively, create a sense of domestic integration that has been core to the public policies that sustain the funding, operation, and long-term view of the SGDC-1 as a civil-military object. The "darks spots of information" are now part of a nation connected by broadband that is regionally connected and constitute part of the global media economy in the exchange of information, capital, and human creativity.

In addition to the dialectics of distance, the emphasis on building human capability via education and broadband connectivity was also expressed in the words of Minister Pontes, who defended the importance of investing in education, science, and technology. Pontes is the same politician who called for the importance of connecting Brazil in order to bridge the digital gap by providing internet coverage to what he called "dark spots of information." The view of the satellite as a tool of national pride capable of promoting social and digital inclusion is also intertwined with the minister's message to the student rural areas on the power of information

when he said, “you are the future of Brazil, the future astronauts, doctors, engineers; what you can do in life is unlimited.”[165]

As I briefly indicated before for the case of cuts in basic education, it is interesting that such a statement occurred around the same time that the federal government announced massive cuts in funds dedicated to the continuity of research and education conducted at the public universities, promoting what international news coverage reported as “Bolsonaro’s assault on education” and a series of massive protests in the country’s major cities.[166] This second high-profile media event also happened around the same time Bolsonaro called the anti-cuts in education protesters “useful idiots [and] imbeciles, who are being used as the maneuvering mass of a clever little minority who make up the nucleus of many federal universities in Brazil.”[167] Hence, the mismatch between government expenditure and the articulation of the SGDC-1 as a savior of connectivity for the improvement in education is, largely speaking, ingrained in a deceptive government propaganda.

Approximately five months after the first videoconference with the rural school in Cavalcante, the federal government held another similar high-profile media event to celebrate the ongoing partnership between the MCTIC and Minister of Education in the use of the satellite. Taking place at the headquarters of the Ministry of Education in Brasília, the second occasion reunited top government executives to make the public announcement that 60 million Brazilian Reais (10.7 million USD) more would be distributed to MCTIC so it could commission Telebras to advance the connectivity points in rural public schools selected via the PIEC/GESAC program. The SGDC’s civil use for connecting rural schools via GESAC/PIEC had already been discussed in previous years. The first public distribution of the funding sharing had already occurred in 2017 in the occasion of the satellite launching. However, there was no reason for celebration at that time, given that only the military capacity

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[165] “Banda Larga via Satélite Chega a Mais De 1 Milhão De ...” *Ministério da Ciência, Tecnologia, Inovações e Comunicações (MCTIC)*. Accessed April 5, 2020. http://www.mctic.gov.br/mctic/opencms/salaImprensa/noticias/arquivos/2019/05/Banda_larga_via_satelite_chega_a_mais_de_1_milhao_de_alunos_pelo_programa_GESAC.html.

[166] Tom Phillips, “Students Protest across Brazil over Jair Bolsonaro's Sweeping Cuts to Education.” *The Guardian.* Accessed April 5, 2020. https://www.theguardian.com/world/2019/may/31/students-protest-across-brazil-over-jair-bolsonaros-sweeping-cuts-to-education.

[167] Anthony Boadle, “Brazil Education Freeze Spurs Biggest Protests Yet against Bolsonaro Government.” *Thomson Reuters*, May 16, 2019. https://www.reuters.com/article/us-brazil-politics-education/brazil-education-cuts-spur-biggest-protests-yet-against-bolsonaro-government-idUSKCN1SL2H6.

of the satellite was fully operational, and the Brazilian justice barred the civil capacity over initial irregularities on the contract between Telebras and other telecom companies.[168] The strategic timing for showcasing inter-ministerial partnerships also suggests the government's maneuvers to promote the SGDC-1 as a space-telecom infrastructure capable of promoting the social and digital inclusion mainly in rural schools.

The new stories that came out after that high-profile media event reminded the public that the GESAC/PIEC is an inter-ministerial partnership marked by six-time installments of 60 million Brazilian Reais to be cashed out until 2023, totalizing nearly 360 million Brazilian Reais (64.6 million USD) of investments in connecting Brazil's public rural schools via satellite Internet.[169] Given that Telebras operate the civil capacity of the satellite under the auspices of the MCTIC, the Minister of Education passes on the money to MCTIC, who then designates Telebras to install on-ground infrastructures, which occurs in partnership with Viasat. To maneuver the government's technological progress in terms of the SGDC via videoconferencing, one can observe a similar strategy of playing the dialectics of distance through the televisual is performed. In this instance, the top government executives held a conference with students from Escola Municipal São João do Ubim, in the city of Manacupuru, in the state of Amazonia, nearly 3,500 kilometers away from Brasília.

During the videoconference, one student expressed how the global reach of Internet access into his will change the gaps of connectivity in his communities, changing how he and his peers were connected. He also went on to emphasize how the SGDC-enabled broadband came "to change the Brazilian education."[170] Standing in front of classmates and with a large image of the Google logo hanging on the back, the student also said that he and his peers would also be able to watch videos online and conduct school-related research on the Internet.

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[168] Helton Simões Gomes, "Briga Judicial Faz Satélite Brasileiro de R$ 2,7 Bilhões Levar Internet a Menos de 0,1% Dos Pontos Planejados." *G1*, May 5, 2018. https://g1.globo.com/economia/tecnologia/noticia/briga-judicial-faz-satelite-brasileiro-de-r-27-bilhoes-levar-internet-a-menos-de-01-dos-pontos-planejados.ghtml.

[169] Thaís Moura, "MEC Repassa R$ 60 Milhões Para Tecnologia Levar Internet a Escolas Rurais." *Correio Braziliense*, August 23, 2019. https://www.correiobraziliense.com.br/app/noticia/eu-estudante/ensino_educacaobasica/2019/08/23/interna-educacaobasica-2019,778877/mec-repassa-r-60-milhoes-para-tecnologia-levar-internet-a-escolas-rur.shtml.

[170] Dyelle Menezes and Guilherme Pera, "MEC Repassa R$ 60 Milhões Para MCTIC Levar Internet a 8 Mil Escolas Rurais." *Ministério da Educação*, accessed April 5, 2020. http://portal.mec.gov.br/component/content/211-noticias/218175739/79521-mec-repassa-r-60-milhoes-para-mctic-levar-internet-a-8-mil-escolas-rurais?Itemid=1.

Figure 23. Screenshot of the videoconference between federal government representatives and students from Escola Municipal São João do Ubim, in the city of Manacapuru, in the northern state of Amazonia.

Moreover, the student also emphasized that thanks to the satellite Internet now available at his school, education would not be only about possessing a "notebook and a pencil"[171] (fig. 23). As he continued to speak on an emphatic tone, the student also thanked the Minister of Education, who immediately responded by saying that students should be, instead, thanking all Brazilians who are paying tax and making this program possible (fig. 24). The collective is thus reinforced through the civil capacity of the satellite, while the military capacity is silenced, overshadowed, and purposefully hidden. In addition to talking to the student via videoconference, the top executives also spoke to the mayor of the city of Manacapuru, who explained that,

> "Amazonas is a state that has its peculiarities and difficulties in implementing and health and education policies. [Its very remote location] makes the service more expensive. And this connectivity comes to improve these services…Pursuing education in Amazonas, or in the Amazon region more broadly, is different from all of Brazil."[172]

As it must be clear by now, the government's strategies of appropriating the televisual via videoconferences with the previously "unconnected" students functions as part of its strategy of promoting the SGDC-1 as a high-capital object that is operated designed, operated, and funded by Brazilians to serve the "poor," the "remote", and

[171] Ibid.
[172] Ibid.

overcome the social and digital divides in those areas perceived as "dark spots of information." The reoccurring and purposeful acts of turning the cameras to the screen to signal the telepresence of the "unconnected" as participants of the domestic and global media economies helps propagate the civil mission of the SGDC-1 to serve those at the margins of society and make the entry access to the "global village" possible.

Figure 24. Photo of government representatives looking at the screen showing students from Escola Municipal São João do Ubim, in the city of Manacapuru, in the northern state of Amazonia, whom they had the videoconference to celebrate the partnership between ME and MCTIC.

Be it either in the Brazilian state of Goiás or Amazonas, these high-profile media events celebrating the advancements of the SGDC-1 in providing broadband connectivity to rural schools are clear examples of the government's tactics of exploring the televisual. I argue that it does so in order to convincingly promote its agenda for publics that otherwise would not grasp the social mission of the satellite: workers, rural communities, and low-income communities. As a result, issues such as regulations, funding priorities, public-private partnerships, long term strategies, and others are then overshadowed and hidden from public discussions.

Therefore, a critical analysis of these high-profile media events discussed in this chapter reveals a strong persuasion attempt of the Brazilian government in framing the SGDC-1 as a "space-telecom propaganda"—a clear message that is orchestrated to the masses through a captivating and celebratory use of the televisual.

Given that both the language and the propaganda are instruments of power,[173] the space-telecom propaganda orchestrated by the Brazilian government through the exploration of the televisual can also be characterized as an expensive, well-orchestrated, persuasive, and purposeful ideological performance for a domestic audience. The exploitation of the televisual elements multiplied via media outlets throughout the country in the form of new stories, TV coverage, blog posts, social network sites, among others, thus help frame a common view of the satellite as savior connectivity capable of overcoming long-existing social and digital exclusions in a country as unequal as Brazil, but also as a reason for national pride.

First, by commissioning Discovery Brazil to produce an expository documentary before the satellite's launch and operations, the government sets out to rely on a well-known documentary production company to forget a sense of national pride behind technological progress. In so doing, it helps justify the high-capital investments in times when the public distrust of the government is growing due to cuts in education, political instability, and economic recession. It is in this terrain that the reputation of an international TV channel, therefore, exacerbates the underlying messages that I explored through the lenses of the voice of the documentary. Second, the dialectics of distance explored through videoconferencing not only corroborates to the government's goal of perpetuating a sensation that it is "turning on" the Internet in regions that might be mistily classified "dark spots of information," but also legitimates the role of the satellite as an object of social and digital inclusion as well as of an instrument of national integration and territorial sovereignty, although the latter is more likely to be correlated with military maneuvers in matters of space exploration.

As a space-telecom propaganda, the televisual relies on the personification of the "unconnected" to characterize them as now full, deliberate users of the Internet and who, in return, will access the world's information and contribute to the progress of Brazil. It also reinforces a sense of national pride through the work of Brazilian nations who possess the scientific and technical know-how to design, launch, and operate new satellites, and whose potential is also acknowledged by the work of foreign satellite engineers. However, I argue that the Brazilian orchestration of the

[173] Paul Rutherford, *Endless Propaganda: The Advertising of Public Goods*. Toronto: University of Toronto Press, 2000, passim.

televisual is not just technology advocacy or persuasion campaign. Instead, as space-telecom propaganda, it depends on a media ecosystem to support the intended technology deterministic message that often obscures matters of political economy, militarism, power, and surveillance. As argued by media scholar Marshall Soules (2015), "propaganda must create a total environment of persuasion, using all available media and leaving no gaps to be filled with opposing views."[174] The SGDC-1 as a space-telecom propaganda, therefore, achieves precisely that level of persuasion for the aforementioned reasons.

Regardless of the technological potential in which SGDC project may bring forth, the televisual creates what Elluh (1965) calls an "organized myth" that acts as a kind of anchoring belief. According to him, it "through the myth it creates, propaganda imposes a complete range of intuitive knowledge, susceptible of only one interpretation"[175] In the case of the government orchestration of the televisual, the interpretation of the SGDC as a lever of social and digital inclusion is extensively explored, though its military side remains secret, hidden, and not uncertain. In this case, as orchestrated by a powerful governmental entity, propaganda is thus powerful for its reach and penetration in the public imagination made possible through the lead, funding, and power of an institution as large, complex, and controversial as a nation-state.

[174] Marshall Soules, *Media, Persuasion and Propaganda*. Edinburgh: Edinburgh University Press, 2015, 8.
[175] Jacques Ellul, *Propaganda: The formation of Men's attitudes*. New York: Vintage Books, 1973, 11.

Chapter 3: Mapping the Footprints on the Ground: Outcomes and Potential Disruptions

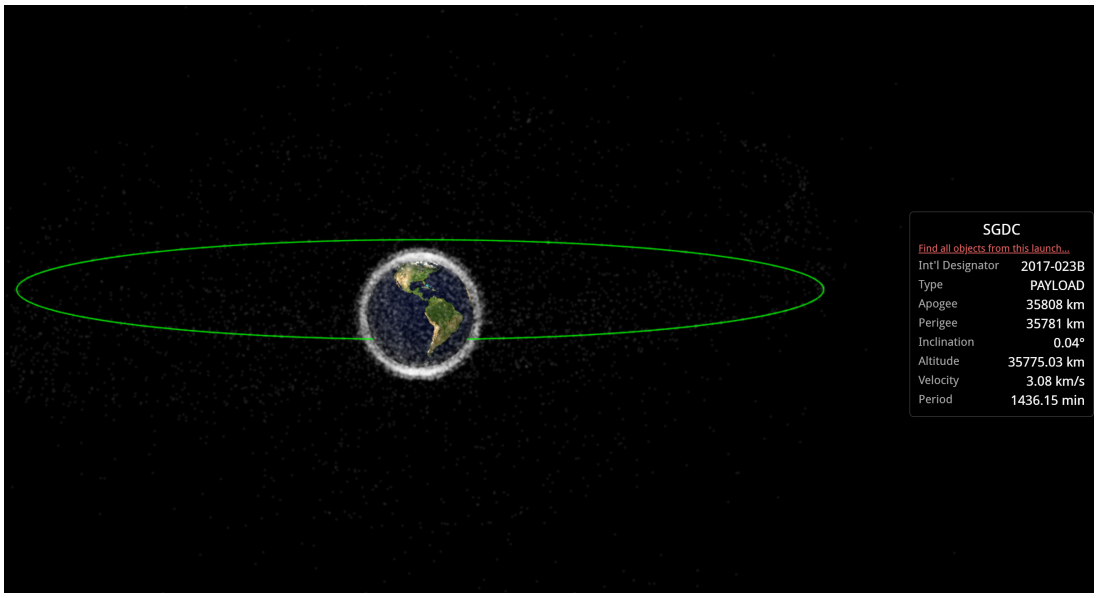

Figure 25. Illustration of the GEO orbit of the SGDC-1 as viewed from an extrapolated southern perspective from Earth, with the satellite hovering a few degrees west of Brazil. (Source: Stuff in Space, based on the data from Space-Track.org)

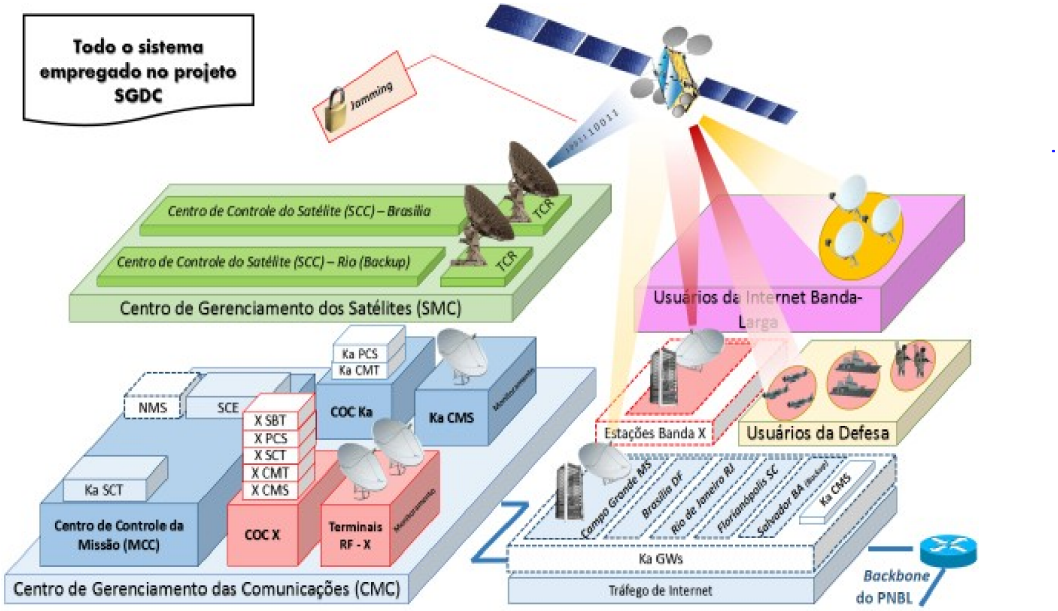

Figure 26. Illustration of the subsystems enabling the SGDC-1's signal trafficking on the ground (Source: Telebras)

The Federal Standard 1037C (FED-STD-1037C), a Glossary of Telecommunication Terms initially conceived by the U.S. government in 1976 and subsequently updated in 1996 and 2000, [176] defined a satellite communication's footprint as the "portion of the Earth's surface over which a satellite antenna delivers a specified amount of signal power under specified conditions."[177] One year after the FED-STD-1037C came out to provide national and international standards to improve telecommunication systems, the launch of the Iridium satellite constellation into geostationary orbit epitomized a significant technological leap forward as one of the first batch of U.S. satellites for telephone service operating on a large global scale. In this chapter, I trace a parallel with the Iridium satellite case in the U.S. in order to contextualize SGDC-1's footprint analysis and its importance in elucidating issues that often remain invisible when it comes to satellite technologies.

As a transnational business ventured conceived by Motorola as early as 1987, the Iridium project's implications gained mounted attention in the media, leading it to news coverage with titles such as "The United Nations of Iridium," which appeared in the *Wired Magazine* in 1998 with a story alluding to what was then referred to as a prime example of "pan-national business," "synergistic endeavors," and "truly global collaborations."[178] As a partnership between international collaborators, the "Iridium stood as a symbol of this fusion of technology, corporations, markets, and international politics" [179] in the post-Cold War years, which happens to be similar to Intelsat and its significant role in the global satellite sector since the 1960s. Such an audacious partnership also signaled that it was in the hands of corporations rather than governments the societal progression into a techno-democratic future, meaning it was "corporations rather than nations [that] would articulate the pathways through which the local and the global took shape."[180]

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[176] At that time, the compilation of the glossary was of high importance for standardizing nomenclatures in the telecommunication realm, considering the fragmentations post-World War II that led up to the Cold War, the Space Race, and other ideological and political tensions between the United States of America and the Union of Soviet Socialist Republics.
[177] Institute for Telecommunication Sciences. (1996). Retrieved from https://www.its.bldrdoc.gov/fs-1037/dir-016/_2287.htm.
[178] David. S. Bennahum, "The United Nations of Iridium," *Wired Magazine*, January 18, 1998. https://www.wired.com/1998/10/iridium-2/.
[179] Martin Collins, "A Second Nature Rising: Spaceflight in an Era of Representation." *NASA Special Publication* 4703 (2008): 185.
[180] Ibid., 197.

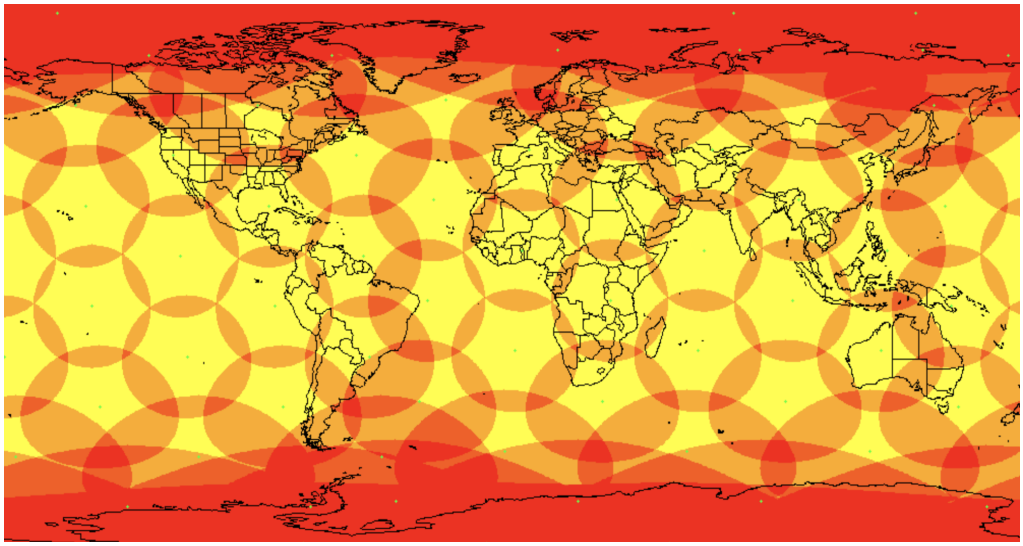

Figure 27. Illustration of the Iridium satellite constellation's footprint on the Earth's surface at a moment in time. (Source: Shahriar, 2006).

Similar to other operating communication satellites in Earth's orbit at a given time, the Iridium satellite constellation's remote physical presence far away from the Earth's surface and apparent indirect and disembodied relation to life matters on the ground—from personal households to public spaces across cities—did not mean their complete absence from the fabric of everyday life. Quite the contrary, the footprint implications of the Iridium satellite constellation were many: it enabled satellite phones, integrated transceivers, and pagers over the entire Earth surface to communicate with one another (fig. 27). It also encompassed a long history of institutional partnerships, large-scale financing, political maneuvers, and other non-technical discourses that are often obfuscated by the satellite as a promising engineered object of high-technicality.

Progressively, the implications of the constellation on the lives of ordinary citizens gave rise to unprecedented changes to the ways we participate in the global information age, transforming society's relationship with media technologies—from TV content traveling through communication satellites to the mapping of physical conditions via remote sensing. As many other satellite technologies, Iridium's operations and footprint on the Earth's surface mainly helped pave the way for new forms of information exchange, thereby implicating novel roles that private firms and governments played in reorganizing the established notions of the "local," "regional," and "global." This way, communication satellites gained special importance as they helped re-organize life on the ground as well as the mediascapes that generate and circulate culture around the world.

However, the Iridium satellite constellation was not the precursors of communication satellites nor the only significant players in space-enabled communication systems for the transnational flows of media and information. Yet, I point to the Iridium constellation as a useful start to introduce the concept of footprint analysis and its connections to the "global village"—which is the context I propose to analyze the SGDC-1 satellite within the Brazilian context. In so doing, it is my goal to map out the extents to which the space-telecom propaganda through the televisual I argued in Chapter 2 corresponds to reality on the ground when scrutinizing the SGDC-1's sociotechnical relations within the context of public rural school broadband.

Footprint analysis is helpful because it enables us to illuminate the entanglement of technical and non-technical discourses and governance processes that are intrinsically connected to satellite technologies but often remain invisible even when described through informational complex system's diagrams (fig. 26). From a media studies point of view, it also helps scholars to rethink the relationship between production, consumption and circulation of information and media around the world. In her observations of the footprints of the Venesat-1 and RascomQAF/1R in Venezuela and Libya as examples of counter-hegemonic satellites controlled in the Global South and with grave regional implications in both South America and Africa, Parks (2012) builds on the work of other critical theory scholars to situate footprint analysis as a research method in media studies. She argues that this method focus lies in the material and territorializing dimensions of satellite technologies, including not only the mark they invisibly make on the surface but also how it encompasses the social and political dimensions. According to her,

> [Such an analysis] involves examining footprint maps, recognizing and foregrounding the eclectic ways in which satellites are developed and used in different parts of the world, and studying the political implications of such uses. This approach requires not only describing satellites and the companies or nation-states that operate them but also considering their participation in the production of new regional signal territories, landscapes of taste, trade routes, diasporic formations, and audiovisual cultures. It also involves specifying how the satellite footprint is situated as part of an orbit-to-ground field of hegemonic relations.[181]

[181] Lisa Parks, "Footprints of the Global South: Venesat-1 and RascomQAF/1R as Counter-Hegemonic Satellites." *The Handbook of Global Media Research* (2012): 123-142.

In other words, such critical approach to satellite technologies is an interdisciplinary attempt that propounds a materialist and socio-historical critique of the satellite—remote, complex, and "obscure objects of media studies."[182]

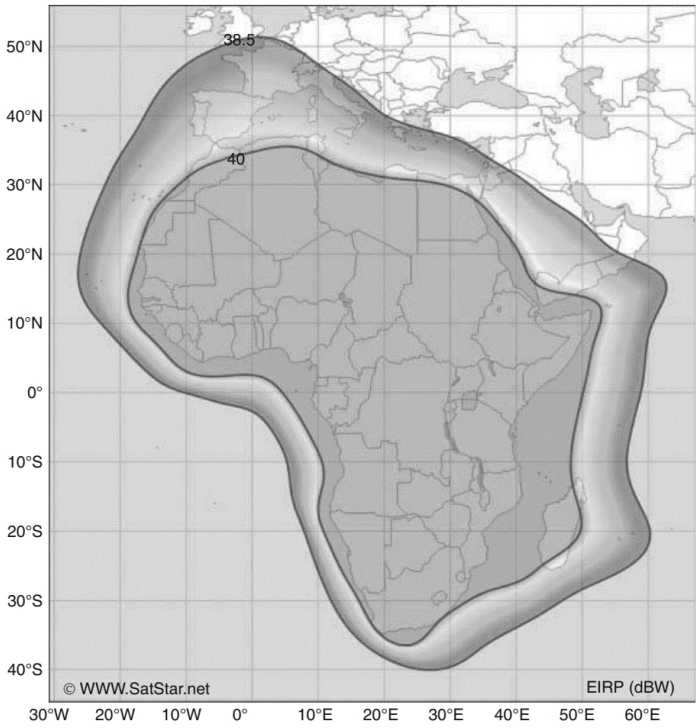

Figure 28. An example of the satellite footprint generated by Rascom-QAF/1R satellite from Libya. As the analysis by Parks shows (2012), RascomQAF and Venesat-1 in Venezuela were developed to support regional autonomy and cooperation. As other footprints, RascomQAF elucidate "zones of struggle, conflict, competition, strategy, and contradiction." Accordingly, "the stakes involved in establishing a regional satellite system are very high, the consequences far reaching. Hence, a decision to commit large quantities of resources (manhours, manpower and money) should be made on realistic grounds, rather than on ideological or political ones (e.g., to vindicate claims to sovereign or preferential rights over parts of the geostationary orbit; to 'show the flag' or become a member of the 'space club')" (Ospina, 1988 , p. 9.6–9.7)

Through the lenses of their local, regional, as well as global forces, political conditions, materialities, and technological promises, satellite technologies can be elucidated and made intelligible for those who do not consciously engage with it as they do with other objects of media infrastructure such as optical-fiber cables, satellite dishes, data centers, and cellphone towers. Assuming that satellites are situated within a field of power relations that are enabled and enacted by corporations and nation-states in a disembodied fashion that is invisible to most of us on the ground, the footprint analysis of their territorial effects helps us critically assess the satellite's multifarious uses. As a result, it is possible to make their functionalities more

[182] Parks, "Obscure Objects of Media Studies," passim.

intelligible to media and communication scholars and to the broader civil society who may wish to participate in discussions concerning the development, revisions or approval of new policy frameworks. Hence, while making a mark on Earth and its social, cultural, and geopolitical systems, satellites are, in other words, more than just technological objects with pre-conditioned engineered implications.

The use of footprint analysis is particularly significant in the context of political economy, mediascapes, governance, and inclusion projects in developing countries, which justifies why I decided to explore its use to unravel some of the sociotechnical discourses around the SGDC-1. As discussed by Wood (2011), most countries in the developing world have only indirect access to satellite technologies and little control over the services when the satellites reach the Earth's orbit. While only a limited number of countries had access to research, develop, launch and operate satellite technologies in the early years of the space era, nowadays this is changing particularly due to the way that "technology matures and business models in the satellite industry evolve"[183] across countries with different techno-scientific experiences in space-related projects.

With a significantly increased number of developing countries such as Brazil pursuing domestic satellite programs, more amplitude is possible over the services that the satellites may offer. As these programs become more nationally operated to serve certain political targets, increased understanding over the footprint is, therefore, possible and even desirable for architecting new projects and convincing the publics of the workings of satellite technologies in re-writing their information access and media consumption. These footprints mark the Earth's surface while considering the stakeholders behind the satellite's technical and non-technical systems as well as the people who benefit from these technologies, such as the "unconnected."

In fact, such a framework of critical analysis opens up new forums for conversations as nation-states prioritize expenditures in space-enabled technologies as powerful pathways to advance not only inclusion, justice, and overall support to the United Nations Sustainable Development Goals,[184] but also political propaganda, military exercises, and re-territorialization. In this chapter, I conduct a document analysis of government reports, publications, and public hearings to explore the

[183] Wood and Weigel, "Building Technological Capability," 1113.
[184] TED Talk. "6 space Technologies we can use to improve life on Earth by Danielle Wood." YouTube video. Posted on February 24, 2018, https://www.youtube.com/watch?v=5RAJvzV9j-o

various nuances of the SGDC-1 as a high-capital technology. I investigate the most relevant challenges, opportunities, and results of the recent public data on the SGDC project, as well as a brief humanistic mapping of what may occur in the foreseeable future, should the government not prioritize some of the legal, political, and financial circumstances that surround the satellite and its operations as a technology "by Brazilians for the Brazilians." By making the SGDC-1 more intelligible via such a critical media studies approach, it is possible to increase public awareness of not only how satellites—as far-flung and highly complex objects—operate, but also closely examine the socio-technical structures they are embedded in while also paying attention to the ways in which they might implicate the lives of students in rural public schools who are increasingly becoming more integrated into the global media economy via their smartphones, personal computers, and other means of Internet access.

The Making of a Communication Satellite and Preliminary Connectivity Impacts

The Geostationary Defense and Strategic Communications Satellite (or SGDC-1 as abbreviated from the Portuguese acronym for *Satélite Geoestacionário de Defesa e Comunicações Estratégicas*) was built in a three-year period in Cannes, France by the Franco-Italian aerospace manufacturer Thales Alenia Space under the auspices of Visiona Tecnologias Espacial S.A. Alongside other regionally reputable space government entities such as INPE and AEB, the newly formed company Visiona, designated as the SGDC-1 prime contractor, emerged as the big player in the integration of space systems in Brazil. As briefly discussed in the previous chapters, the SGDC program emerged as a government-funded project with three chief objectives: I) to reduce Brazil's digital divide by providing high-quality Internet services to 100 percent of the country territory as part of the National Broadband Plan (PNBL); II) to provide sovereignty and secure means for the Brazilian government's defense and strategic communications; III) and to acquire critical technologies for the Brazilian space industry as part of a technology transfer and absorption program, enabling the national industry to take increasingly essential roles in the future

Brazilian space programs.[185] In a country of continental proportions, the SGDC-1 materializes the Brazilian government's long-standing political desire to achieve national sovereignty over its strategic communications.

On May 4th, 2017, the SGDC-1 was launched from the European Spaceport Kourou launch facility in French Guinea, together with South Korean's KOREASAT-7 satellite, onboard the rocket Ariane 5 ECA, a heavy-lift launch vehicle manufactured by Arianespace. The launch of the satellite represented a milestone by many of the government officials in Brazil, generating massive media coverage associated with political speeches in Brazil and beyond. The French newspaper *Le Monde*, for example, contended that the SGDC-1 would help make Brazil competitive in the space sector as it materialized a nation-state's decades-long desire to have a government satellite.[186] In addition to discussing the benefits of national sovereignty over strategic communication, the international media coverage also indicated that the SGDC-1 would be the government tool capable of ending with the "digital apartheid" in Brazil as it would provide broadband to rural and remote areas.[187]

Michel Temer, the former Brazilian President at the time, claimed that with the launch of the SGDC-1"[we] will democratize the digital phenomenon in Brazil, since broadband will reach all corners of the country…[thus] democratizing the digital system in our country. It is a great time for our government."[188] The former head of MCTIC, Gilbert Kassab, said upon the successful launch of the satellite that "Brazil is finally entering the digital era [189] (fig. 29).

[185] "Audiência Pública: Debater o Programa Espacial Brasileiro à Implantação do SGDC-1." *Telebras*, November 2014, http://legis.senado.leg.br/sdleg-getter/documento/download/779a5294-691a-429d-a2df-95c9259137cd

[186] Claire Gatinois and Dominique Gallois, "Arianespace Réussit Son Premier Tir Depuis La Fin Du Blocage En Guyane." *Le Monde*, May 4, 2017. https://www.lemonde.fr/sciences/article/2017/05/05/arianespace-reussit-son-premier-tir-depuis-la-fin-du-blocage-en-guyane_5122508_1650684.html.

[187] Ibid.

[188] Laís Lis and Gustavo Aguiar, "Brasil Lança Satélite Que Permitirá Acesso à Banda Larga Em Áreas Remotas." *G1*, May 4, 2017. https://g1.globo.com/ciencia-e-saude/noticia/governo-lanca-satelite-que-permitira-acesso-a-banda-larga-em-areas-remotas.ghtml.

[189] Ibid.

Figure 29. High-level government representatives watching SGDC-1's launch in real time from the Aerospace Command Operations (COMAE) in Brasília.

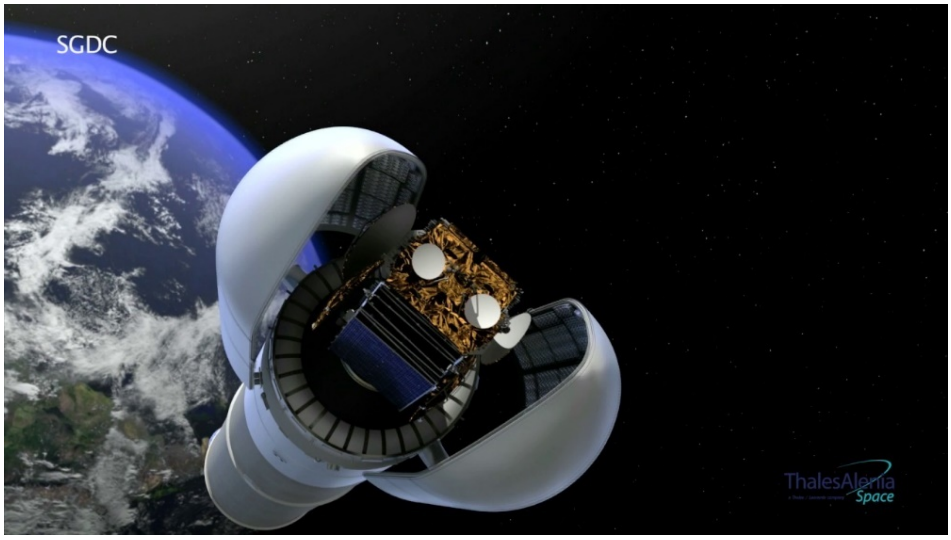

Figure 30. Illustration of the SGDC being deployed into the Earth's orbit on board of the rocket Ariane 5 ECA by Thales Alenia Space in 2017.

A close look into the political economy of the SGDC-1 provides us with an intriguing provocation. The costs associated with this satellite surpasses any other satellite project in the history of Brazil and many other Latin American countries. The manufacturing alone cost the public coffers approximately 1.8 billion Brazilian Reais (nearly 430 million U.S. dollars)—and overall project costs nearly 2.8 billion Brazilian Reais (more than 660 million U.S. dollars), according to the Brazilian

Federal Court of Accounts (TCU).[190] However, the initial satellite program's budget was set at 404.7 million Brazilian Reais for the partnership that enabled the manufacturing, which means that the levels of expenditure more than tripled its original budget.[191] Curiously, the overall 2.8 billion Brazilian Reais cost for the overall project is about 12 times more expensive than a similar project carried out by the Indian government from that same year, which led some journalists to refer to the SGDC-1 as the "world's most expensive satellite."[192] Such information on financial expenditure is interesting and deserves more public attention as it is taxpayers mostly fund it and, therefore, deserves more attention and close financial monitoring.

At liftoff, the SGDC-1 weighed approximately 5.8 tons and was installed on a geostationary orbit at 75 degrees west (fig. 30) and 35 kilometers above the surface, covering Brazil's total territory and parts of the South Atlantic Ocean.[193] The satellite lifespan was initially projected for 15 years, though it was later expanded for 18 years due to Brazilian technicians who "managed to increase the satellite's fuel tank capacity after going to France as part of a technology transfer program."[194] In terms of the use of satellite transmission capacity, 70 percent is destined for civil use, and 30 percent is allocated to serve strategic communications of the Armed Forces of Brazil––mostly for connecting military posts and monitoring the country's political borders.[195]

To track and control the SGDC-1 in GEO orbit, the satellite is currently operated by the Main Space Operations Center (*Centro de Operações Espaciais Principal*—COPE-P) based Brasília, and the Secondary Space Operations Center (*Centro de Operações Espaciais Secundário*—COPE-S) based in Rio de Janeiro.

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[190] "GRUPO I – CLASSE VII – Plenário TC 023.683/2018-0." *Tribunal de Contas da União (TCU)*, https://portal.tcu.gov.br/data/files/C2/37/D4/41/9AE4C6105B9484B6F18818A8/023.683-2018-0-AA%20-%20satelite%20SGDC%202.pdf

[191] "MP Destina R$ 404 Milhões à Telebras Para Aquisição De Satélite - Notícias." *Portal da Câmara dos Deputados*, January 7, 2015. https://www.camara.leg.br/noticias/448420-mp-destina-r-404-milhoes-a-telebras-para-aquisicao-de-satelite/.

[192] Cláudio Humberto, "Satélite Mais Caro do Mundo," *Jornal O Dia*, accessd April 2, 2020, https://brazilianspace.blogspot.com/2017/05/claudio-humberto-satelite-mais-caro-do.html

[193] "Ariane Flight VA236 launch kit," *Arianespace*, May 2017, https://www.arianespace.com/wp-content/uploads/2017/03/DDP_VA236-May-2017_GB.pdf

[194] "Engenheiros Brasileiros do SGDC Trazem Tecnologia de Ponta para o País." *Sindicato dos Engenheiros no Estado do Ceará*, May 17, 2017. https://sengece.org.br/engenheiros-brasileiros-do-sgdc-trazem-tecnologia-de-ponta-para-o-pais/.

[195] Luciene da Silva Demenicis, "O Satélite Geoestacionário de Defesa e Comunicações Estratégicas (SGDC): Uma Análise das Contribuições para a Defesa Nacional." Master's thesis, 2018, Escola de Comando e Estado-Maior do Exército Escola Marechal Castello Branco, https://bdex.eb.mil.br/jspui/bitstream/123456789/2895/1/MO%205896%20-%20LUCIENE.pdf

Both COPE-P and COPE-S are administered by Telebras and the Ministry of Defense, the government entities responsible for operating the civil and military bands of the SGDC-1. In addition to these major operations center, the satellite's operational systems include five gateways based in the cities of Brasilia, Rio de Janeiro, Florianopolis, Campo Grande, and Salvador, as well as eight Carrier Monitoring System, located in strategic locations throughout Brazil's territory, to carry out telemetry for the SGDC.[196]

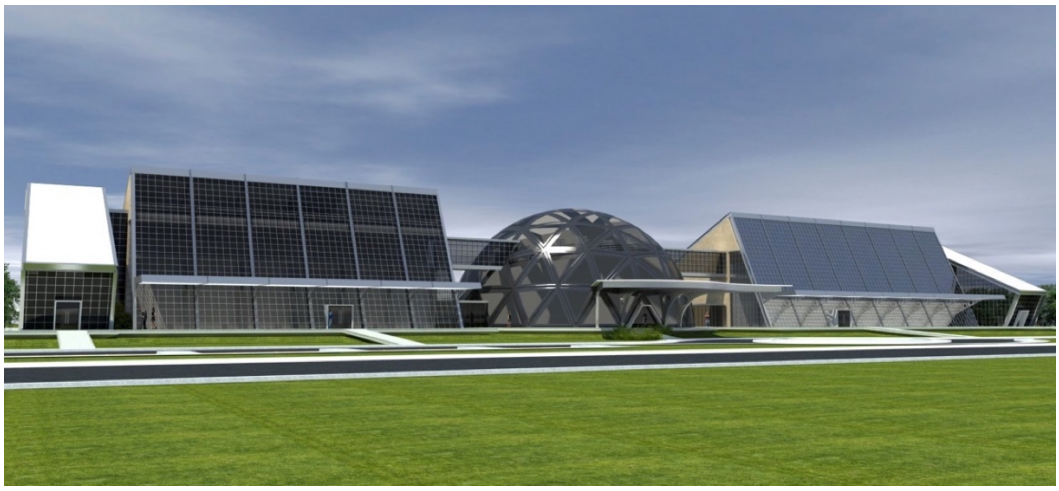

Figure 31. Illustration of the Main Space Operations Center facility in Brasília (Source: COMAE)

The technological building capability sparked by the SDGC-1 in the Brazilian territory helps spur positive side-effects, given that it is opening "new market opportunities for future satellite operations and new equipment."[197] In this sense, the satellite implicates infrastructural improvements on the ground as well as in the organization of a solid technological apparatus—as well as political agenda—that may go well beyond the government satellite program's initial intentions, thus expanding domestic on-ground infrastructure for other space-telecom projects in the years to come. Building on the previous analysis of Brazilian economist Fernando Barcellos (2017), the following tables illustrates the multi-level partnerships and some of the major outcomes stemming out of the SGDC-1 since the legislation that mandated its manufacturing.

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[196] Câmara dos Deputados, "Ciência e Tecnologia - Satélite Geoestacionário para Prover Internet - 22/08/19." *YouTube video*. Posted on August 22, 2019, https://www.youtube.com/watch?v=LMgtLrvf7-8&

[197] Fernando Barcellos, "The Brazilian Space Industry: Geostationary Satellite of Defense and Strategic Communication Program." *Astropolitics* 15, no. 3 (2017): 264-276, https://doi.org/10.1080/14777622.2017.1381827

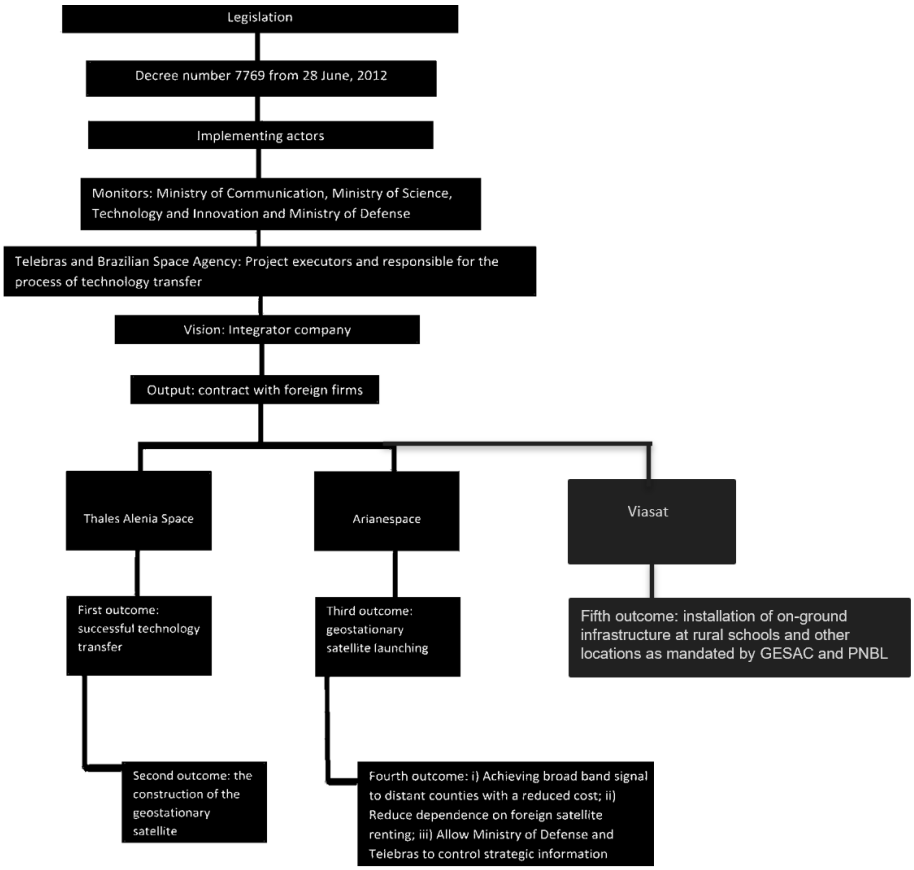

Table 5. Organization chart of the SGDC-1 from the legislation that enabled its manufacturing, launching, and operation to the five major outcomes. Adapted from a previous chart created by Barcellos (2017).

If the above information provides a glimpse into the institutional partnerships, financing, and early outcomes of the SGDC project in terms of manufacturing, launching, and operations, a look into the satellite's civil footprint will help elucidate the satellite's broadband points within the context of rural schools. The SGDC-1's civil footprint is organized as a multi-spot beam high-throughput (HTS) satellite via its 67 spot-beams operating in the Ka-band made possible by 50 transponders. Unlike pico, nano, micro, and small satellites that are often cheaper and with a shorter lifetime, the HTS requires much more technology, technoscientific know-how, and a set of on-ground segments for data transmission. Out of the SGDC-1's 67 spot-beams, 58 have 0.5º (or diameter of 320 kilometers), and 19 spot-beams of 1º (or diameter of 640 kilometers) reach when covering the country's territory.[198] When combined, these 48 spot-beams of 320 kilometers and the 19 spot-beams of 650 kilometers of diameter

[198] Telebras, 2017.

offer coverage to the entire territory of Brazil.[199] In addition to that, the satellite also has seven channels in the X-band, to be used for military purposes.[200] Based on the Spacebus-4000C4 model, the SGDC-1's width is about 37 meters, and its height is about 7 meters, making it a large and hard-to-build satellite that requires robust scientific knowledge and years of experience in technical know-how.

According to Houlin Zhao, ITU's Secretary-General, HTS satellites are "among the game-changing innovations enabling a range of solutions from digital financial services to better health care to smarter cities,"[201] alongside small satellites, satellites with all-electric propulsion and Low-Earth Orbit (LEO) satellites. Unlike previous Internet structures that relied mostly on on-ground infrastructures, now the entire territory of Brazil is covered by a government-operated communication satellite with the capacity to deliver more than 57 Gbps over the territory (fig. 32). As pointed out by communication scholar Monroe Price (2002), the improvements in satellites technologies "add further complexities, just as changing shipping technologies did in seventeenth- and eighteenth-century trade routes."[202]

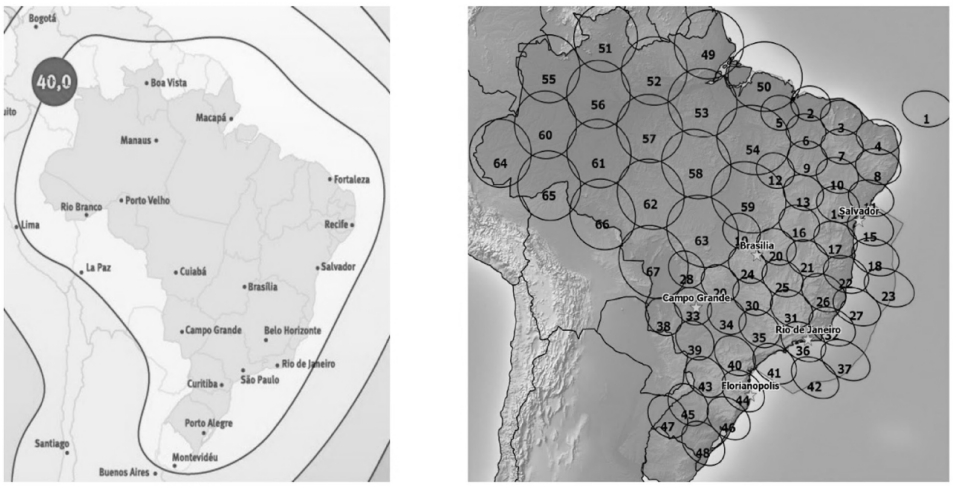

Figure 32. Illustration of the SGDC-1's multi-spot beam footprint throughout the Brazilian territory. Unlike the conventional wide beam footprint on the left, the right shows the spot beam configuration currently targeting specific regions, covering different conditions on the ground and allowing for more focused coverage. (Source: Telebras)

[199] Ibid.
[200] "Satbeams - SGDC." *Satbeams Web and Mobile*. Accessed April 16, 2020. https://www.satbeams.com/satellites?norad=42692.
[201] "Evolving satellite communications: ITU's role in a brave new world," *ITU Magazine*, 2019, accessed January 2020, https://www.itu.int/en/itunews/Documents/2019/2019-02/2019_ITUNews02-en.pdf
[202] Price, "Satellite Broadcasting as Trade Routes in the Sky," 148.

While the Ka-band of the SGDC-1 is operated by Telebras, very little is public about the use of the seven channels operating in X-band, since it is the Brazilian Armed Forces that utilize it for military and strategic communications.[203] In this sense, the footprint I focus on is primarily the one used for civil use, distributed via 67 spot-beams (organized via 50 transponders) that hold the technical capacity to transfer high amounts of data. Unlike conventional communication satellites of band C or Ku, which tend to cover a large territory of a country or region, HTS satellites have several spot-beams that are directed at one defined part of the country. In other words, we are talking about 67 several circle-like footprints that cover a specific part of the territory and, when in conjunction, they provide a nation-wide collection of footprints that fuel, at least in theory, a government agenda of providing broadband Internet connectivity to the "dark spots of information" (fig. 33). Each spot-beam provided by the SGDC may serve different infrastructural needs as well as economic, political, and social realities on the ground.

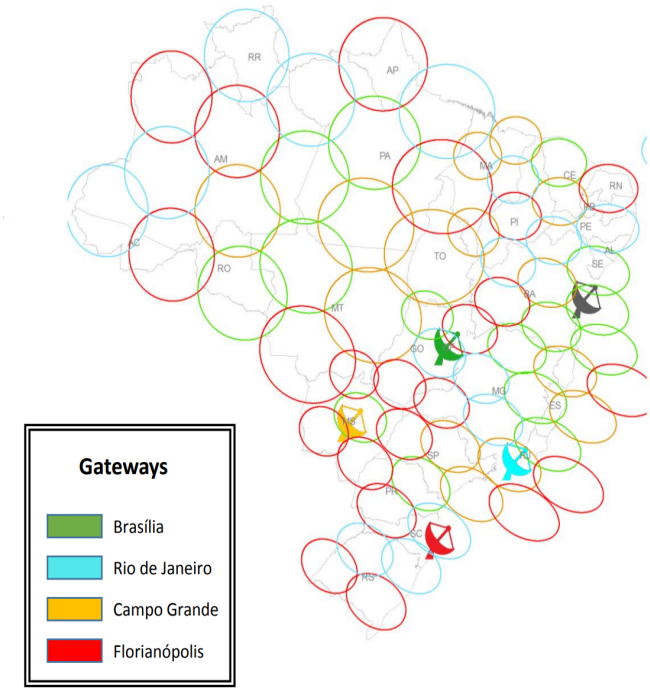

Figure 33. Map of the SGDC's 67 circular spot-beams in the Ka-band as well as the major four gateways distributed in the cities of Brasilia, Rio de Janeiro, Campo Grande, and Florianopolis. (Source: Telebras)

[203] Cadete Aviador Moacyr Maneechai Duarte et al. "O Uso Militar de Sistemas Espaciais: Aplicações do Satélite Geoestacionário de Defesa e Comunicações Estratégicas (SGDC)." *Ministério da Defesa,* accessed April 22, 2020, https://www.defesa.gov.br/arquivos/ensino_e_pesquisa/defesa_academia/cadn/artigos/xvi_cadn/o_uso_militar_de_sistemas_espaciais__-aplicacoes_do_satelite_geoestacionario_de_defesa_-e_comunicacoes_estrategicas_sgdc_atual.pdf

Therefore, each of the 67 spot-beams may enact various types of local and regional footprints as these circles overlap, thus requiring different kinds of infrastructures, personnel, labor, materials, while enacting various impacts on the ground. This transponder makes footprint analysis of the SGDC-1 much more region-specific, given the number of beams and areas of coverage, which have specific on-ground infrastructural conditions, unique local histories, geographic configurations, and so on. Pragmatically speaking, each beam produces its footprints on the region it covers, thus allowing further critical analysis.

The satellite footprint of the SGDC-1 also has a temporal dimension that allows for a detailed contextualization of the non-technical motivations that preceded its development and possibilities to extend its applications onto the future. In other words, it is possible to trace back in time a satellite's direct and indirect constituents. As such, it may include the satellite's politically charged motivations, synthetics materials that enable its functionality in orbit, the low and high-skilled types of labor that are printed on its multiple parts, the complex engineering systems as well as the geopolitical strategies, transnational partnerships, and policies that enable its planning, research, building, launch, and operations.[204] In other words, a mix of technical and non-technical reasons that shape the satellite and the meta-discourses around it. The broadband-connected future enabled by the SGDC-1, as I argue, is one that promises a connected regional future aimed at providing broadband connectivity to Brazil's most remote areas, as advertised by the government on several occasions through the televisual as I discussed in Chapter 2.

Accordingly, the temporal interpretation of the non-technical dimension of the SGDC is a useful tool to make these often-imperceptible complex systems processes more intelligible, carving "a space for imagining, specifying, and critiquing the changing practices of states, corporations, and the people in the global information age."[205] A crucial observation here is the fact that SGDC-1's footprint and its blueprint of a connected regional future can be seen beyond just a specific geographical area of which a signal from a given satellite can be received, but also as a trace of the satellite's embeddedness within, social, cultural, political conditions on

[204] Parks, "Footprints of the Global South," passim.
[205] Ibid., 128.

Earth. In other words, the SGDC-1's footprints represent a demarcated zone in which a satellite's multifarious uses can be scrutinized and contextualized in relation to other factors such as on-ground media infrastructures, the inclusion of marginalized groups to the Internet, and questions of national sovereignty.

Before projecting the potentialities of the SGDC-1's as a connector of rural schools, however, it is essential to step back and consider the conditions that gave importance to this government satellite program. Since the beginning of its space activities in 1967, Brazil managed to establish partnerships with various countries to enable the development of satellite projects. For instance, Brazil's National Institute for Space Research (INPE) has collaborated with the Chinese Academy of Space Technology in the development of the CBERS (China-Brasil Earth Resources Satellite), a series of remote sensing satellites, since 1988.[206] However, in the realm of civil telecommunication, the country's nearly entire dependency on foreign satellites was the most viable alternative before the SGDC project. One of the resulting implications is that Brazil, as a nation-state with domestic priorities and a strategic political agenda, was dependent on foreign companies to establish communication channels via satellite even within its territory, costing the government millions of dollars per year to guarantee that such communication would occur.[207] From a military point of view, the SGDC project also represents a critical capability for realizing various of the goals articulated within the country's National Strategy of Defense, which documents and orients guidelines for national security. The National Strategy discusses space as one of three "strategic sectors" (alongside cyber and nuclear) that are critical to the country's national security.[208] In regard to the overall developments in space technology, therefore, the SGDC-1 contributes to a long-held vision of independence:

> The ultimate goal for Brazil is independence in the space arena: independent access to space by means of indigenous satellite launch vehicles; independent satellites with beneficial applications. What started as a presumed military need in the 1960s changed into a

[206] Carlos de Oliveira Lino, Maury Gonçalves Rodrigues Lima, and Genésio Luiz Hubscher, "CBERS—An international space cooperation program." *Acta Astronautica* 47, no. 2-9 (2000): 559-564, https://doi.org/10.1016/s0094-5765(00)00094-1

[207] Nia Monteiro and Lisandra Paraguassu, "Defesa Destaca Urgência de o País ter seu Satélite - Internacional." *Estadão*, July 15, 2013. https://internacional.estadao.com.br/noticias/geral,defesa-destaca-urgencia-de-o-pais-ter-seu-satelite-imp-,1053607.

[208] "Estratégia Nacional de Defesa." *Ministério da Defesa*, 2008, 32. https://www.defesa.gov.br/estado-e-defesa/estrategia-nacional-de-defesa

> realization that Brazil could become an environmental power and one of the first developed nations in the tropics.[209]

In a country of continental proportional with vast amounts of diverse natural resources, satellites gain extra significance, making their footprints on the ground—and the sets of sociotechnical entanglement it represents—a complex one. The government's view that "only those countries that master space technology will have the autonomy to develop global evolution scenarios"[210] is an indication of how much the SGDC-1 appears as a politically pushed project.

On June 28th, 2012, the decree number 7769, signed by the former Brazilian President Dilma Rousseff, functioned as the "birth certificate" of the SGDC project, which would not only be key in establishing the PNBL goals, but would also help the government with military communications. The 2012 decree designated members from the former Ministry of Communications, the Ministry of Defense, and the Ministry of Technology, Science, and Innovation as the Project Steering Committee of the SGDC project—the governing group and ultimate decision-making body for the SGDC project. Some of the goals of the SGDC's Project Steering Committee included the following: the approval of technical protocols proposed by the Executive Group; the monitoring and evaluation of the execution of the SGDC project throughout all its phases, determining the necessary adjustments; the supervision of financial resources transfer for the implementation of the SGDC project; and the establishment of guidelines for the performance and participation of direct and indirect federal public administration bodies and entities in the SGDC Project.[211] In addition to the Director Committee, the decree also mandated the establishment of an Executive Group that would include members from the Minister of Defense, Minister of Communications, Telebras, AEB, and INPE. The responsibilities for the Executive Group, the technical advisory body for the directives and decisions of the Project Steering Committee, included the following:

> I) propose the technical requirements for the SGDC that may have relevance on the satellite's costs, chronogram, system performance, as

[209] Brian Harvey, Henk HF Smid, and Theo Pirard, *Emerging Space Powers: The New Space Programs of Asia, the Middle East and South America*. Springer Science & Business Media, 2011, 372, https://doi.org/10.1007/978-1-4419-0874-2

[210] "Programa Nacional de Atividades Espaciais, 2005-2014." *Agência Espacial Brasileira*, 2005, http://www.aeb.gov.br/wp-content/uploads/2012/11/pnae_web.pdf

> well as the planning, budget and project timeline related to the SGDC implementation and the on-ground infrastructure associated with it;
> II) be responsible to submit to Telebras a reference term for the hiring of the company that will be responsible for the acquisition, launch and operation of the SGDC;
> III) to monitor the physical and financial execution of the SGDC project; and
> IV) to submit to the Project Steering Committee quarterly monitoring and evaluation reports on the implementation of the SGDC.[212]

The 2012 decree demanded that the SGDC project would have to be implemented by December 31st of 2014, a date that later was postponed to 2016 (Decree number 8.153, 2013) and, once again, to 2017 (Decree n. 9.051, 2017), when the SGDC was finally launched into orbit. The decree also highlighted that it was under Telebras' responsibility to establish contracts with third parties to obtain the supply of goods, services and engineering know-how necessary for the construction, integration, and launch of the SGDC and the transportation of telecommunications signals, as well as the corresponding on-ground infrastructures. As Brazil lacked necessary technical know-how, the decree also mandated that it was Telebras and AEB's responsibility to develop a joint technology absorption and transfer plan. Once manufactured and launched into the Earth's GEO orbit, Telebras and the Minister of Defense would be responsible for managing the SGDC operations. Furthermore, in the initial phase of the SGDC, the government plan was to deploy a constellation of three geostationary satellites that would be launched with five years apart from one another.

In 2013, one year before President Dilma Rousseff was democratically re-elected for a second mandate, the SGDC's Project Steering Committee approved a 1.3 billion Brazilian Reais (232.9 million USD) contract with Visiona to oversee the foreign firms that would collaborate with om manufacturing (Thales Alenia Space) and launching (Arianespace) of the SGDC. Based in the countryside of the state of São Paulo, Visiona was founded the same year the decree for the SGDC satellite was approved. Since its beginning, it has been a joint venture between Embraer and Telebras guided by the mission to become an international reference in developing

[212] "Decreto Nº 7.769, de 28 de Junho de 2012, P*residência da República, Casa Cívil – Subchefia para Assuntos Jurídicos*, Accessed September 20, 2019, http://www.planalto.gov.br/ccivil_03/_Ato2011-2014/2012/Decreto/D7769.htm

"integration space systems to address the needs of the Brazilian Space Program."[213] As the Brazilian space system integrator, Visiona's central vision is rooted in three main goals: I) to become the Brazilian company of choice for technologically independent space-based integrated solutions; II) to have a strong presence in the international market while fostering the domestic supply chain; and III) to contribute to Brazil's development and sovereignty.

The emergence of Visiona as a joint venture between a leading telecommunications company in Brazil (Telebras) and a private aerospace company (Embraer) was of tantamount importance not only for the manufacturing the first of satellite of the SGDC's constellation but also for its launching partnership with Arianespace. In his article on the current moment of the Brazilian Space Industry, Barcellos (2017) writes that the creation of Visiona as a complete space system integrator that supports governmental programs is highly strategic and aligned not only with the space activities but also with questions of national defense. He contends that "Visiona engenders space commerce because it can operate as a company and serves as an example for other companies in the space sector to emulate."[214] From this perspective, the SGDC-1 represents a milestone for future domestic satellite projects and the training of new engineers.

Once the satellite is manufactured and launched into orbit, the operations and on-ground infrastructure that enable the broadband in the rural public schools became a salient issue. In February 2018, Telebras established a contract with the U.S. company Viasat that would enable the installations of on-ground segments at rural schools. In North America, Viasat has a demonstrated technical and market expertise history in bringing cost-effective satellite-enabled communication and wi-fi spots to the unconnected community, in addition to have operated in a dozen of countries.[215] With the satellite in GEO orbit, however, Telebras faced a series of legal issues with its contractual agreement with Viasat as pointed by Brazilian courts, which prohibited the full use of the SGDC-1. The court's blockage of the contract with Viasat generated a financial loss of about 800 thousand Brazilian Reais (136.9 thousand

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[213] "Quem somos," *Visiona Tecnologia Espacial*. Accessed December 10, 2019, https://www.visionaespacial.com.br/quem-somos

[214] Fernando Barcellos, "The Brazilian Space Industry," passim.

[215] "Telebras, Viasat Enter into Strategic Agreement to Connect the Unconnected in Brazil." *Viasat*, February 26, 2018. https://www.viasat.com/news/telebras-viasat-enter-strategic-agreement-connect-unconnected-brazil.

USD) daily for several months between 2017 and 2018 for Telebras,[216] which contributed to the 224 million Brazilian Reais (38.3 million USD) loss the state company had by the end of 2018.[217]

The legal uncertainties lasted for nearly a year, a period in which Viasat established an office in Brazil to comply with the federal regulations and allowed Telebras to make the necessary amendments to the contract to comply with Brazil's General Telecommunications Law (Law N 9.472, 1997) and, consequently, winning the bid as Telebras's only private partner in using the SGDC-1.[218] While not so much media coverage addressed these issues, a few media outlets wrote about the SGDC-1 as a failing project due to these issues that hinder the full use of the satellite as predicted in its 2012 birth certificate. One of the top Telebras executives even said that, despite all the hurdles, the SGDC-1 was set to become a successful national project because "it was written in the stars,"[219] a metaphor suggesting that the project would have to occur even if it faced opposition or financial insecurity or risk.

Aside from the initial contractual difficulties that ended up at Brazil's Federal Supreme Court (STF), Telebras managed to prove the legality of the public-private contract and the Viasat was allowed to resume its activities on July 2018.[220] However, although it was not until May 2019 that Brazil's TCU approved the new contract between Telebras and Viasat. On that occasion, Lisa Scalpone, Viasat Brasil's vice president and general manager, commented,

> With today's TCU approval, Brazil's important goal to reach every corner of the country with internet will be realized. We expect to connect thousands of additional sites in the coming months, bringing important social and economic benefits to the people that need it most in the region. We are proud to be a part of Brazil's digital growth plans, and will continue to work with Telebras to provide critical

[216] Natália Portinari, "Briga por Satélite dá Prejuízo de R$ 800 Mil por Dia, Diz Presidente da Telebras." *Folha de S. Paulo*, May 15, 2018. https://www1.folha.uol.com.br/tec/2018/05/briga-por-satelite-da-prejuizo-de-r-800-mil-por-dia-diz-presidente-da-telebras.shtml.
[217] Lúcia Berbert and Rafael Bucco, "Telebras Confirma Prejuízo de R$ 224 Milhões pelo Diário Oficial." *TeleSíntese*, April 5, 2019. http://www.telesintese.com.br/telebras-fecha-2018-com-prejuizo-de-r-2249-milhoes/.
[218] "Viasat Abre Escritórios No Brasil, Em São Paulo e Brasília." *EXAME*, September 26, 2019. https://exame.abril.com.br/negocios/releases/viasat-abre-escritorios-no-brasil-em-sao-paulo-e-brasilia/.
[219] Helton Simões Gomes, "Briga Judicial Faz Satélite Brasileiro de R$ 2,7 Bilhões Levar Internet a Menos de 0,1% dos Pontos Planejados." *G1*, May 5, 2018. https://g1.globo.com/economia/tecnologia/noticia/briga-judicial-faz-satelite-brasileiro-de-r-27-bilhoes-levar-internet-a-menos-de-01-dos-pontos-planejados.ghtml.
[220] "Ministra Cármen Lúcia Libera Contrato da Telebras com Empresa dos EUA para Exploração de Satélite." *Supremo Tribunal Federal*, July 17, 2018. http://www.stf.jus.br/portal/cms/verNoticiaDetalhe.asp?idConteudo=384148.

> socio-economic benefits, achieved through the power of our connectivity partnership.[221]

Largely characterized as a revenue-sharing contract, the partnership established Viasat as the responsible firm for installing the necessary infrastructure to use the satellite-enabled broadband and receiving, in return, part of what will be paid for the satellite Internet service. That is, Telebras remains indeed the responsible institution for the satellite operation and data transmission while Viasat acts on the other side of the broadband infrastructural scheme, providing on-ground installation and maintenance.[222] Although specific terms and conditions of the agreement between Telebras and Viasat remain classified, a public release by Viasat contends that partnership between them is "founded on a success-based revenue-share model in which Telebras expects newly-enabled market opportunities can potentially generate more than billion dollars in revenues for the company over the next 10 years.[223]

While one can consider a matter of speculation the prediction over whether the Telebras-Viasat agreement will live on, their contract poses intriguing questions that demand more public attention and scrutiny. The available public information informs that out of the 70 percent civil capacity of the SGDC-1, 58 percent is being commercialized by Viasat. Telebras' share of the SGDC's civil beam capacity is, therefore, 42 percent. The social and digital inclusion nature satellite's footprint is, thus, concentrated in only 42 percent of the SGDC capacity for on-ground installations.[224] Given that a more substantial portion of the satellite's capacity is to be commercialized by a foreign private firm, the immediate question that arises is if the SGDC-1 is really a public satellite, funded by taxpayers to serve those who need the most.

Although Telebras has insistently justified its contractual maneuvers by stating that the partnership with Viasat poses no threat to strategic communications or the nation's interests—as it is not the direct operator of the satellite—such an agreement

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[221] "Viasat and Telebras Announce Contract Approval by the Brazilian Federal Court of Accounts." *Viasat*, May 22, 2019. https://www.viasat.com/news/viasat-and-telebras-announce-contract-approval-brazilian-federal-court-accounts.
[222] Débora Álvares, "Satélite Brasileiro Causa Prejuízo de R$ 800 Mil ao Dia." *Gazeta do Povo*, May 12, 2018. https://www.gazetadopovo.com.br/politica/republica/a-incrivel-historia-do-satelite-brasileiro-que-gera-prejuizo-de-r-800-mil-por-dia-114xj9outw34mzfa7m4a15ndz/.
[223] "Telebras, Viasat Enter into Strategic Agreement to Connect the Unconnected in Brazil." *Viasat*, February 26, 2018. https://www.viasat.com/news/telebras-viasat-enter-strategic-agreement-connect-unconnected-brazil.
[224] Telebras, 2017.

deserves more interdisciplinary analysis and civic understanding, given the history of failed telecommunication infrastructure policies that are often encapsulated in a social inclusion narrative. Furthermore, it deserves more nuanced and precautionary attention when thinking of the SGDC project in the long run as a satellite constellation. Although Telebras representatives make the case that the partnership "will enable Brazil to leverage the benefits of the investments made in its satellite communications infrastructure, and bring broadband connectivity to key government points of interest,"[225] what could possibly happen if Viasat decides to pull out of the agreement? What does happen if Telebras gets privatized as it was in the late 1990s? What does happen if the revenue generated by the SGDC-1 ends up benefiting more the accumulation of capital for a private firm instead of the interests of the nation's unconnected? These are questions that I do not directly examine in this thesis, but I hope that it provides necessary provocations for future research.

Upon overcoming the series of issues pertinent to manufacturing, launching, and operating as well as acquiring legal authorizations to provide on-ground infrastructures at rural public schools, Telebras, the Ministry of Education, and the MCTIC make public releases informing the publics on how fast and successfully the SGDC-1 is providing broadband connectivity in schools. In a public event that took place in the State of Rio Grande do Norte, in the northeast region, for instance, the government announced that 2 million students were now connected as part of the GESAC program, and that out of the 8,900 on-ground points connected up until that point and that 7,050 were schools.[226] The satellite specifications predict that it can connect up to 50,000 on-ground points throughout Brazil, covering different regions in each of the SDGC's beam footprint. According to most recent reports, nearly 11,000 points are currently being used, which leaves a significant number for the following years.[227] Until March 2020, 2.4 million students were arguably connected to the broadband as part of the SGDC-1 program through the GESAC and PNBL.[228]

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[225] "Viasat and Telebras Announce Contract Approval by the Brazilian Federal Court of Accounts." *Viasat*, May 22, 2019. https://www.viasat.com/news/viasat-and-telebras-announce-contract-approval-brazilian-federal-court-accounts.
[226] Bruno Amaral, "Com SGDC, Gesac Chega a 2 Milhões de Alunos Conectados." *TELETIME News*, August 13, 2019. https://teletime.com.br/13/08/2019/com-sgdc-gesac-chega-a-2-milhoes-de-alunos-conectados/.
[227] Henrique Julião, "Gesac Alcança 11 Mil Pontos Atendidos e pode ter Aditivo Contratual." *TELETIME News*, March 12, 2020. https://teletime.com.br/10/03/2020/gesac-alcanca-11-mil-pontos-atendidos-e-pode-ter-aditivo-contratual/.
[228] Ibid.

Project Sustainability, Government Uncertainties, and Potential Breakdown

Equipped with an understanding of the SGDC-1's technical, institution, financial, and legal dimensions that characterized the satellite's early phases, I now turn the attention to some of the shortcomings that may hinder the satellite project's development in the foreseeable future. As I have shown up until this point via footprint analysis, the SGDC project has shown progress in providing connectivity points in more than 7,000 schools, benefitting millions of students, mostly due to the inter-ministerial and public-private partnerships. However, the sustainability of the project is increasingly questionable for three main reasons: I) the reliance on a single highly complex object with a limited lifetime as part of a national media infrastructure with the goals to connect "dark spots of information" to the broadband; II) the soon-to-be total used capacity of the satellite's Ka-band beams both due to the growing public and private agreements (MCTIC, ME, and Viasat) as well as uncertainty over its shared use and coverage; and III) the suspension by the Brazilian Federal Court of Accounts (TCU) for the selection of the SGDC-2. These three significant points of contention constitute a crucial part of the SGDC-1's footprint, although they remain invisible in the public discourse, not only because they directly connect the satellite to socio-political circumstances on the ground, but also because they signal how the satellite is part of a much more complex government maneuver that has a history of misleading the masses to unrealistic telecom projects.

Given that SGDC-1's class satellite is expensive and one whose manufacturing is part of a much larger, standardized, hierarchical system, I argue that should there be no strategic view for the project's sustainability, it is clear that rural public schools that rely entirely on the satellite for their local broadband connection will face major issues. According to Brazilian engineers who participated in the technology transfer program in France, the expertise they gained working with Arianespace engineers would require at least three years to manufacture the SGDC-2. The prediction was that SGDC-2 would be launched in 2020; however, as of now, there is no official document allowing the manufacturing of a second communication satellite to continue with the SGDC project's vision as predicted in the decree that established it. In light of the social and digital inclusion programs the SGDC seems to support, the sustainability of the government-led satellite technologies for broadband Internet connectivity is becoming even more contentious, which may exacerbate

problems in the long-run if not enough investment, research, and development is pursued.

As a matter of fact, Telebras' executives have already pointed to the real importance of developing the SGDC-2 in order to continue the program. They claim, among other things, that it is quite risky for a company to use only one satellite, given the conditions in orbit that deteriorates the satellite's bus and payload instruments overtime. Nonetheless, it is important to acknowledge that this is not only the case for Brazil. Frequently, nation-states deploy hybrid telecommunication networks that either complement one another in moments of breakdown, repair, or maintenance. This is particularly relevant not only for the mixed public-private business that Telebras operates under, but primarily for macro infrastructure projects such as the SGDC-1. After all, satellites are sophisticated objects that demand strategic planning due to their sizeable financial scope complex and governance as well as their manufacturing, launching, orbital control, and policy frameworks to accomplish missions on the ground.

Furthermore, the SGDC-1 already indicates the negative consequences of not aligning the space program with sustainable funding, strict timeline, and clear governance. As discussed before, from the government decree in 2012 that enabled the creation of the SGDC's Steering Committee and the Executive Group to its launch, it took more than five years, though the initial plan was to launch the SGDC in 2014. The current political climate of Brazil's federal government, characterized by an increasing inflation and transition to a populist leadership and the unprecedent effects of the COVID-19 pandemic, might also have serious implications for how projects like the SGDC can continue accomplishing the social and digital inclusion discourse the government grounds its arguments when dealing with the "dark spots of information." While the SGDC-1 complements Telebras' backhaul optic fiber networks in Brazil, the reliance on one single object may incite problems in the future, as there would not be a backup. Consequently, alternative satellite projects must take place so that an infrastructural breakdown is avoided and does not compromise regions that are not connected by optic fiber networks and that are dependent on the SGDC.

Despite all, Visiona holds a positive outlook for the development of SDGC-2. In a 2018 press release, Visiona staff said that although there are only studies being carried out on the SDGC-2, they hope that the Brazilian space industry will have a

stronger and more relevant participation in the second time around.[229]Aside from that, Brazil's space-related public agencies have also signaled they are interested in expanding global partnerships while engaging with the existing international stakeholders for the SGDC-2. If the interests are held true and sustainable, Visiona will continue to help Brazil establish a domestic geostationary satellite manufacturing capability.[230] The fact is that the budget expenditure expenses for the SDGC-2 have not been submitted to competent agencies; moreover, it has not been formally designated as a priority and has not been included in any classification guaranteeing the priority of its implementation.[231]

If the reliance on a single satellite may present issues in the foreseeable future, another growing concern is the satellite reaching its total capacity in the next few years. According to Helcio Vieira, one of Telebras' top executives, if the on-ground connectivity continues to grow at the same rate as it has been since 2018, the SGDC-1 will have its total capacity reached by 2020, utilizing all of the beams in the Ka-band. In light of the GESAC contract, which enables the partnership with MCTIC, as well as other smaller contracts, Vieira recognizes that if all the SGDC-1's capacity is occupied without launching on a second satellite, Telebras will certainly break and go bankrupt.[232] The fact that the government needs to approve a budget as well as establish contracts for the manufacturing and launching of a new satellite, that would require years of planning. Furthermore, Vieira's observation points to the fact that the beams pointed at Brazil's north regions might be all occupied, which would prevent neither the installation of new on-ground connectivity points nor the expansion of signal trafficking with the ones already in place.

As I alluded before, such a bewildering scenario is certainly not exclusive to the Brazilian case or the SGDC-1 as a macro-scale infrastructural project, but it gains stronger salience in a moment when the nation's public institutions are undergoing budget cuts in education, as well as struggling with inflation as unemployment rates

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[229] A.J. Oliveira and Felipe Floresti. "Subutilizado, Satélite Brasileiro tem Custo Diário de R$ 800 Mil." *Revista Galileu*. Accessed April 5, 2020. https://revistagalileu.globo.com/Ciencia/noticia/2018/07/subutilizado-satelite-brasileiro-tem-custo-diario-de-r-800-mil.html.

[230] Caleb Henry, "Brazil to Order Second Dual Civil-Military Communications Satellite." *SpaceNews.com*, April 10, 2019. https://spacenews.com/brazil-to-order-second-dual-civil-military-communications-satellite/.

[231] TCU, 6.

[232] "Satélite Da Telebras Estará Todo Ocupado Em 2020, Avisa ..." *TeleSíntese*, Accessed April 5, 2020. http://www.telesintese.com.br/satelite-da-telebras-estara-todo-ocupado-em-2020-avisa-o-diretor/.

continue to grow, and the COVID-19 global pandemic is set to exacerbate existing inequalities and generate what specialists are calling a "national tragedy."[233] Furthermore, as acknowledged out by Telebras, the advance of 5G in the next years will also demand a large share of the satellite's capacity to reach certain cities or regions, and having one satellite reaching its maximum capacity is not a positive sign of a sustainable, development progress whose goal is to connect communities that historically have remained unconnected.

Back in 2017, when Telebras started a process to obtain additional information on the market to assess the feasibility and existing demand for a second satellite, it was decided that Visiona would be the satellite contractor for the SGDC-2, but that ended up being suspended because results of the SGDC-1 were still unclear. During months of incertitude over whether the SGDC-2 would be executed, the TCU officially informed the suspension of the process for the selection of suppliers to build the country's SGDC-2 by Visiona. TCU identified irregularities in Visiona's choice in the Request for Information Process (RFI), as well as the Request for Proposal (RFP). The TCU document that suspended the SGDC-2 highlights that although the planning process had begun at least two years ago for the manufacturing of the second satellite, the elements listed in more detail in the next sections of this instruction indicate that Telebras contracted the RFI and RFP phases with Visiona when they were still absent, which included,

> I) the definition of competence for management decisions affecting the implementation of the SGDC 2;
> II) the support in the budget and financial planning of the Federal Government, in 2018 and following years, to cover the costs of implementing SGDC 2, in the order of billions of Reais;
> III) the preparation of business plan and proof of cost-benefit conditions that are favorable to the implementation of SGDC 2;
> IV) the complete definition of the SGDC 2 minimum technical specifications;
> V) the study of a consistent and coherent demand aimed at estimating the capacity utilization of the SGDC 2;
> VI) the apparent contradiction between the availability of 58 percent of SGDC 1's satellite bandwidth capacity utilization to the private sector, for a period of at least 10 years, for its use in strict commercial interest, and the significant repressed demand on the Government side, over the

[233] Ligia Guimarães, "Drauzio Varella Prevê 'Tragédia Nacional' Por Coronavírus: 'Brasil Vai Pagar o Preço Da Desigualdade''." *BBC News Brasil*, April 20, 2020. https://www.bbc.com/portuguese/brasil-52329579.

> next five years, as justification for the construction and launch of the SGDC 2.[234]

As the TCU documents reveal, the legal issues concerning the contracts and the execution plans for a new satellite are also intertwined with identified two major contradictions with the funding needed for the SGDC project. One has to do with the fact that the TCU has questioned the business model adopted by Telebras with the SGDC-1, given that since 58 percent of the civil Ka-band is being used for a private company Viasat, as I elaborated earlier in this Chapter. Another point of contention raised in the TCU document has to do with Brazil's investment capacity for the SDGC-2. According to one of the rapporteurs, minister Ana Arras (2019), there would be no "resources in the budgetary and financial planning of the Union for 2018 and following years" that could be utilized by the government for the program.[235]

Telebras had previously expressed that it expects to finance SGDC-2 mainly with its own revenues. Nonetheless, according to TCU, the company had also presented a financial loss of 210,8 million Brazilian Reais (nearly 50 million USD), and that the company has presented continuous financial losses over the years, jeopardizing even Telebras' designation as an independent company.[236] In response, Telebras informed the press that it had already suspended the SGDC-2 project before the TCU assessed the program and calculated its expenditures, understanding that it is nation-state's project, and, as such, that it was up to the federal government to create a new Steering Committee as well as Executive Group for the SGDC-2—similar to what had occurred in 2012 when President Rousseff signed the document. The crux is that the lack of communication, uncoordinated participation between the government agencies, and uncertainties over the government's ability to designate part of the budget to the SDGC-2 or even SDGC-3 may have severe consequences for the feasibility of the project, potentially jeopardizing the SGDC constellation use in relation to existing social and digital inclusion programs such as GESAC and PIEC.

These shortcomings, as I suggest and continue to insist, have direct consequences for the development of the SGDC project in the foreseeable future. On the one hand, I demonstrated that despite the initial difficulties the government faced

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[234] "GRUPO I – CLASSE VII – Plenário TC 023.683/2018-0." *Tribunal de Contas da União*, https://portal.tcu.gov.br/data/files/C2/37/D4/41/9AE4C6105B9484B6F18818A8/023.683-2018-0-AA%20-%20satelite%20SGDC%202.pdf

[235] Ibid.

[236] Ibid., 5.

upon launching the SDGC-1 into orbit and high expenditure in the satellite's development, the most recent data regarding the Internet connectivity at rural school is promising. Additionally, the results show that the SGDC-1's aspects of technology transfer, side-effects, and public-private partnerships have the potential to help Brazil increase its participation in the global discussions of satellite design and operations, thereby boosting the national space program for the next decades and attracting new transnational collaboration. More specifically, the SGDC's side-effects, spurred by the creation of Visiona as a system integrator company (between Embratel and Telebras) and other on-ground infrastructures, coupled with the government maneuver in putting forth policy frameworks such as GESAC and PNBL are some of the major examples of domestic programs that have been central to SGDC.

On the other hand, there are critical deficiencies that may be obfuscated if only looked through the technical lenses of the benefits that the satellite as a technological object may provide. While the SGDC-1's blueprint of a connected regional future reflects the government's ambition to provide Internet throughout Brazil and bridge the urban-rural dichotomies in terms of broadband access, its footprints alert us of potential shortcomings that are embedded in both technical and non-technical dimensions that may hold serious implications for the sustainability of the SGDC as an important politically-pushed project with the goal to offer broadband to underserved communities. By relying solely on one technological artifact that is expensive, complex to build and difficult operate, that lasts for only about 15 years, and with a limited amount of beams/transponders that can be used, Brazil may run the risk of reaching an "infrastructural breakdown" with deep consequences for future projects.

The basic conceptual provocation here is to avoid what sociologist Susan Leigh Star and information scholar Karen Ruhleder characterize as a becoming-visible-upon-breakdown quality that defines infrastructures, their materialities and embedded systems of power. If the "the normally invisible quality of working infrastructure becomes visible when it breaks,"[237] what could possibly be some of the consequences of an infrastructural breakdown within the context of a satellite publicly funded to provide broadband for those in rural and remote areas which have

[237] Susan Leigh Star and Karen Ruhleder, "Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces." *Information Systems Research* 7, no. 1 (1996): 111-134, https://doi.org/10.1287/isre.7.1.111

historically been at the margins of society? Actions are, therefore, needed so that a potential infrastructure breakdown on the satellite use does not assume a "normal state of affairs" as other failed infrastructure telecommunication projects in Brazil, Latin America, and in other parts of the Global South. After all, a potential infrastructure breakdown due to the reliance on a single object, the use of its maximum transmission capacity, or the lack of vision for the manufacturing new communication satellites may even be much more costly and politically challenging than giving the necessary investments for the project's sustainability to achieve its arguably inclusion mission.

As the country does not operate a fleet of communication satellites, I argue that public investment and inclusion-oriented policies ought to continue on track so that new projects can guarantee the program's sustainability in the long-run and during moments of government transitions. If Telebras's predictions that the SGDC-1 will reach its limit sometime between 2020-2022 is accurate and reliable, I recommend that the development and contract execution of the SGDC-2 must occur as soon as possible. In doing so, it is important that the stakeholders think of solutions in the foreseeable future to maintain all the progress that has been made in the past years. After all, it is the funds collected from taxpayers that finance these macro-scale infrastructure projects and, as such, they demand more nuanced public understandings.

Conclusion: Toward a National Internet Satellite Plan

This thesis has sought to provide a critical assessment of Brazil's Geostationary Defense and Strategic Communications Satellite (SGDC-1) in advancing its mission to connect rural public schools to the so-called "global village" via broadband Internet. By scrutinizing the satellite as a political object through the interdisciplinary lenses of media and communication studies, this thesis has also sought to explore the intricate relationship between often opposing circumstances: the high-capital versus the poor; the technologically advanced versus the outmoded or backward; and the controversial conundrum between the connected and those perceived as the unconnected. While critically examining the SGDC-1 within the context of rural public schools, I attempted to provide a nuanced scholarly view of the satellite's role in providing broadband connectivity to the inhabitants of the "dark spots of information," thus assembling a myriad of materials ranging from news media coverage to government reports and from school census data to congress hearings.

Oriented by the work of other media and communication scholars, I started off this thesis by arguing that there is a growing importance of situating communication satellites operated in and for the Global South countries through a myriad of academic approaches and disciplines. Such a critical approach to tackle satellites through the lenses of media studies is useful because they may shed light on a variety of issues as diverse as inclusion and equity, urban-rural dichotomies, social welfare, information access and sharing, national sovereignty, digital inequalities, and many others.

Based on a triangulation of research methods encompassing historical and data analysis, close-reading of televisual texts, as well as government reports, news media and footprint analysis, I explored the satellite's diverse complex systems and untangled some its technical and non-technical discourses while situating them in relation to the long-held inclusion narratives of telecommunication infrastructures in a country as diverse, unequal, and geographically challenging as Brazil. This approach proved itself fruitful because it allowed for a more critical understanding of a complex, distant, and obscure object of study as a satellite.

As I argued throughout this thesis, one of the advantages of offering a critical media studies perspective on a public telecommunication project as large and expensive as the SGDC-1 is that it opens up new terrains for academic inquiry that

might help elucidate other types of government-operated complex systems that are purposefully hidden or distorted to the publics. By framing high-technological objects and government programs in relation to ordinary citizens, I believe that scholars can help inform the publics on how they can exhort more civic power toward revisiting policy frameworks, establishing novel government-led programs, and monitoring existing inclusion projects.

In a country of continental proportions built upon a complex colonial history marked by exploitation and inequality on many levels, the mapping of broadband access and territorial typologies is significantly challenging. By ascribing a brief history of the term digital divide in the U.S. context, I demonstrated how the Brazilian government relied on the same structural binary definition of "information-haves" and "information have-nots" when reinforcing SGDC-1's role as savior connectivity, national integrator, and a motif for collective pride. I argued that the government's confounding discourse around the notion of "dark spots of information" is not adequate because it tends to ignore the importance of digital media and information literacies that are becoming increasingly relevant as the diffusion of media technologies and Internet access evolve on unprecedented geographic scale and speed. While bold inclusion and telecom infrastructure policies such as GESAC and PNBL seem to acknowledge this notion on the paper, the urban-rural school dichotomies they are intricated with show a wholly different reality that is hard to be translated in nation-wide policy framework.

Although this discourse tends to revolve around rural public schools, it also ends up ignoring the adjacent realities that are not necessarily bound to public education but that still may benefit from the use of ICTs and broadband access. After all, the use of a high-capital object as a complex as a satellite deserves to be more of a coordinated public utility that is capable of serving as many communities as possible. Thinking beyond broadband access, school environments, and outside the digital-divide discourse is, therefore, essential for future policy frameworks of social and digital inclusion whenever dealing with ICTs and questions of rurality in Brazil.

A close-reading analysis of the televisual text correspondent to the "turning-the-broadband-on" moments arguably made possible by the SGDC-1 also revealed an intriguing way of conceptualizing the workings of the satellite in the public's imaginary. Based on the premises that the televisual holds power to function as an aesthetic and persuasive texts as well as to distract the general public from critically

assessing the details behind the satellite as a complex and distant technology, I argued that there is a great deal to learn from the government's usage of the televisual. If the televisual text encompasses critical discourses that define and at the same time attribute properties to the medium, the Brazilian government's orchestration of the televisual reveals its political positioning via the "savior" broadband potential of the satellite as a technology "by Brazilians for the Brazilians."

The proposed analysis of two high-profile media event found in a Discovery Brasil's TV series and celebratory public gatherings in Brazil's capital via videoconferencing show that the orchestration of the televisual by the government characterizes as a "space-telecom propaganda"—a clear message that is orchestrated to the masses through a captivating and celebratory use of the televisual. By showing how the current infrastructural developments funded by the government are helping leverage social and digital inclusion as well as forge national integration and domestic pride, the televisual reveals a series of organized myths that help make the satellite visible to the public while also exploiting the voice and images of those who are at margins of society, concealing the military nature of the satellite as well as the legal, financing, and governance challenges that remain largely undiscussed.

Although the Brazilian government keenly relies on framing the SGDC-1 as a space-telecom propaganda capable of magically connecting the "dark spots of information" to the "global village," I suggested that a look into the satellite's sociotechnical relations on the ground unveil that there is vast critical informational that remains invisible in the public discourse. Questions of militarization, uncertainties over public-private partnerships as well as strategic long-terms for the project's sustainability in achieving its social and digital inclusion goals remain largely unaddressed about; thus, they deserve more public attention as they hold power to compromise the SGDC project in light of the growing political and economic circumstances. Through a footprint analysis that scrutinizes the satellite's legislation, technological and governance organizations, as well as its finances and preliminary connectivity results on the ground as part of existing policy frameworks, I demonstrated that the SGDC-1 indeed represents a significant impact for future space-telecom projects.

However, a critical footprint analysis of the satellite also reveals three significant concerns that remain obscure. First, I argued that the reliance on a single highly complex object with a limited lifetime as part of a national media infrastructure

could turn out to be a challenging matter. Second, I showed that there is evidence that the soon-to-be used total capacity of the satellite's Ka-band beams both due to the growing public and private agreements (MCTIC, ME, and Viasat) as well as uncertainty over the shared use and coverage, may provide additional infrastructural and financial challenges. Third, I contended that the suspension for the selection of the SGDC-2 by Brazil's Federal Court of Accounts (TCU) signals difficulties in funding the manufacturing, launching, and operations of the next satellites predicted in the legislation that created the SGDC project. When combined, these technical and non-technical conditions may jeopardize the social and digital inclusion mission of the satellite as well as compromise the existing policy frameworks addressing issues of broadband inequality access in rural public schools.

For instance, what does it happens if the SGDC-1 break down? What does it happen when the satellite reaches its full beam capacity? What does it happen if the private U.S. firm Viasat decides to pull out of the agreement that designates the company as the on-ground infrastructure provider at schools? What does it happen if Brazil is unable to publicly fund the manufacture of the next generation of communications satellites predicted in the SGDC project? What could possibly happen to the rural schools, "the unconnected" and whoever inhabits and studies in the so-called "dark spots of information"? What would it happen if the country enters a recession due to an unexpected global pandemic? While I did not directly address these questions in my thesis, I asserted that some of these issues precisely point to various ongoing issues and satellite Internet projects in other parts of the Global South. Government-funded satellite Internet projects are often indirectly financed by ordinary citizens and taxpayers who tend not to be aware of how communication satellites may or may not help leapfrog development and/or be instruments of power exhorted by robust institutions such as transnational corporations or nation-states.

Conjecturing that the SGDC-1 will continue to make it to the headlines in the next years, I propose the creation of a National Satellite Internet Plan (*Plano Nacional de Internet via Satélite*—PNIS, in Portuguese). Like other audacious telecom policy frameworks such as PNBL and GESAC, PNIS would be able to address broadband access via the SGDC-1 specifically. While GESAC focus relies primarily on rural and remote areas and PNBL focuses on price, coverage, and speed by establishing optical-fiber networks underground, PNIS, on the other hand, would specifically address the duo civil-military capacity of the SGDC-1, SGDC-2, SGDC-3, and potentially other

publicly funded domestic communication satellites focused on broadband. Oriented by the various issues this thesis dealt with in assessing the SGDC-1 and its integrating policy frameworks within the context of rural public schools, I propose below seven initial features that the PNIS could encompass. Based on these features, PNIS would not only make the satellite operator, stakeholders, and politicians from the different ministries more accountable for the projects they so emphatically promise to the publics, but also to assess the state of expansion of satellite-enabled broadband connectivity in Brazil, including potential challenges as well as opportunities that come with such moments of transition from "unconnected" to "connected."

Therefore, the potential PNIS could include the following initial features:

1. *Long-term strategic planning.* One of the issues that this thesis addressed is grounded on the disconcerting fact that the lack of long-term strategies in tackling telecom infrastructure on a federal level often results in the government's incapacity to accomplish its inclusion goals and its failure in delivering measurable results. Long-strategic planning would, therefore, articulate digital inequalities beyond the issues of the digital divide, rural schools, and account for the complexities surrounding a space-telecom infrastructure, which requires years (if not decades) of planning, researching, development, deployment, and evaluation.

2. *Transparency over funding and public-private business models.* A more comprehensive political economy understanding of the satellite may provide a richer collective literacy in understanding how public-private business models comply with existing legislation. Thus, such transparency might reduce the uncertainties of financial issues and provide the publics with a safer and more explicit assurance over the economic feasibility of manufacturing, launching, and operating the next generations of publicly funded communication satellites.

3. *Real-time information on connectivity points via interactive maps.* Access to geographic information coupled with achievements in broadband connectivity remains classified information, usually under the possession of public entities such as MCTIC, ME, and Telebras. Publics only get to obtain information about on-ground broadband connectivity, Internet speed, connected schools and number of connected students from the SGDC-1 in instances of public events held by the federal government. Such information could, instead, be plotted in a real-time map so researchers, educators, and the civil society could have access to real-time information about the connectivity points in local and regional maps across the country.

4. *Data visualization tools.* Useful data related to the satellite should be open access and available through visualization tools such as the ones provided by IDEB and IBGE in the school and demographic censuses. A few

visualization tools available in other government programs such as PIEC could help orient these visualization tools on local, regional, and national levels. They can also include temporal visualization tools so that the publics can observe the evolution of the state of broadband over time in specific locations.

5. *Set of clear and measurable goals and strict timelines for socially relevant projects.* Operating an expensive macro-scale infrastructure requires a set of clear and measurable goals planned and deployed according to strict timelines. While these goals and timelines can be structured or influenced by a variety of factors such as financial, legal, infrastructural dimensions, I suggest that more clarity is desirable so back up plans can be put in place when needed. In so doing, these clear and measurable goals would help avoid socially relevant projects to be jeopardized by potential infrastructure breakdowns, glitches, and/or repair.

6. *Clarity on governance, stakeholders, policy frameworks as well as domestic and foreign partnerships.* As a high-technological artifact that emerges at the nexus of multiple stakeholders, diverse policy frameworks, and domestic and foreign partnerships, it is imperative that such a complex system is visible to the publics in accessible ways. A clear understanding of such sociotechnical relations and exchanges of capital, technical know-how, and agreements are critical because they enable researchers, policymakers, and civil society to understand the implications of non-technical discourses as well as the basics of revenue sharing and accountability on various levels.

7. *Community integration and local practices on the use of broadband.* As the understanding of digital inequality becomes more complex, thinking about access or the digital divide as "information-haves" and "information have-nots" is no longer enough. That said, it is essential that the functioning of the satellite is conceptualized not only in terms of leveraging social and digital inclusion or diffusion but also in relation to the integration of the community into local cultural practices that go beyond the school environment and that often remains invisible to the government. Therefore, it is essential to understand broadband and cultural practices embedded in the fabric of everyday life: from the school environment to the home and the broader community.

Overall, the implementation of a National Satellite Internet Plan shall not solve all the problems I consider throughout this thesis at once. Manufacturing, launching, and operating satellites involves a complex set of technical and non-technical factors that vary as we navigate countries, regions, as well as techno-scientific and military motifs. However, drafting and establishing a National Satellite Internet Plan that encompass and articulate these seven initial features I suggest might mitigate some of the reoccurring issues that I described throughout this thesis. By drawing on the lessons learned from discussion of the digital divide limitations, the propaganda-like

tone encapsulated in the government's orchestration of the televisual, and the socio-technical relations that determine the satellite's past, its workings in the present, and its shortcomings for a connected future, PNIS as a base document would help orient the workings of the SGDC-1 toward a more participatory civic impact. Furthermore, the establishment of PNIS holds power to vitalize the government's understanding of what is at stake when planning a space-telecom infrastructure and the various roles that institutions and citizens might play.

Further amendments to the research contribution and, potentially, the National Satellite Internet Plan, may need to incorporate other kids of methods by other interdisciplinary researchers. Given that the access to government-related information and data is difficult in a country like Brazil, more quantitative analysis may help expand the research findings, particularly those concerning business models, revenue sharing, and broadband connectivity points on the ground by region. Additionally, ethnographic research at the government-secured locations that operate the satellite as well as in rural areas might provide further insights that are not noticeable in the critical analysis of the televisual and the SGDC-1's sociotechnical relations. From engaging with rural schoolteachers and students to mapping the work of engineers and technicians collaborating in the SGDC project, it is possible to integrate the user-experience insights that might help orient how the broadband is received at schools and how it can permeate the communities and social worlds in which they are part of.

Most importantly, I also believe that the establishment of PNIS will require more research on local and already-existing pieces of knowledge, community practices, and diverse digital capacitation so that we can learn more about the needs, aspirations, and skills that could be learned from the "unconnected." As someone with lived experiences in studying and living part of my teenage years in a rural area, I believe that there are significant and original knowledges yet to be considered about media usages beyond access and broadband that remain invisible in academic works. Furthermore, I also believe that technology integration must be part of much more contextual processes that consider technological tools not as isolated levers that define one's engagement with the Internet, with one another, or with the community, region, country, or the social worlds they inhabit. Instead, we need to critically think of technology as a set of non-neutral human-made tools that deserve to be continuously assessed and re-imagined as we navigate through urban and rural dichotomies, nations, cultures, languages, and distinct socio-economic realities. Diversity, in this

case, is capable of enriching and amplifying the possibilities that the broadband can bring about—from schools to communities and from households to governments. In so doing, I believe it is possible to refine our critical views of the world around us and potentially complicate the assumptions that tend mistakenly orient our judgments of what the "global village" and "the unconnected" really signify.

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