Marte Levantando-se?
The Growth of Brazil's Space Program as a Pillar of National Security

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"For the wise man looks into space and
he knows there are no limited dimensions."

-- Lao Tzu

When Brazil's first astronaut, Lt. Col. Marcos Pontes, hitched a ride to the International Space Station aboard a Russian Soyuz spacecraft in March 2006, more casual observers of space flight were no doubt caught off-guard. Though more widely recognized to the outside world for carnival and soccer, Brazil has for the past half-century quietly but steadily pursued a dedicated program of technological development in the areas of defense and space technologies. Thus, a Brazilian astronaut is but the latest step in the country's journey to establish a successful space program. While more attention is typically focused today on the space programs of the rising powers of China and India, especially as potential competitor states to the United States, it is commonly agreed that Brazil is among a very small elite group of "upper-middle" developing states with advanced programs in missile, defense, and space research.[1]

Within Latin America in particular, Brazil stands alone in its capabilities. While a number of Latin American countries have developed some type of space program, these endeavors have been largely relegated to the development of satellites and related aerospace technology, and are frequently dependent upon outside partners for technological development. What's more, they are entirely dependent on other states for launch capability. By contrast, though Brazil has collaborated with, even depended on, more advanced space powers to help build its program (which both the U.S. and Soviet Union did as well in the form of captured Nazi scientists after World War II), it has now begun to approach the point of achieving independent launch capability with programs that considerably more sophisticated, diversified, and advanced than most other developing states.[2]

This work examines the rationale, trajectory, and the current role Brazil's space program plays in the country's national security and development agenda. Brazil is Latin America's largest and most populous country and has the the world's tenth-largest economy at market exchange rates and is the ninth-largest in purchasing power.[3] This work argues that the development of Brazil's indigenous space program has evolved as a natural extension of the country's long-running strategy to establish itself the regional hegemon, encompassing not only South America but the South Atlantic Ocean as well, and as an additional justification for its consideration as a future world leader, possibility leading to a seat on the UN Security Council.

The Sky is No Longer the Limit

As the late astronomer and NASA scientist Carl Sagan astutely observed, "…governments do not spend vast sums just for science and technology, or merely to explore. They need another purpose, and it must make real political sense."[4] Thus, space power can be

understood in modern times as integral to understanding national power. China's manned orbital flights and the test of its anti-satellite ballistic missile system on January 11, 2007 demonstrated in stark terms that national power is still esteemed and measured in large part by a state's autonomous capabilities. Among possible national assets, a space program now figures highly as an integral facet of any aspiring or current power's national security strategy.

Rocketry and space programs have been fundamental in the calculus of national power since Nazi Germany's successful rocket program, which in 1944 saw the launch of a V-2 rocket to an altitude of 189 kilometers at Mach 5. Thereafter, both the U.S. and the Soviet Union dedicated large amounts of resources and strategizing toward the use of ballistic missiles. And while Winston Churchill's 1946 declaration of an "iron curtain" across Europe is commonly accepted as the metaphorical beginning of the Cold War, it was in practice the Soviet Union's successful launching of Sputnik in 1957 that heightened the acute sense of urgency of the ideological competition between East and West. The success of Sputnik put space programs firmly in the minds of geostrategists as an additional, if not crucial factor in assessing national power in the modern era. The ability to launch payloads into space became a question of sovereignty, national security, and later, economic advantage, communications, and environmental monitoring.

The benefits of a successful space program were many and laid the foundation for a considerable amount of the struggle of the Cold War. First, the practical considerations were unavoidable as tactical concerns took on a truly three-dimensional aspect with enhanced communications, improved mapping capacity, and the ability to spy on one's adversary via satellites orbiting far above sovereign territory and out of reach of a state's defensive potential. This became especially acute following the Soviet shoot-down of the U-2 spy plane of Francis Gary Powers in 1960. The post-Westphalian boundaries of national sovereignty again became murky. Second, and equally important, space programs provided the host state a venue to practice, improve, and develop better technology *within* one's country, thus assuring national security free from outside dependence.[5]

Lastly, a successful space program with independent launch capability became a way to bolster one's national prestige at home and abroad. Among the superpowers during the Cold War, space programs became a mantel upon which these opposing states could display the reputed superiority of their respective societies. Besides putting satellites into orbit, being the first to reach various solar system objects—the Moon, Venus, and Mars in particular—became stepping stones for the United States and the Soviet Union along the path to establish terrestrial hegemony. It is difficult to deny the symbolic power of having one's citizens orbiting the Earth or standing on the Moon, even if the scientific returns were relatively modest. For almost two decades (1957-1975), the "space race" occupied a central place in the national security strategies of the superpowers.

Thus, the quest for the means to put more powerful rocketry into production to boost ever larger payloads into space became the driving force in space research, occupying a prime role in the national security doctrines of major world powers. Besides the United States and the Soviet Union, other developed states such as France, Britain, and later, Japan, all developed indigenous ballistic missile programs, which evolved into their current space programs, capable of launching a variety of satellites for both civilian and military uses. Today, virtually every developed nation has a stake in the space technology, but no longer is space the sole domain of the superpowers.

Developing Countries Add Space

Though the quest for a presence in space has been traditionally associated with wealthier, developed states, an increasing number of "small" and "rising middle powers" have likewise sought to add or have added indigenous space capabilities to their list of national security priorities. The development of space technology offers these states a powerful strategic option, which can be a favored option due to its cost-benefit: a relatively modest outlay of research funding can yield substantial gains in domestic national pride and international prestige. Therefore, a space program has become an almost obligatory step to raising a country's standing as a potential regional or world power. Thus, developing states as diverse as Malaysia, Mexico, India, and Nigeria have all pursued space programs dedicated to developing technology for satellite telecommunications, meteorological services, environmental surveillance, and, most recently, geographical positioning services (GPS).

States with Advanced Launch Capabilities

- Brazil
- China
- France
- India
- Iran
- Israel
- Italy
- Japan
- Pakistan
- North Korea
- South Korea
- Russia
- Ukraine
- United Kingdom
- United States

Figure A

What most aspiring space powers lack, however, is the independent launch capacity to put payloads into orbit, without which, dependence on others for launch facilities greatly reduces the perceived and real sovereign power achieved through a space program. However, a handful of developing states have achieved this critical next step. Though states such as North Korea receive much press coverage for their forays into advanced rocketry, a more comprehensive list includes a handful of rising regional powers (Figure A). This growth has been evidenced in the past decade by China's manned Earth orbital shots and Moon probe as well as India's development of an indigenous launch capability, which most recently included its successful Moon probe *Chandrayaan-I* in October 2008.

In these and other examples, the space programs of developing countries serve much the same functions as did the earlier ones for the superpowers: to gain prestige among nations and, more importantly, to increase the experience and capabilities of the country's space industry in order to make it as autonomous as practicable, and by extension, through competition driving down launch costs across the globe. However, most developing states do not yet possess this ability and rely on an outside source with launch capacity to realize their goals. Brazil, by contrast, is one of the few developing states that have pursued autonomous launch capacity.

Building the Rationale for a Brazilian Space Program

Brazil's growing emphasis on the development of a space program has become a vital component in its national security strategy. The Brazilian government's rationale for its space endeavors is unambiguously expressed as being "strategic for the sovereign development of Brazil…only those countries that master space technology will have the autonomy to develop global evolution scenarios, which consider both the impact of human action, as well as of natural phenomena. These countries will be able to state their positions and hold their ground at diplomatic negotiating tables."[6] Clearly, Brazil has made the same assumptions as earlier space powers—that space is merely another arena in which the country must exercise its power to ensure its sovereignty.

Brazil's space policy can be summarized by three general goals: 1) to exert sovereignty over its vast, rich but thinly populated geographic interior; 2) to develop economically and militarily to obtain an assumedly deserved regional leadership position; 3) to become eventually receive recognition as a world power. First, in territorial integrity, Brazil's position as Latin America's largest country makes it a natural, though not unchallenged, hegemon. But with upwards of 80 percent of the country's 185 million people living within 400 kilometers of the coast, a considerable portion of the country is under-populated, averaging only 18 persons per square kilometer. Brazil has adopted a number of other policy initiatives over the years to extend and strengthen Brazilian territorial integrity.

First championed by President Castelo Branco in 1966, *Operacão Amazónia* was a program to encourage human migration into the interior, and in 1970 the Plano de Integração Nacional was launched to ensure national control of its vast interior through road construction, human resettlement, and agricultural subsidization. The same year, as a result of the so-called "Lobster War" with France (a dispute over fishing rights), Brazil unilaterally extended its territorial waters to 360 kilometers offshore.[7] Lastly, in 1984 Brazil extended its reach by declaring a "zone of interest" in Antarctica (making it the third Latin American state to do so), though as a signatory to the Antarctic Treaty System of 1959 it has not formally made territorial claims. This move was part of what Brazilian geopolitical strategists called *defrontacão*, a theory that espoused a greater South Atlantic presence for the country.[8]

Likewise, a long-standing theme in Brazil's quest to be recognized as a world power has been the effective utilization of its extensive natural resources for economic development, which has manifested itself in a number of ways. From moving the capital to Brasília in 1960 to various massive hydroelectric projects and extensive agricultural endeavors, the boldness of Brazil's undertakings has paralleled the country's ambitions to be recognized as a rising power. Thus, to better understand the implications of Brazil's foray into space and the role its space program plays in the country's national security strategy, it is useful to contextualize this program within the evolution of the country's broader national security programs and strategic needs.

It is important to note at this juncture that in addition the tangible factors outlined below, another, more subjective matter should be considered as providing some level of justification for the country's expansive projects and security agenda: this is Brazil's perennial notion of *grandeza*. Living in by far Latin America's largest country (slightly larger than the contiguous United States), Brazilians have traditionally seen their country as a natural regional and potential world power. This concept of *grandeza* goes a long way toward understanding the logic of Brazil's national development and defense priorities. This perception of destiny is bolstered by Brazil's geostrategic location along the sea lanes of communication in the Atlantic, from the equator to Antarctica. This notion of regional hegemony has always been resisted by Argentina, but after that country's defeat in the Falklands/Malvinas War in 1982, Brazilian geostrategists felt Brazil had to fill the power vacuum. To achieve this goal, former President Juscelino Kubitschek declared that Brazil would produce "50 years of development in five." From the late 1950s to the mid-1970s, during a period known as *O Grande Brasil*, the Brazilian government undertook a series of daunting projects, which read like a list of engineering hyperbole: the world's longest bridge, the world's largest hydroelectric dam, the Trans-Amazon Highway, and it plans for a network of up to 10 nuclear power plants (in cooperation with West Germany).[9]

Accordingly, a space program fit logically into these grand designs, and successive military governments of Brazil (1964-1985) predicted with all confidence that the country would join the world's space powers, launching Brazilian-made satellites on Brazilian-made rockets. It

was also assumed that the space program would foster a traditionally inward-looking country toward some degree of technological independence in diverse sectors, such as informatics, arms industries, nuclear power plants, and satellite technologies.

Development of a Brazilian Strategic Vision

The beginning of the expansion of Brazil's geopolitical consciousness is found in the early 20th century up through World War II. During this time period, Brazil's defense spending spiraled upwards in response to perceived actions by its perennial rival, Argentina, and to establish hegemony in South America, particularly because of Argentina's covert involvement in the Chaco War (1932-1935) and the Argentine military's pro-Axis leanings in the early 1940s. Brazil's ultimate entrance into the Italian Campaign during World War II with the Força Expedicionária Brasileira marked a turning point. Although its contribution was relatively minor to the overall war effort, Brazil was one of only two Latin American countries to actively participate in the war (the other being Mexico), and such active participation in world affairs was perceived by Brazilian strategists as essential to the country's aspirations to be taken seriously as a potential world power.

Brazil's pursuit of this recognition led the county to begin development of an independent rocket and nuclear energy program in the late 1950s. During the administration of President Juscelino Kubitschek (1956-1961), Brazil began to develop an indigenous nuclear energy and weapons program, partly in response to a similar program in Argentina. These nuclear ambitions were later accelerated by subsequent military government, which pursued a variety of uranium enrichment approaches by all the military services.[10] The plan went so far as to construct a 300 meter-deep shaft in the northern state of Pará for never-achieved underground nuclear tests. Consequently, the genesis of Brazil's modern space program can be traced to the development of the country's nuclear enrichment and ballistic missile programs during the military dictatorship.

One of the military government's concurrent priorities was the development of an indigenous ballistic missile program, and by 1965, Brazil was launching sounding rockets from its newly built *Centro de Lançamento Barreira do Inferno* in the state of Rio Grande do Norte. Its indigenous meteorological program began the following year. More than 2,000 successful launches have been achieved from this site.[11] During this period, Brazilian strategists began to envision the national security need for a space program, based upon three general strategy areas: resource management, economic and state development, and defense/territorial integrity (discussed below).

The formalization of Brazil's space program began in 1961with the creation of the Grupo de Organização da Comissão Nacional de Atividades Espaciais (GOCNAE), a presidentially appointed group that examined the country's needs in order to develop a viable space program.[12] Over the next thirty years, Brazil would spend about US$1.5 billion towards improved ballistic technology, even creating university engineering and physics programs to sustain the project. Due in large part to these advances, Brazil became one of the original signatories of the 1967 Outer Space Treaty (OST), which, among other things, forbade the placement of weaponry in orbit. Though 91 countries signed the OST, Brazil was one of the few signatories that actually had both the ambition and means to develop a space program that could impinge on the treaty.

Even so, prompted by ongoing competition with longtime rival Argentina and the latter's ambitious Condor II ballistic missile program in the 1970s and early 1980s, Brazil put increased resources into improving defense-related technology, especially missile technology. Brazil

created its first space bureau for space-related technologies in 1969 with the creation of the Instituto das Atividades Espaciais.[13] This was consolidated in 1971 into the Comisão Brasilera das Atividades Espaciais (COBAE), under the Ministry of Aeronautics. Chaired by the head of Brazil's Armed Forces General Staff, the program's aim was unabashedly military in orientation and sought to produce Brazilian self-sufficiency in missile technology. The program was sufficiently successful that the United States enacted a ban on missile technology to Brazil as the U.S. had strong reservations about a ballistic missile, potentially nuclear-armed, Brazil, and as it turns out, these concerns were not unfounded.

While Brazil had begun its own research into nuclear fission in the 1930s. Initially trying to acquire centrifuges from West Germany in 1953, Brazil eventually acquired nuclear reactors and fuel from the United States in the 1960s. However, successive Brazilian military governments felt increasingly hamstrung by restrictions imposed by the U.S. on technology transfers. Thus, for the first time since World War II, Brazil went outside Washington's purview and again approached West Germany, entering into an agreement in 1975 which was to provide up to eight nuclear reactors without International Atomic Energy Agency (IAEA) oversight. Though a signatory to the 1967 Treaty of Tlatelolco, which banned nuclear weapons in Latin America, Brazil's military government nonetheless felt the nuclear option crucial to the country's long-term security plans because it allowed the country to begin to transfer nuclear technology into a covert program of uranium enrichment, code-named *Solimões* (aptly named after the beginning of the Amazon River in Brazil). The objective was to master all phases of nuclear energy production, including those with potential military applications.[14]

Coupled with the country's growing missile program, this arrangement became the foundation for Brazil's defense program, which was to provide a credible deterrent to Argentina. The program was publicly repudiated by President Collor de Mello in 1990 and two years later Brazil entered into the Non-Proliferation Treaty and affected domestic legislation (Law 9112) to regulate the export of nuclear enrichment technology, which in part, was seen as a necessary step to membership to the Missile Technology Control Regime (MTCR), which would allow the importation for foreign civilian space technologies.[15] Nonetheless, indications are that the Brazilian military continued to circumvent these intended controls and continued a surreptitious program of perfecting nuclear enrichment.[16] Though a signatory to the Nuclear Non-Proliferation Treaty since 1995, Brazil has continued to include nuclear power as part of its strategic plan, and Brazil has continued to actively pursue an accelerated program of nuclear energy. First declared in 1975, the official policy of Brazil is to be completely self-sufficient in uranium for nuclear electricity production by 2014, and still produce enough for export.[17]

From Bullets to Blastoff

Concurrent to the growth of nuclear and rocketry programs was the development an indigenous defense industry, which produced top quality armaments, reaching its zenith during the 1980s. Brazil's military industries grew dramatically during the 1970s, reversing the country's long-standing dependence on foreign suppliers and making Brazil an arms-export leader among the developing world.[18] Brazil's defense industry reached sufficient capacity and quality that the country became one of the world's principal exporters of small arms, basic defense products such as radars, and even nuclear and chemical weapons technology. An extensive network of defense industries flourished, and by the 1980s Brazil had become the world's eleventh largest arms exporter.[19]

During the 1980s, its largest regional market was the Middle East, to which Brazil sold roughly half of its arms, with nearly half of all of the US$1 billion in Brazilian arms transfers from 1985 to 1989 going to Iraq during the Iran-Iraq War,[20] and most of that being in the form of one of the most successful and profitable Brazilian exports of this period was the Astros II multiple rocket launcher, produced by Avibrás Indústria Aerospacial, which specializes in rocket, missile, aircraft, and telecommunication technology. At the same time, Avibrás was developing ballistic missiles for the military with ranges up to 1,000 kilometers. Brazil's military sales ambitions went beyond delivery systems. In addition, from 1981 to 1982 Brazil secretly sold Iraq uranium dioxide (used in nuclear fuel rods) without notifying the International Atomic Energy Agency (IAEA).[21]

One of the chief results of this refocusing of priorities was that by 1987 Brazil had transformed itself from a net importer of defense-related technologies to one of the world's top ten exporters with sales of small arms, tanks, aircraft, and ships.[22] But after the fall of military rule via the *abertura* in 1985, the defense industry fell into disarray and Brazil's arms exports shriveled by the early 1990s, with only US$3 million in annual sales and the three largest arms manufacturers in bankruptcy. As a result, the totality of Brazil's ballistic and missile programs were transferred into civilian hands by 1994.

Space Takes Center Stage

While Brazil's military-industrial complex had peaked and waned, its space program progressed steadily. In 1981, the military-run COBAE became the Missão Espacial Completa Brasileira (MECB), which was to encompass a broader range of national security concerns that reflected Brazil's acknowledgement of a more complex national and international reality. Endowed with a generous US$1 billion budget, the stated objectives of the program were expanded to include a broader set of national priorities: 1) Seek out and monitor natural resources; 2) Map the Amazon region and track deforestation; 3) Oversee agricultural activities; and 4) provide telecommunications.[23] In addition, Brazilian officials have plainly stated a desire to use the country's launch capability to make the country competitive in the international commercial space launch market, "including the military applications sector."[24]

To achieve this goal, the Brazilian government began construction in 1982 of the Alcântara Launch Center on Brazil's northern Atlantic coast in the state of Maranhão, a tracking station at Cuiaba in the western state of Mato Grosso, and a mission control center in São Paulo. Built on 62,000 hectares expropriated from the local inhabitants and costing almost a half billion dollars, Alcântara is the closest launch facility to the equator (less than two degrees south), which makes it the best launch facility in the world for reasons of launch efficiency (e.g., launches from Alcântara take approximately 30 percent less fuel to achieve orbit that equivalent launches from Cape Canaveral in Florida, USA). The facility houses its own meteorological, telemetry, and vehicle assembly operations. Brazil hoped to benefit from the facility by learning the cutting-edge technology that would eventually help create the country's own satellite industry.

Of particular importance to Brazil in recent years has been the ability to monitor the deforestation of the Amazon region, which comprises about one-third of the country as well as approximately two-thirds of all the tropical forests on Earth. Though it had traditionally ignored illegal logging activities, the Brazilian government declared the preservation of the Amazon rainforest a matter of national security concern, and recent Brazilian legislation has sought to regulate illegal logging.[25] Beginning in 1988, the Brazilian Science Ministry monitored

deforestation via United States Geological Survey (USGS) Landsat satellite imagery. But with Brazil's first satellite in 1993— the Data Collecting Satellite (SCD1)—Brazil began to monitor the region through its own *Program for the Estimation of Deforestation in the Brazilian Amazon* (PRODES). A more recent satellite, CBERS, which is a joint effort with China, has yielded impressive and sobering results. It has revealed that the rainforest is disappearing twice as fast as previously estimated, releasing a further 100 million tons of carbon dioxide into the atmosphere each year.[26] Consequently, Brazil is now on the cutting-edge of the study of carbon emissions from forest burning.

One measure of Brazil's success was the fact that the country's technological capacity had grown so fast that it was one of only two developing countries (Argentina was the other) to be a signatory of the 1987 Missile Technology Control Regime (MTCR), an agreement that sought to control the proliferation of nuclear-capable ballistic missiles. Though not a treaty, the agreement did result in a delay in Brazil's missile program as its proposed missile development cooperation program with France was pressured into cancellation by the MTCR.

The Present and Future of the Brazilian Space Program

The quest to be a space-faring power was at one time part and parcel of the tug-of-war between civilian and military supremacy in Brazil. The country's first civilian space agency was created in 1994 whereas the majority of previous space program research had been under the control of the Brazilian military. But despite Herculean efforts, it was not always clear that Brazil would have success in achieving its goal of an autonomous space program, and some observers doubted the prospects as well. A 1993 Rand Corporation study concluded that Brazil's space ambitions were "not economically viable."[27] However, Brazil's goals have never been purely economic-oriented. Nonetheless, the U.S. Congress did not overlook the fact that Brazil was increasing joint space program efforts with China and Russia to circumvent technology transfers denied to it by the United States. Though the U.S. at last waived its objections to Russian technology sales to Brazil, by 1996 the U.S. Congress expressed concern that Brazil had acquired ICBM technology.[28]

Brazil's indigenous launch vehicle, the Veículo Lançador de Satélites (VLS) had a rocky start. As a joint civilian-military venture (with the Brazilian Air Force), the VLS was envisioned as Brazil's answer to European Space Agency's *Ariane-5*—a powerful and dependable launch vehicle for domestic and for-charge foreign satellite launches. However, in August 2003, an accidental explosion of the rocket's first stage at the Alcântara Launch Center killed 21 of Brazil's leading engineers and technicians. Attributed to insufficient funding and lax management, it was the third failed launch of the VLS rocket (previous attempts had been made in 1997 and 1999). Launch failures have been a fact of life of all states in the development of launch vehicles (witness the ill-fated Apollo I). However, to the surprise of many observers, only 14 months later Brazil successfully launched a smaller VSB-30 rocket, carrying a "mini-satellite" into a low Earth orbit of 260 kilometers. A second successful launch soon followed. Though originally envisioning up to 22 launches by 2014, the VLS launch vehicle now is expected to re-enter service and launch a Brazilian-made satellite by 2011.[29] While modest, these successes have put Brazil on the map as a budding space port.

In addition to pressing forward with its launch program, Brazil has continued to build a reputation as a dependable partner in space programs, though at a cost. In 1997, at the invitation of the Clinton Administration in the U.S., Brazil became the only developing country among a long list of developed space powers to contribute technology to the International Space Station.

While on the surface a gesture of goodwill, the invitation was in fact a machination of the Clinton administration intended to mold the Brazil's space and nuclear program in a favorable way toward U.S. interests.[30] Initially promising a $120 million contribution of flight equipment, Brazil was later forced to pare it down to $10 million because of the country's persistent foreign debt. Though smaller, this contribution does fit with Brazil's perennial interest in space cooperation, a tact that Brazilian officials undoubtedly expect to pay dividends in furthering Brazil's position as a world power.

In July 1988 Brazil and China signed a protocol of cooperation in the development of the high-resolution remote sensing satellites CBERS-1 and CBERS-2. The cooperation was very successful and has been praised as an example of "South-South" cooperation in technology.[31] In October 2004 Brazil signed further agreements with China to develop the high resolution CBERS-2B imaging satellites, which was launched in 2007 aboard a Chinese Long March rocket. There is an agreement for the option of two more models extending to 2014. In a gesture of reciprocity, China is considering shipping its powerful Long March rockets to Brazil for launch from Alcântara.

Regardless of its successes, the space program has struggled to overcome inherent bureaucratic infighting, corruption, and an almost legendary misallocation of funds. Before 2003, 95 percent of the meager $10 million budget went to *Embraer*, the fourth-largest civil aircraft manufacturer in the world, and only 0.5% found its way into the space program.[32] But following the 2003 explosion, the Brazilian government adopted a completely different approach. In addition to opening up the program to outside scrutiny, principally in the form of Russian advisors, the government drastically increased funding to $100 million for FY2005, which still trailed India or China's annual space program budgets of $300 million and $1.8 billion, respectively.[33] Even so, this figure represents a 235 percent increase over 2003 outlays and is a clear sign of the importance the Lula government has put on the space program. Finally, in 2009 the Brazilian government made a drastic policy shift and allocated US$343 million to the space program, finally funding it on par with its competitors.[34]

But despite its drive to develop autonomy in its launch systems, Brazil has nonetheless been ambitious in seeking partners to bolster its capabilities and its image as a space partner. In October 2003 Brazil's INPE signed a joint venture with Ukraine for commercial missions, which would launch a Ukrainian Tsyklon 4 medium-class rocket from the Alcântara launch site. Beginning in 2007, up to a dozen launches a year for 10 years were projected, which would make the Alcântara Center one of the world's leading space ports.[35] Other collaboration agreements have been entered into with Argentina, Canada, China, Germany, India, and Israel on projects ranging from night-vision radar (with Germany) to satellite construction (China and Israel).

The most visible collaboration, however, has been with Russia. In November 2004 Brazil signed a "memorandum of understanding with the Russian Federal Space Agency, which will create a new generation of launch vehicles capable of carrying larger satellites, as well as a liquid-propellant version of the VLS. Russia also agreed to improve telemetry and tracking systems as well as improve the ground infrastructure at the Alcântara launch facility. The VLS-2, which will use a liquid-fuel stage, is expected to be ready for projected 2011 launch.

The Benefits and Challenges

The present and future benefits of the Brazil space program are many. In the near-term, Brazil has successfully positioned itself as an important player in the satellite launch business,

potentially a competitor against both NASA and ESA. However, the most salient rewards of Brazil's ambitious program are not found in the vacuum of space.

First, becoming a space power gives added weight to Brazil's quest to gain a permanent seat on the United Nations Security Council (UNSC). As one of the so-called "G4 countries" vying for a seat (along with Germany, India, and Japan), Brazil is positioning itself by using its space program as additional evidence of its role as a regional power much as the current UNSC members utilized their unique positions as both the victors of World War II and as declared nuclear powers. Since Brazil has formerly renounced the development of nuclear weapons through its ratification in 1998 of the Nuclear Non-Proliferation and Comprehensive Test Ban Treaties (NPT), such a trump card is not a viable option (though it has been hinted at by President da Silva). However, it should be noted that Brazil's signature on the NPT permitted it to pursue a nuclear energy option. In 2006, Brazilian officials formally announced the opening of its *Resende II* uranium enrichment facility, which closes the nuclear energy "loop" for the country, eliminating its dependence on outside sources for enrichment. A third nuclear power plant is to be opened in 2014. Taken together with the country's more independent space program and demonstrated launch capacity, Brazil is positioning itself well to make a unique argument for inclusion as a permanent member of the UNSC.

Second, an equally important consideration is that the space program, along with nuclear enrichment, will give Brazil an added measure of autonomy from U.S. influence, something Brazil has chaffed at since the end of World War II. These milestones mark some liberation from previous technological dependence from the United States. In perfect irony, the United States, which represents four-fifths of all commercial space launches, since 2000 has permitted the launch of U.S. space vehicles by foreign powers. This could eventually result in Brazil capturing up to 10 percent of world (especially U.S.) satellite launches in the coming decade, producing an estimated $30 million in annual revenue.

Lastly, a successful space program gives Brazil an economic advantage over its Latin American neighbors as well as most other developing states. Brazil already leads other Latin American states in the number and capacity of its telecommunications and imaging satellites. But a principle obstacle faced by the Brazilian government is not as much technical as bureaucratic. Because of the country's antiquated, protectionist tax structure, important Brazilian satellite producers actively court foreign launchers, thus defeating the country's hard-sought goal of autonomy.[36]

In sum, Brazil has largely succeeded in creating a young but functioning space program that rivals or surpasses practically every other developing state. Coupled with its broad-based technological and resource bases, Brazil is poised to use this newly acquired launch capacity to further its claim to the *grandeza* as a burgeoning world power for the 21st century. Much as the legendary soccer star Pelé would astound and confound his opponents, Brazil seems intent on proving its place among world powers, launch button at the ready.

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Endnotes

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