

# A New Experience on the International Transfer of Space Technology

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The first Brazilian Geostationary Defense and Strategic Communications Satellite – SGDC - will meet Brazil's plan for satellite development, including the National Broadband Program and strategic defense. In order to discuss the SGDC Project, the Brazilian Government established a consultant multidisciplinary group whose consensus indicated that the contract for the construction of SGDC by a foreign company should include binding plans of technological absorption, as well as of transfer of technology. This way, the SGDC Project could increase the development of the Brazilian space industry. Concluding its work, the group proposed the creation of a mixed-capital company, where the state company Telebras (of the Ministry of Communications) would perform the public part. Due to its commercial success in the global market of airplanes, the Brazilian private company Embraer was invited to join the SGDC Project. The company "Visiona Space Technology", of which Embraer holds 51% share and Telebras 49%, was created on May 29, 2012, to act as a prime contractor of the SGDC Project. In September 2013, Telebras and Visiona signed the contract for the management and construction of SGDC. On February 15, 2013, Visiona issued the Request for Proposal (RFP) regarding the SGDC Project. On August 12, 2013, it was announced that the proposal of the French company Thales Alenia Space had been selected for the development of SGDC and its ground segment. The contract between Visiona and Thales Alenia Space was signed on December 12, 2013. According to the mentioned contract, Thales Alenia should provide technological absorption to Brazilian professionals, mostly engineers, involved in the national space program, nominated by the Ministries of Communications and Defense, Telebras, the Brazilian Space

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Agency (AEB), the National Institute for Space Research (INPE) and Visiona. Because of this contract, AEB and Thales Alenia Space signed a Memorandum of Understanding to regulate the transfer of technology to the Brazilian industries, during the SGDC's development. Within the SGDC Project, the transfer of technology involves a plenty of areas, such as, the systems of communication, attitude & orbit control, ground control, payloads and software. The purpose of this paper is to evaluate the probable results derived from the mentioned Memorandum of Understanding, which represents a remarkable achievement in the history of the Brazilian space activities.

## **I. Introduction**

In the eighties, during the phase of classification for the 1982 World Football Cup, two games of the Brazilian team were not broadcast on TV, but only on radio, because data from Intelsat satellite, then utilized by the state company Embratel, were not available at the games' time. Whereas the Brazilians are affectionate for football games, due to this episode, the Government began to consider the need to purchase an exclusive satellite for its communications.

In 1985, Brazil procured its first communication satellite – “Brasilsat A1” – built by the Canadian company Spar Aerospace, and launched from the Guiana Space Centre (Kourou) to provide services of telephony, TV, broadcasting, and data transmission to all country.

In 1986, another identical satellite – Brasilsat A2 – was launched with range to attend South-American users.

Near to the end of their lifetime, Brasilsat's first generation satellites were replaced by “B” series. Brasilsat B1 was launched in 1994 and Brasilsat B2 in 1995. The North American company Hughes built this Brasilsat's second generation and they were bigger and more powerful than their predecessors were.

In February 1998, Brasilsat B3 was launched to meet some Amazonian cities that had not been benefited by a satellite communication.

Brasilsat B4, the last one, was launched on August 17, 2000.

At the end of nineties, the Brazilian Government decided to privatize public services of telecommunications. On July 29, 1998, the North American company MCI International (former “Worldcom”) bought Embratel. In 2000, the satellite area from Embratel was transferred to a MCI's subsidiary company called “Star One”.

The first Star One satellite, called Star One C1, built by Alcatel Alenia Space, was launched on August 31, 2007. Currently, there are four Star One satellites in orbit (Star One C1, C2, C3 e C12) and other two (Star One C4

and C5) shall be launched in 2015. The launching of a new series of Star One satellite, called Star One D1, is scheduled to 2016<sup>1</sup>.

According to Spacenews<sup>2</sup> “the Brazilian Ministry of Defense already leases X-band capacity on the commercial Star One C1 and C3 satellites operated by Brazil’s private-sector operator, Star One, for about 23 million reais annually (...) Brazil’s Ministry of Communications leases seven Ku-band transponders on Star One satellites for about 43 million reais per year”.

In November 2003, MCI confirmed its intention of commercializing the company Star One. At the time, the Brazilian Agency for Telecommunications (ANATEL) demanded of MCI further information about the business, because it was concerned about preserving national strategic communications. But later, ANATEL considered that trading was legal.

In March 2004, the Mexican company Telmex (Teléfonos de México, S.A.B. de C.V.) bought Star One by the amount of US\$ 400 million<sup>3</sup>.

Therefore, currently Brazilian strategic communications are on the hands of a foreign private company (Telmex). That is not, for sure, the best condition for the security of governmental communications.

## II. The Creation of Visiona

The Visiona Space Tecnology was created to elaborate the project and the plan of construction of the new Brazilian geostationary satellite. This satellite must serve the objectives of national strategic defense and of digital inclusion (Internet). It will amplify the National Broadband Program to many areas of the country, especially to Amazon region.

The Brazilian Government set up a consultant group to discuss the project, composed by representatives from the Ministries of Communications; Defense; and Science, Technology, and Innovation; as well as Telebras and AEB.

The group strongly recommended that the contract for the construction of SGDC by a foreign company should include binding plans of technological absorption, as well as of transfer of technology – differently of that had occurred with the Brasilsat satellites, which were simply bought abroad<sup>4</sup>.

This way, the SGDC Project could increase the development of the Brazilian space industry. Concluding its work, the group proposed the creation of a mixed-capital company, with the participation of Telebras as public part, and Embraer, as private company. The new company should act as a primer

<sup>1</sup> <http://pt.m.wikipedia.org/wiki/Brasilsat>

<sup>2</sup> <http://www.spacenews.com/article/satellite-telecom/34822brazilian-competition-provi...>

<sup>3</sup> [www.folha.uol.com.br/folha/dinheiro/ult91u83543.shtm1](http://www.folha.uol.com.br/folha/dinheiro/ult91u83543.shtm1)

<sup>4</sup> That is why, sometimes, SGDC is called “first” in this paper. Although geostationary, Brasilsat satellites did not provide any absorption or transfer of technology to Brazil.

contractor of the Brazilian Government in the scope of the SGDC Project. Embraer was invited for this Project due to its industrial and commercial success in the global market of airplanes.

On November 3, 2011, Telebras and Embraer signed a Memorandum of Understanding to form the company.

The company “Visiona Space Technology S/A”, a joint venture between Telebras and Embraer, was legally created on May 29, 2012, to project the SGDC and to coordinate its purchasing, whose cost is estimated in US\$ 375 million<sup>5</sup>.

Visiona has become part of the industrial branch of the Brazilian National Program of Space Activities - PNAE.

As stated Visiona’s Technical Director, Dr. Himilcon Carvalho, the new company should become specialized at conception, development, integration, tests, and operation of space systems in accordance with the Brazilian National Program of Space Activities - PNAE. The company’s main business will be focused on the Brazilian space program, especially in the areas of remote sensing, meteorology and communication. Dr. Carvalho emphasized that the SGDC Project will allow to professionals from Visiona and from governmental institutions follow, systematically, all phases of project’s development, including management, design, integration and tests of the geostationary satellite. He considers this is an unique opportunity to set up a solid and sustainable growth of Brazilian space activities<sup>6</sup>.

Telebras's former President, Caio Bonilha, says that SGDC will foster broadband to remote regions that cannot be reached by optic fiber. The Brazilian National Broadband Program foresees a range of 4,200 cities and SGDC will allow an additional range of 1,300 cities. SGDC data will also be used by the Brazilian Ministry of Defense as a source of strategic and critical information<sup>7</sup>.

Based on the Space Bus 4000 platform, SGDC will take two payloads, one with 50 transponders in Ka band, offering transfer rates up to 80 Gbps, and the other with 7 transponders in X band. SGDC will weigh about 5.8 tons at takeoff and will offer more than 11Kw of power. The satellite will provide both civil and military telecommunications services from its original position at 75 degrees west. The X-band transponders will cover all of South America and neighboring maritime routes. The Ka-band will offer isolated villages in Brazil access to high-quality broadband services at an affordable price.

Spacenews has stated: “The mission clearly overlaps current and planned commercial satellites over Brazil, although Star One has said it hopes SGDC might stimulate the overall market in Brazil and not undermine the

<sup>5</sup> <http://pt.wikipedia.org/wiki/Visiona> - the original amount in Brazilian currency is R\$ 750 million. The amount in US\$ considered the exchange rate US\$ 1.00 = R\$ 2.00.

<sup>6</sup> In his article: “Visiona Space Technology – An Integrative Company for Brazil”.

<sup>7</sup> AEB Clipping – Feb. 13, 2012

company's business. The effect of the SGDC satellite's Ka-band payload on the business plans in Brazil of other satellite operators – SES of Luxembourg, Hispasat of Spain, Eutelsat of France, Telesat of Canada and EchoStar/Hughes of the United States among them – is not clear”<sup>8</sup>.

### **III. Decree # 7.769**

On June 28, 2012 the Brazilian Government issued the Decree # 7.769, which establishes the procedures for the management, construction, and launching of SGDC.

Its Article 1, paragraph unique, stated that SGDC should be concluded by December 31, 2014. However, the Decree # 8.153 of December 12, 2013, established a new deadline: December 31, 2016.

Article 2 states that SGDC management will be carried out by a Main Committee and by an Executive Group which is a technical instance in charge of implementing policies and decisions from Main Committee.

According to Article 3, representatives of the Ministries of Communications, Defense, and Science, Technology and Innovation will compose the Main Committee. For its turn, representatives from the Ministries of Communications and Defense, as well as from Telebras, AEB, and the National Institute for Space Research – INPE - will form the Executive Group, according to Article 5.

Article 8 authorizes Telebras to contract private companies to supply goods and carry out services for the construction, integration, and launching of SGDC, as well as services related to the reception of telecommunications data and its respective ground system. The prevailing idea is to give preference to the Brazilian private companies.

Article 10 states that Telebras and AEB should elaborate a strategy for absorption and transfer of technology, which will be evaluated by the Executive Group and approved by the Main Committee. According to Paragraphs 1 and 2, respectively, AEB is in charge of coordinating, monitoring and evaluating the results from the proposed strategy. It also establishes that AEB will own the intellectual property rights derived from the transfer of technology.

### **IV. The Selection of the Company to Build SGDC**

In September 2013, Visiona and Telebras signed the contract for the management and construction of SGDC. As informed by Telebras' former President, the construction and launching of SGDC will take 31 months. The lifetime of SGDC is 15 years, approximately<sup>9</sup>.

<sup>8</sup> <http://www.spacenews.com/article/satellite-telecom/34822brazilian-competition-provi...>

<sup>9</sup> [http://www.correiobraziliense.com.br/app/noticia/brasil/2013/09/05/interna\\_brasil,386...](http://www.correiobraziliense.com.br/app/noticia/brasil/2013/09/05/interna_brasil,386...)

Visiona's former President, Nelson Salgado, explained that SGDC will be built abroad because the Brazilian industries are not yet able to fulfill this work. However, he pointed out that the SGDC purchasing process will include transfer of technology to national industries, which will allow them to carry out other coming projects<sup>10</sup>.

The former Brazilian Minister for Science, Technology, and Innovation, Marco Antonio Raupp, stated that the SGDC Project will be the parameter for future Brazilian projects, such as the meteorological geostationary satellite (scheduled to be launched in 2018), the microsatellite launching vehicle (VLM), and the second communication satellite (scheduled to be launched in 2019)<sup>11</sup>.

Telebras and the Ministries of Communications and Defense elaborated technical specifications of SGDC. The Executive Group referred in Article 2 of Decree # 7.769 consolidated the results of the work.

The Request for Proposal (RFP) was issued on February 15, 2013. Seven companies shown interest at RFP: the Europeans Astrium and Thales Alenia Space; the North-Americans Boeing, Lockheed Martin, and Space Systems Loral; the Japanese Mitsubishi; and the Russian Reshetnev<sup>12</sup>. The deadline for presenting proposals was April 8, 2013.

According to Spacenews<sup>13</sup>, SGDC "was viewed by several bidders a door opener to further work in Brazil on Earth observation and meteorological satellite programs (...) Because of its potential as an entry into Brazil's ambitious national space program, the SGDC competition drew bidders from the United States, Canada, Europe, Israel, Russia and Japan".

Visiona chose the French companies Thales Alenia Space and Arianespace, respectively, to build and launch SGDC. Arianespace was selected under a separate competition.

The Council for Administration of Telebras, as informed on August 12, 2013, ratified this decision. In its statement announcing the results, Visiona said the bidders were judged by financial and technical criteria and by their ability to meet Brazil's requirements on technology transfer.<sup>14</sup>

According to Telebras, the two French companies were chosen because their proposals had presented best technical and commercial conditions. The Executive Group also agreed with the choice and the Main Committee ratified this decision<sup>15</sup>.

The contracts between Visiona and Thales Alenia, relating to the acquisition of SGDC and its ground control system, and between Visiona and

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<sup>10</sup> Idem

<sup>11</sup> <http://jornaldaciencia.org.br/Detailhe.jsp?id=80388>

<sup>12</sup> <http://defesanet.com.br/space/noticia/9552/satelite-atrai-sete-grupos-mundiais>

<sup>13</sup> <http://www.spacenews.com/article/satellite-telecom/36761thales-alenia-space-wins-h...>

<sup>14</sup> Idem

<sup>15</sup> <http://brazilianspace.blogspot.com.br/2013/08/visiona-escolhe-thales-alenia-para.html>

Arianespace, regarding the launching services, were both signed in Brasilia on December 12, 2013, during the visit of the French President François Hollande to Brazil.

## **V. Absorption of Technology**

The contract signed between Visiona and Thales Alenia established conditions for absorption of technology to the Brazilian team, formed by professionals, mostly engineers, involved in the national space program, nominated by the Ministries of Communications and Defense, Telebras, AEB, National Institute for Space Research – INPE – and Visiona. The names of the Brazilian professionals were all submitted to the AEB's approval, which is, at last instance, the responsible for the absorption of technology.

According to the contract, Thales Alenia should provide training to Brazilian professionals in a plenty of satellite's development areas, such as management, propulsion, payload, thermic structures, attitude & orbit control, etc.

It was established in the contract that the Brazilian institutions would support expenses related to air-tickets, accommodation, food, insurance and health care, among others. Thales Alenia would only support the expenses related to the courses, including the didactic materials applied.

It is important to remark that Article 10 of the Decree # 7.769 states that Telebras and AEB should elaborate a strategy for absorption and transfer of technology within the scope of the SGDC Project. Therefore, Telebras and AEB have chosen the subjects of training in accordance with the Brazilian interests for the future developments in space area.

Thales Alenia proposed three different levels of courses and activities: introductory and advanced courses; and "on job training".

The Brazilian team is submitted to a "non-disclosure agreement", which means that the knowledge they will absorb cannot be transmitted to third persons outside their organizations.

The first group, composed by 26 Brazilian professionals from the Brazilian Ministry of Defense, AEB, INPE, and Visiona, started training in April 2014<sup>16</sup>. From the initial group, there are currently 17 Brazilians considered "residents", and they will stay in France by January 2015. Some of these will remain in France for an additional time, probably up to March 2015, in order to transfer their activities to newer trainees.

The courses are being held in the facilities of Thales Alenia, in Cannes and Toulouse, both in France.

On January 12, 2015, a new team will start training at Thales Alenia, in France. This group will stay in France up to the beginning of the SGDC's launching campaign, scheduled to June 2016. About 30 persons will compose

<sup>16</sup> <http://www.aeb.gov.br/brasileiros-sao-capacitados-em-tecnologia-espacial-na-franca/>

the second group, because professionals from the Ministry of Communications and from Telebras will join the team from the Ministry of Defense, AEB, INPE and Visiona.

## **VI. Transfer of Technology**

In December 2013, just after the signature of the contract between Visiona and Thales Alenia, the Brazilian Space Agency – AEB – and Thales Alenia signed a Memorandum of Understanding (MOU) to regulate the transfer of technology derived from the SGDC Project to the Brazilian industries.

Since the terms and conditions of the MOU are under clauses of confidentiality, just a few board members of AEB and Thales Alenia have access to the document. For this reason, the MOU or even parts of it cannot be reproduced in this paper.

Taking into account the future interests of the Brazilian space developments, AEB has negotiated with Thales Alenia the areas where the transfer of technology would be feasible.

It can be mentioned that the transfer of technology involves a plenty of areas, such as, systems of communication, attitude & orbit control, ground control, payloads and software.

Whereas that the subjects of interest were duly identified, Thales Alenia stipulated the prices for each of them, including the criteria for updating the values, if necessary.

The procedures for the transfer of each technology will involve AEB, Thales Alenia, and a Brazilian company selected by AEB through a public process. The selected Brazilian company will receive the transfer of technology in a specific area. Among the criteria for selecting the company, AEB will consider its legal and fiscal regularity, in accordance with the Brazilian legislation, as well as its experience in the chosen area.

With a view to enabling the transfer of technology, the contract signed among AEB, Thales Alenia and the Brazilian company may foresee the solution of a technical specific problem, the development of an innovative process, or even the delivery of a product. In all of these hypotheses, AEB will pay the price specified in the MOU to Thales Alenia as well as it will support the expenses of the Brazilian company.

The purpose of the transfer of technology is to provide capacity for Brazilian companies in order to enabling them to attend the future needs of the national space program.

The MOU will be valid while the contract between Visiona and Thales Alenia remain effective, i.e., up to the launching of SGDC, schedule to September 2016. However, all the contracts for the transfer of technology signed before the launching of SGDC must have to be concluded. AEB expects to exercise the options of the transfer of technology by that time.



## VII. Differences between Absorption and Transfer of Technology

It is important to emphasize that the absorption of technology established in the contract signed between Visiona and Thales Alenia has no relationship with the transfer of technology foresaw in the MOU signed between AEB and Thales Alenia. As shown in this paper, there are sound differences between absorption and transfer of technology. The first – the absorption – is applied to individuals, while the second – the transfer – is directed to companies.

The absorption of technology will be provided to a Brazilian team from public institutions, as well as to the employees of Visiona, the company that act as the prime contractor in the scope of the SGDC Project. On the other hand, the end users of the transfer of technology will be the employees of the companies selected by AEB.

In both cases, the Brazilian professionals will be submitted to “non-disclosure agreement” clauses. However, those who will absorb technology may use their knowledge to improve management of the Brazilian space projects as well as the technical requirements of space assets. Therefore, absorption of technology will enhance the role of the Brazilian space public institutions in defining and guiding the priorities in the space area.

For its turn, the transfer of technology will contribute to the development of the Brazilian space industries, with a view to enabling them to attend the future needs of the Brazilian National Program of Space Activities - PNAE<sup>17</sup>.

## VIII. Expected Results

The main question that arises from the facts presented in this paper is “will Brazil, in a near or distant future, be able to produce its own geostationary satellite, without the support of a foreign company?”

The answer to this question is not so easy, because it depends on a bunch of conditions.

Brazil needs to increase its budget for space area. The Brazilian budget for space activities is the lowest among the BRIC’s countries, a Group of States composed by Brazil, Russia, India, and China. In 2010, the Brazilian Federal budget for space activities was about US\$ 175 million<sup>18</sup>. China invests more than US\$ 1 billion per year in space activities and intends to take a man to the Moon by 2020. India invests over US\$ 800 million per year in space activities. Roscosmos, the Russian Space Agency, gets an annual budget of about US\$ 2 billion. As a result, Brazil, that in the seventies occupied a

<sup>17</sup> The author would like to express his gratitude to Dr. Petrônio Noronha de Souza, AEB’s Director of Space Policy and Strategic Investments, who kindly provided information presented in topics VI, VII and VIII of this paper.

<sup>18</sup> The original amount in Brazilian currency is R\$ 353 million. The amount in US\$ considered the exchange rate US\$ 1,00 = R\$ 2,00.

position similar or even better than China and India, nowadays is very far from them<sup>19</sup>.

There are in Brazil a few number of private companies exclusively dedicated to space activities. The Brazilian Association of Aerospace Industries (AIAB)<sup>20</sup> has 50 affiliated companies, but less than a third of them have the area of space as their main business. The major revenues of space companies usually come from public institutions. The constraints in the federal budget for space activities interfere directly in the financial health of the Brazilian space companies. Brazilian companies have not yet conditions to attend the global space market at the same level of North American and European companies, simply because they do not have access to the high technology.

Since the budgetary funding is modest, space is not an attractive area for Brazilian students, who usually look for a profitable job. This is a vicious circle: the lack of financial resources causes a lack of interest in space area that leads to a lack of expertise.

Therefore, one of the challenges of the Brazilian authorities is to motivate the study of spatial technologies. This is the reason why one of the PNAE's targets is to "encourage the human resources development by training of experts needed in the Brazilian space activities, both domestically and abroad".

Although timid, the MOU signed between AEB and Thales Alenia is a step forward. It is a remarkable achievement, because this is a rare case where a developing country is being treated as a partner by a developed country, and not merely as a customer.

There is still no answer to the question presented before. Notwithstanding, the contract signed between Visiona and Thales Alenia, as well as the MOU signed between AEB and Thales Alenia have established mechanisms to improve the Brazilian space activities. Despite the fact that there are still no conditions to affirm if Brazil someday will be able to make its own geostationary satellite, it has clearly set this as the target<sup>21</sup>.

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<sup>19</sup> <http://democraciapolitica.blogspot.com.br/2010/02atividades-espaciais-brasil-tem.html>.

<sup>20</sup> [www.aiab.org.br](http://www.aiab.org.br)

<sup>21</sup> The author would like to thank Dr. Leonel Perondi, Director of INPE, for having sponsored his attendance to the 65<sup>th</sup> IAC.