

## CURRENT SPACE PROJECTS OF THE BOLIVARIAN REPUBLIC OF VENEZUELA

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### RESUMEN

A partir del año 2008, con el lanzamiento exitoso del primer satélite venezolano de telecomunicaciones, satélite *VENESAT-1*, la República Bolivariana de Venezuela pasa a formar parte del grupo de países que a nivel internacional utilizan activamente la ciencia y la tecnología espacial como una herramienta para promover el desarrollo nacional. Sobre esa base, a través de la Agencia Bolivariana para Actividades Espaciales (ABAE), se ha impulsado la ejecución de diversos proyectos espaciales, entre los que destacan la fabricación y lanzamiento del primer satélite venezolano para la observación de la Tierra, la construcción de un centro especializado para el diseño y fabricación de satélites de pequeño peso, así como actividades de investigación y desarrollo relativas a la medición de propiedades físicas de la Tierra. El trabajo presenta una breve descripción de los proyectos espaciales desarrollados en Venezuela.

### ABSTRACT

Since 2008, with the successful launch of the first Venezuelan telecommunication satellite *VENESAT-1*, the Bolivarian Republic of Venezuela became an active player in the international space sector aimed at using space science and technology as a powerful tool to promote the national development. Based on that, through the Bolivarian Agency for Space Activities (ABAE), Venezuela has been implemented several space projects such as the manufacturing and launch of the first Venezuelan remote sensing satellite, the construction of a design center for small satellite technologies, as well as research and development activities related with the estimation of the physical properties of the Earth. This paper presents a brief description of the current space projects that are being developed by Venezuela.

*Key Words:* space vehicles — space vehicles: instruments

### 1. GENERAL OVERVIEW

As part of the legal framework for the development of space activities in Venezuela, Article 11 (on national territory) of the National Constitution of 1999 establishes that “The Republic has rights in Outer Space and those areas which are or might be a Common Property of Humanity, on such terms and conditions as may be determined by the international agreements and by the national legislation” (Acevedo et al. 2011). Under the scope of the new constitution of 1999 the Bolivarian Agency for Space Activities (ABAE) was created, which is an institution attached to the Ministry of Popular Power for Science, Technology and Innovation. It was created by law in August 2007 and started its operations on January 1st, 2008 (Asamblea Nacional, 2007); it is responsible for developing the Venezuelan space pol-

icy, program and plans related with the peaceful uses of outer space.

In order to fulfill its duties, ABAE has used international cooperation as a mechanism to strengthen the space programs promoted by Venezuela that aim to provide social benefits at the national and regional level (Acevedo et al. 2011). Thus, currently Venezuela and its Ministry of Science, Technology and Innovation have signed cooperation agreements in space science and technology with Brazil, China, India, and Uruguay (Becerra 2009), and also with Argentina and Bolivia.

As part of the national mandate, all the bilateral agreements must include the development of space projects in specific areas such as Earth observation, telecommunication and scientific research, among others, as well as consider capacity building, training of qualified personnel and technology transfer.

These national guidelines and the current international cooperation have expanded the local space capabilities allowing the successful commissioning and operation of the *VENESAT-1* satellite, the up-

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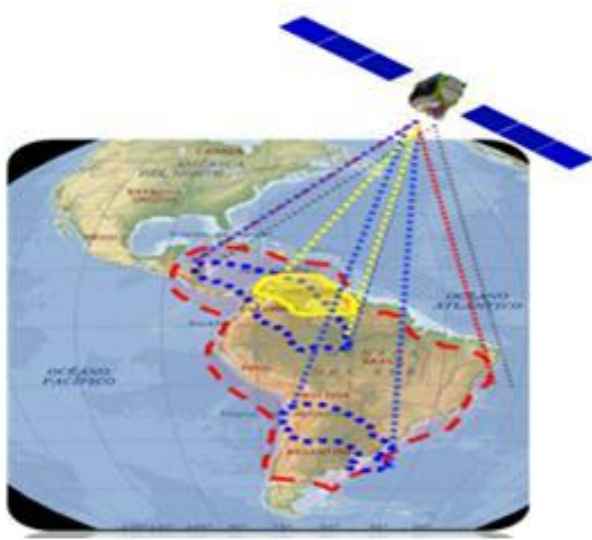


Fig. 1. Footprint of the *Venesat-1* Satellite (source: ABAE's Technical Report 2008).

coming launch of the first Venezuelan Remote Sensing Satellite (*VRSS-1* satellite), the construction of a design center for small satellite technologies, as well as the implementation of research and development activities related with the estimation of the physical properties of the Earth. All the current space projects of Venezuela will be briefly described in the following sections.

## 2. VENESAT-1 SATELLITE

Built in cooperation with the People's Republic of China, in October 29th of 2008, Venezuela launched its first Telecommunication Satellite, the *VENESAT-1* satellite, locally called Simón Bolívar Satellite in honor of the Venezuelan South America independence hero. The launch of *VENESAT-1* represents the starting point for Venezuela as an active player in the field of space science and technology (Acevedo et al. 2009).

The *VENESAT-1* is located in the geostationary orbit (GEO), at 78° west. The satellite, designed with a mission life of 15 years, was constructed by the China Academy of Space Technology, based on the country's DFH-4 Bus, China's new-generation telecommunications satellite platform (Acevedo et al. 2010). Some of the technical parameters of *VENESAT-1* are described as follow:

- Type: GEO.
- Platform: DFH4.
- Weight: 5100 kg.
- Payload: 28 transponders (14 C-band, 12 Ku-band and 2 Ka-band).



Fig. 2. Image of the Venezuelan coasts (Source: Landsat7 image) and the Satellite Control Center in BAMARI Station (El Sombrero, Guarico State, Venezuela), where will be located the ground segment of the *VRSS-1* Satellite.

- Total bandwidth: 1342 MHz.
- Life time: 15 years.

The satellite is intended to provide telecom services such as TV, radio, internet, telephony, fax, and cutting-edge programs such as satellite television or direct to home TV among others, mainly for people located in remote areas of the country, and also to support telemedicine and tele-education programs.

The satellite covers Venezuela, Cuba, Dominican Republic, Jamaica, Haiti, Central America excluding Mexico, all south America without the southern part of Chile and Argentina, (C Band), Venezuela, Haiti, Cuba, Dominican Republic, Bolivia, Uruguay and Paraguay (Ku Band), and finally the Ka band is restricted for Venezuela only.

As part of the *VENESAT-1* Program, 90 local professionals were trained in China in different fields of space science and technology. After almost 4 years of successful in-orbit operations, the satellite is working 100% under its nominal design capacity and is fully operated by Venezuelans trained in China as part of the technology transfer plan.

## 3. VRSS-1 SATELLITE

On May 26th of 2011, the Ministry of Popular Power for Science, Technology and Intermediate Industries (the current Ministry for Science, Technology and Innovation) and the China Great Wall Industry Corporation signed a contract for the design, manufacture, development, testing and launch of the first Venezuelan Remote Sensing Satellite (*VRSS-1*), the construction of the ground infrastructure in Venezuela, as well as technology transfer and human training (Acevedo et al. 2011). The *VRSS-1* satellite (locally called Francisco de Miranda satellite in honor of the Venezuelan independence hero) will support the decision making processes at governmental

TABLE 1  
SUMMARY OF CAPACITY BUILDING

Field	Country	Institution	Number	Remarks
Epidemiology	Argentina	Institute of High Space Studies Mario Gulich	1	Master studies currently ongoing
Geomatic	Brazil	Instituto Nacional de Investigaciones Espaciales (INPE)	14 Professionals	Personnel on duty in different governmental institutions
Telecommunication	China	Beijing University of Aeronautics and Astronautics (BUAA), Chinese Academy of Space Technology (CASTa)	30 doctors and 60 satellite operators	VENESAT-1 Program. Personnel on duty at the ground stations
Remote Sensing	China	CAST Shenzhen Institute	52 Professionals	VRSS-1 Program, currently ongoing
Geomatic	India	Indian Institute of Remote Sensing (IIRS)	38 Professionals	Personnel on duty in different governmental institutions
Space Management	France	International Space University (ISU)	1 Magister	Personnel on duty in ABAE
Use of sat. images/ Geomatic/ Positioning systems	Venezuela	Agencia Bolivariana para Actividades Espaciales (ABAE)	1385 Professionals	Training courses for governmental institutions. Geomatic training in collaboration with the FII
Teledetection	Venezuela	The Bolivarian Agency for Space Activities (ABAE)	25 professionals of the Bolivia Plurinational State	On line course
Satellite operations	Venezuela-France	The Bolivarian Agency for Space Activities (ABAE)-EADS/ASTRIUM	52 professionals	Training course ABAE-ASTRIUM
Space Project Management	Venezuela-France	The Bolivarian Agency for Space Activities (ABAE)-EADS/ASTRIUM	41 professionals	Training course ABAE-ASTRIUM
Satellite engineering and design	Venezuela-France	The Bolivarian Agency for Space Activities (ABAE)-EADS/ASTRIUM	40 professionals	Training course ABAE-ASTRIUM
Space Insurance	Venezuela-UK	The Bolivarian Agency for Space Activities (ABAE)-Willis LTD	20 professionals	Training course ABAE-Willis LTD

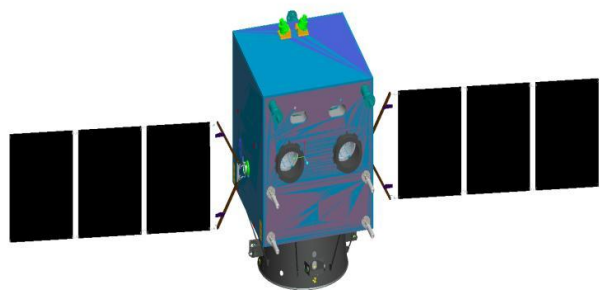


Fig. 3. *VRSS-1* Satellite (ABAE's Technical Report 2012).

level in areas such as natural disaster management (earthquakes, floods, heavy rainfall), assessment of the desertification, processes and land uses, agricultural and urban planning, illegal mining, border surveillance, and natural resource management, among others. By improving the territorial planning, the *VRSS-1* satellite images will increase the national capabilities to use space science and technology as a fundamental tool to promote social inclusion and sustainable development, allowing the continuous and consistent monitoring of the country.

Some of the technical parameters of the *VRSS-1* satellite are described as follow:

- Platform: Cast 2000.
- Orbit: Sun synchronus orbit (SSO).
- Weight: 880 kg.
- Payload: 2 panchromatic cameras (PMC) and 2 wide multispectral cameras (WMC).
- Altitude: 639.5 km.
- Inclination: 97.93°.
- Spatial resolution: 2.5 m, 10 m and 16 m.
- Lifetime: 5 years.

The *VRSS-1* Satellite will be launched at the end of September- beginning of October 2012 from the People's Republic of China. As part of the technology transfer plan, 52 local professional are being trained in CAST Shenzhou Institute (China) in areas such as satellite control and operations, ground station operations and ground application management.

#### 4. SUMMARY OF CAPACITY BUILDING IN SPACE SCIENCE AND TECHNOLOGY FROM 2006 UP TO DATE

At the end of this paper (Table 1) a summary of capacity building in space science and technology is

shown, from 2006 up to date (notice the changes from Acevedo et al. 2011).

#### 5. RESEARCH AND DEVELOPMENT CENTER FOR SMALL SATELLITE TECHNOLOGIES

In order to promote the development of the local space sector, Venezuela is assessing the establishment of a research center for small satellite technologies. The goal is to promote research networks and the development of space projects with the participation of local productive sectors in fields such as materials science, electronics, chemistry, engineering, telecommunications, education, informatics, geomatics and geophysics (Acevedo et al. 2011), among others.

#### 6. RESEARCH AND DEVELOPMENT ACTIVITIES ON THE ESTIMATION OF THE PHYSICAL PROPERTIES OF THE EARTH THAT COULD BE MEASURED FROM OUTER SPACE

According to Acevedo et al. (2011), ABAE is developing, in conjunction with the academic sector, several research projects intended to produce maps of Venezuela's absolute gravity, gravity anomaly and total magnetic field anomaly from satellite data (Orihuela et al. 2010a,b).

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