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## Editorial

# Access to Space in Brazil – Current and future scenarios

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The search for autonomy to access to space has always been the objective of the Brazilian Space Program. At the end of the 1970s, the Complete Brazilian Space Mission – MECB established the goal to develop a national satellite to be launched, by a launch vehicle designed and manufactured in the country, from a launch site located in Brazil.

In order to master the critical technologies to build this launch vehicle, sounding rockets of a family named SONDA were developed. With these, technologies were acquired to produce solid propellants, thermal protections, stage separation systems, motor structures made of highly resistant steel, structures of composite materials, attitude control systems, pyrotechnic devices, on-board electronics systems, as well as the associated ground support equipment.

Even though MECB goal has not been completely achieved as initially planned, due to misalignments in the stage of development on its three segments (while the Launch Center was created in 1987, the satellite was concluded in 1992, the first test of the launch vehicle VLS-1 only occurred in 1997), its establishment was essential for many advances and for the consolidation of the development of space technology in the country.

Concerning the suborbital vehicles, in replacement of the SONDA family, which was deactivated, the rockets VS-30, VSB-30 and VS-40 were developed, and nowadays they are internationally acknowledged for their performance and reliability. VSB-30 is widely used in the European Microgravity Program, and the VS-40 was employed by the German Space Agency for the experimental flight SHEFEX-2.

Concerning the orbital launchers, after the accident with the third prototype of VLS-1, in 2003, the project was fully reviewed, resulting in the re-design of electrical and pyrotechnic networks, besides many minor changes in other systems, as well as the conducting of new ground tests. Nowadays, the construction of three other prototypes is predicted for the conclusion of the project: the first one aims the qualification of the lower part of the vehicle (first and second stages) and the flight test of a national inertial navigation system; the second one concerns the complete test of the vehicle with a technological payload; and the third one aims to launch a national satellite into orbit.

In 2005, in order to establish long term goals to develop launchers in the country, the *Cruzeiro do Sul* Program was proposed, consisting of a family of five launchers with increasing satellite launching skills - the last vehicle able to inject a four-ton satellite into geostationary transfer orbit.

However, changes in the current scenario, which includes lower financial investments, lack of specialized human resources, low national demand for geostationary orbit satellites and the existence of a binational company, Alcântara Cyclone Space, with the Ukrainian rocket Cyclone 4, led to a revision of the *Cruzeiro do Sul* program.

The current proposal plans not only the conclusion of the VLS-1 project, as aforementioned, but also the development of a microsatellite launch vehicle – VLM-1 and the development of the two first vehicles of the *Cruzeiro do Sul* program, the VLS-Alfa and the VLS-Beta.

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The development of VLM-1 started in 2009, and the first flight is scheduled for 2015. Its initial version will be a three-stage vehicle, and all of them will use solid propellant and motor cases in composite material.

The Alfa launcher will consist of the lower part of the VLS-1 as the first (four S43 boosters) and second stage (one S43) and of a liquid rocket engine of 7.5 t of thrust (L75) as upper stage. The performance of the vehicle, higher than VLS-1, will enable the injection of 600 kg satellites in 400 km equatorial orbits, 500 kg in 750 km equatorial orbits, or 200 kg in polar orbit.

On the other hand, the VLS-Beta should be able to attend the missions of 800 kg to an 800 km equatorial orbit. The Beta vehicle will use a 40 t solid rocket motor (P40) as first stage; a liquid rocket engine of 30 t of thrust (L300) as second stage; and a liquid rocket engine of 7.5 t (L75) as third stage.

Studies show that with the initiatives proposed in this review, 75% of the national needs concerning satellite launches will be met, and also the knowledge of critical technologies to access space will be ensured, including the development of larger vehicles, in case of future needs.

As established by the National Program of Space Activities – PNAE and by the National Defense Strategy – END, considering that Brazil is a country of large dimensions, with extensive land and sea borders, it cannot give up the knowledge of space technology and the autonomous capability to access space. Also, according to the last document, “Whoever does not master critical technologies is neither independent for defense nor for development”.