

Space Transportation (6)
Space Transportation (1) (1)

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FLAMENCO: AN INNOVATIVE REUSABLE LAUNCH SYSTEM FOR EFFICIENT ACCESS AND RETURN FROM SPACE

Abstract

We are facing the resurgence of a New Space Age in which a continuously increasing number of companies and institutions require reliable and periodic access to space, remarkably in the small satellites range. At the same time, the access to the microgravity environment of space with the possibility to return to Earth opens to that market new opportunities to perform basic and applied research, validation of space resources utilization, technology test and demonstration, biomedical and pharmaceutical research and applications, remote sensing, on-orbit servicing and more.

In this paper we go into the details of a conceptual design of a reusable launch system (RLS), specifically designed for small payloads and focused on its reliability and cost efficiency to provide periodic access and return from space.

In our view, the RLS should fulfill the requirements of the global trends in the industry: multiple use, mitigation of the space debris accumulation in near-earth orbits, environmental friendliness, reliability and simplicity of design, and durability. We propose to achieve this by combining a single-stage launch vehicle and a 1000 Kg unmanned Orbiter with a payload capacity of 100 Kg. The Orbiter will be able to maneuver in space, open its payload bay to expose them to space or deploy satellites, and re-enter Earth's atmosphere. Both vehicles will be reusable, the LV via vertical landing on engines and the orbiter on parachutes and air-captured by helicopters.

The technical design is based on the modernization and update of concepts previously developed in Ukraine and reviewed in Spain, and it is at a maturity level ready for manufacture, testing and operation. Key elements of this proposal are its reusability and the reduction of environmental impact, thanks to the following specific design features:

- **Engines:** have an original design and use 100% ethanol and 98% hydrogen peroxide (both non-toxic substances bring advantages for the engine in terms of re-usability and reliability, with "cold" temperatures in the combustion chamber)
- **Orbiter:** has one-piece carbon fiber outer shell, which is not in contact with internal equipment.
- New design for a radar guidance and landing system in any weather for the LV

The economic efficiency of the RLS is also ensured, among other things, by the planned use of each launch vehicle for at least 10 flights, while each Orbiter is planned to be used around 100 times.