



ESA – GSTP

**Assessment and Accommodation Studies for
Technology Flight Opportunities (TFO) -
Portuguese Micro Launch System (PMLS) Phase 0**

Contract N°.: 4000125044/18/NL/KML/zk

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Acronyms and abbreviations

ESA	European Space Agency
PMLS	Portuguese Micro Launch System
MRD	Mission Requirements Document
TFO	Technology Flight Opportunities

Applicable documents

- [AD1] ESA, "Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase", Statement of Work, ESA-GSTP-TECMPA-SOW-009164, Issue 2
- [AD2] ESA, "Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase", RFP Response No. ESA RFP/3-15461/18/NL/KML/

Reference documents

- [RD1] Omnidea Lda, Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase 0, Project Management Plan, OMN-PRJ-AAS-TN-01.01
- [RD2] Omnidea Lda, Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase 0, Systems Engineering Plan, OMN-PRJ-AAS-TN-02.01
- [RD3] Omnidea Lda, Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase 0, Business Plan, OMN-PRJ-AAS-TN-03.04
- [RD4] Omnidea Lda, Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase 0, Mission Definition, OMN-PRJ-AAS-TN-04.02
- [RD5] Omnidea Lda, Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase 0, Conceptual and Preliminary Sizing study, OMN-PRJ-AAS-TN-05.03
- [RD6] Omnidea Lda, Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase 0, Mission Requirements Document, OMN-PRJ-AAS-TN-06.03

1 Introduction

The Assessment and Accommodation Studies for Technology Flight Opportunities (TFO) - Portuguese Micro Launch System (PMLS) Phase 0 activity was developed under an ESA GSTP 6 Element 3 contract by Omnidea, Lda in partnership with Armilar, CEiiA, ISQ and Tekever. TRL achieved during activity 2.

The proposed activity aims to combine the technological, social and geographical potential of Portugal, specifically the Azores, with the increasingly sought-after market for micro-satellite launch services.

2 Objective

The proposed activity is a starting point activity that aims developing the core competencies needed to enable the creation of a Portuguese Micro Launch System to target the deployment of small satellites, with great emphasis in propulsion technologies, further developing the European autonomy on this market segment. The main objective of this activity is to investigate the technical and economic feasibility of a new launch system for access to space of satellites with mass up to 200 kg. During the activity, the team performed the market analysis, the mission definition, the preliminary sizing and the mission requirement document for the future Portuguese Micro launcher System (PMLS).

3 Achievements and status

From the study conducted the following main conclusions were drawn:

- It is predicted a development cost of €52 Million, with total launch costs ranging from €3.8 million to €5.7 million considering a new launch system for access to space of satellites with a mass between 140kg and 180kg. Please note that these are the only first cost assessments.
- Azores location was studied and mission profiles based on the unique geographical advantage were studied including polar, sun-synchronous orbits and medium inclination launches.
- Preliminary sizing was done for a vehicle capable to perform the reference missions.
- The project management plan (PMP) defining the project management approach and methodology to be used throughout the life cycle of the Portuguese Micro Launch System (PMLS) activity was outlined.
- The System Engineering Plan (SEP) describing the overall technical management and integration activities for the design, development, test and evaluation of the PMLS was also outlined.
- A robust Portuguese industrial consortium to support this activity was created throughout the activity. The consortium is composed by Omnidea Lda as the Prime Contractor and Armilar, CEiiA, ISQ and Tekever as subcontractors.
- Phase 0 of PMLS was successfully completed.

4 Benefits

Small satellites (under 500 kg) constitute a weight category whose market has been rapidly expanding. However, this weight category is very diverse. While the upper classes of the category (200 kg to 500 kg and 60 kg to 200 kg) currently average around two accessible payloads per year for European launchers, the micro and nano-satellite classes have seen a very large increase of individual spacecraft being launched over the last decade, with a much better market accessibility. This has included not only research and university cubesats and technology demonstrators, but also commercial constellations of

Earth Observation nano-satellites.

Due to the predominance of new entrants and non-institutional actors in this new market, analysing and quantifying it has been a significant challenge, with different specialist entities arriving at substantially different results for the evaluation of said market. However, one conclusion appears to be common: the market will continue to grow, and at a rapid pace, creating demand for a greater launch capability in the small satellite category, particularly at the bottom.

Up until now, most small satellites flown on European launchers were launched as a piggyback payload. In response to the growing demand, ESA has endorsed the Light satellites Low-cost Launch service (LLL) initiative. This initiative encompasses a number of activities required to define, develop and qualify the products, processes and organisation to provide timely, low-cost, standardised launch service solutions suited to the needs of satellites under 500 kg based on Ariane 6 and Vega/Vega C launch systems.

However, from the point of view of satellite operators, piggyback and rideshare launches even on light vehicles such as Vega are not without their drawbacks. These are mostly associated with scheduling, orbit and other constraints imposed by a main payload or by several payloads of a rideshare launch on each other. Since an increasing portion of the micro and nanosatellite market is being taken up by commercial operators, the desirability of dedicated (or at least less constrained) launches becomes greater, as timing constraints and sub-optimal orbits may represent lost revenue and lost opportunities. On the other hand, and in parallel with market developments, technological advance and a growing tendency for commercialization of space operations have led to a large number of projects being announced for the development of micro launch vehicles, and, to a lesser extent, new spaceports from which these would be operated.

In this context, Portugal appears well positioned to take advantage of a number of factors which are converging to create a unique window of opportunity. With the market demand duly recognized and possessing a territory with undeniable geographic advantages for the operation of launch vehicles (the Azores archipelago), the last decades of technological and industrial development in the country and the years of cooperation with the European space industry in the framework of ESA may be leveraged to create a Portuguese Micro Launch System (PMLS), which will be a strategic entry in the small satellite launch market for both the country and Europe as a whole.

5 Next steps

Following the successful evaluation of the MDR (mission definition review) the PMLS will enter Phase 1 – Feasibility. The overall objective of this activity is to perform two parallel studies to assess the Sub-Orbital vehicle definition and Flight Engine definition and derive requirements for the detailed technology building block activity.

A secondary objective is to define the development roadmap for the SOV and FE and as a consequence define the technologies that shall be assessed under future building block activities.