

**1<sup>ST</sup> PHASE**

SEPTEMBER • 2018

*An International Call for Interest*

# ATLANTIC INTERNATIONAL SATELLITE LAUNCH PROGRAMME:

Launch services to Space from the Island of Santa Maria, Azores (PT)

A Joint Initiative of the Government of Portugal and the Regional Government of the Azores, through the Portuguese Science and Technology Foundation (FCT) and the Mission Structure of the Azores for Space (EMA-Space), with the technical support of the European Space Agency (ESA)





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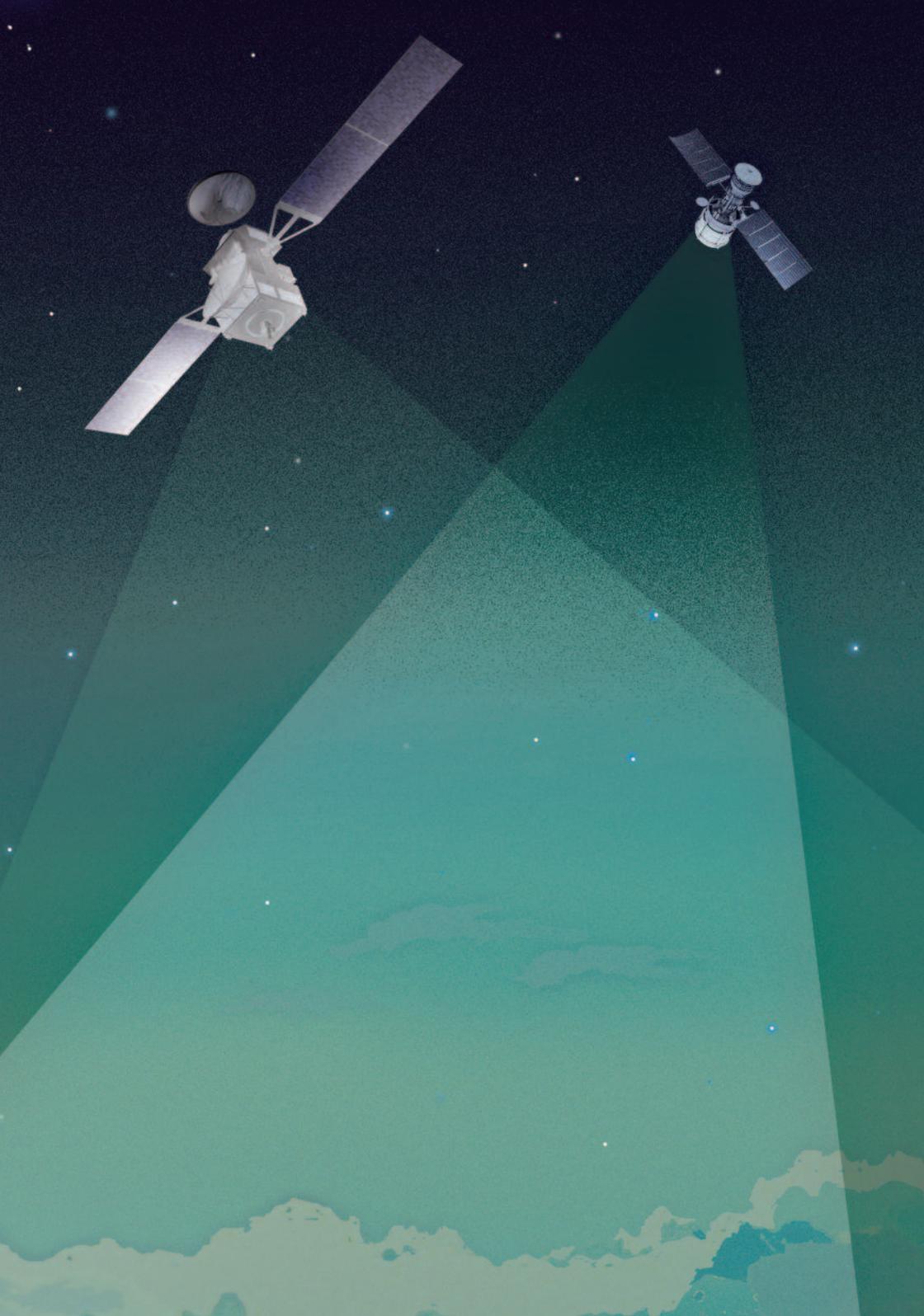
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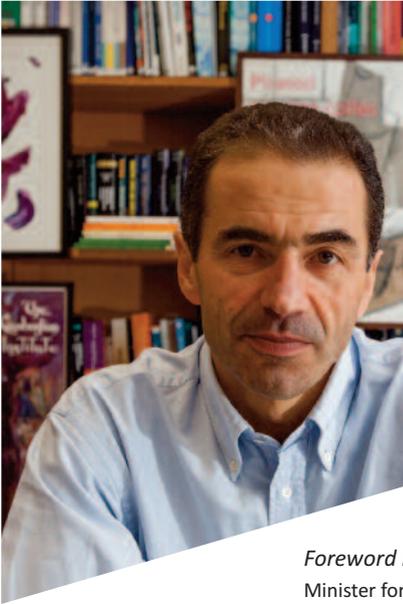
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Foreword by **Manuel Heitor**

Minister for Science, Technology and Higher Education

Economic growth and the creation of skilled jobs can be achieved by stimulating the market uptake of space-based and space-enabled services that deliver a wealthy amount of space data and signals. Global internet coverage, autonomous vehicles, remotely operated vehicles, smart agriculture and the internet of things are some of the technological trends that will inevitably push for the development of a new generation of space-based services, well beyond the traditional use of satellite navigation and Earth observation systems and open the way to limitless business opportunities.

The engagement of users and end-clients is critical to boost the use of space data and ultimately to fuel the growth of *downstream* public and private markets in all areas of activity that address economic and societal challenges within the next decade. This considers maritime monitoring and surveillance, agriculture, fisheries, natural resources monitoring, desertification and wildfire protection; climate change monitoring and meteorological services; improvement and deployment of communication, energy and mobility networks; health assistance; monitoring of migratory flows.

Portugal already hosts important space infrastructures with which it contributes to ESA and European Union space programmes and initiatives. A notorious example is the ground-based infrastructure located in the Azores. On top of that, Portuguese companies and research organisations take part on important innovation and technology development projects also within the frameworks of ESA and European Union space programmes, proving an increasing competitive and reliable skills and capacity of national stakeholders.

It is now time to step-up the efforts and adopt a differentiation strategy, taking advantage of Portugal’s geographical and Atlantic positioning, as well as capitalising on the country’s scientific and technological base and its thriving entrepreneurial community. This strategy must consider the imminent technological evolution, the growth prospects of the space sector, requiring a careful consideration of the following:

- Reducing the cost of access to space, resorting to innovative, environmentally responsible and safe launching technologies, enabling the growth of the small-satellite markets and envisaging disruptive operation approaches, including the development of an “open spaceport” in the Atlantic, between Europe, the Americas and Africa, in a way to foster international cooperation with a wide range of operators;
- Development and construction of the next generation of satellites, following the trend of miniaturisation of satellite platforms, with an increasing use of flexible multi-purpose sensors and beyond the state-of-the-art energy and orbit management technologies;
- The deployment of large inter-connected constellations for multiple and integrated applications, in domains such as Earth observation, satellite navigation and satellite communications.

The potential development of a spaceport in the Island of Santa Maria, in the Azores, in association with the development and operation of a new generation of satellite launch services to space, will boost the utilisation of space for the benefit of humanity.





Foreword by **Gui Menezes**

Regional Secretary for the Sea, Science and Technology

The ‘Atlantic centrality’ of the Azores represents not only an asset, but – and above all – a unique location for scientific and technological development of our Region in many domains.

Growth based on knowledge and innovation, involving the society and entrepreneurs, is at the heart of our vision for the future of the Azores.

While making the most of the geostrategic position of the archipelago, the Government of the Azores has implemented, over the last 10 years, an investment policy in space related infrastructures, some of them within ESA and European Union programs and initiatives, following a strategy to boost synergies among various stakeholders linked to Space.

Now, and once again, the Government of the Azores reinforces the commitment to this sector by supporting activities that may contribute to the promotion and implementation of new processes related to the Space industry, which may contribute to strengthen the regional, national and European position within the context of “New Space” initiatives.

The Azores have one of the most comprehensive business incentive systems in the European Union, with attractive reimbursement rates that provide good investment opportunities.

We have the lowest Corporate Income Tax (CIT) in Portugal (20% less than on mainland), which is also the eighth lowest CIT rate in the European Union.

We also have the second lowest Value Added Tax (VAT) rates in the European Union and the lowest Personal Income Tax (PIT) rate in the country (up to 30% less than on mainland Portugal), which constitute tax benefits that can be granted to strategic investment projects.

The unique investment context of the Azores includes also programs that promote the creation of permanent jobs, which guarantee financial support to companies that hire new full-time employees.

Our Region has industrial and technological parks with excellent infrastructures, benefitting from a high-speed communications network, provided by a submarine cable fibre optic system, linking the archipelago to the USA and Europe, with commercial harbours and airports on all Azorean islands, allowing for millions of passengers and tons of cargo to pass annually.

The Government of the Azores trusts that Research and Development programs can bring effective benefits not only to the Region but also to the partners who are involved, and we believe Space knowledge and the opportunities that the future space exploration will open will be the answer to many of the challenges of modern society.

We have the conditions and the ambition to be part of this future, for the well-being of our citizens and for a better living planet.





*Foreword by* **Paulo Ferrão**

President, Portuguese Foundation for Science and Technology, FCT

Science and technology in Portugal, are key enhancers of the Azores as a strategic location to develop a spaceport uniquely suited to reduce the cost of access to space and to facilitate the growth of the next generation of satellites, unleashing the potential of the “New Space” economy.

Portugal has been increasingly investing in space and creating scientific and technological capabilities for over twenty years, mostly driven by its participation in ESA, which contributed to extensive research and development activities targeted to applications, user segment, space system software and control, flight dynamics, mission control and operations, RF payloads for radio navigation, quality, dependability and safety, ground station systems or on-board data systems. This resulted in a striving entrepreneurial and innovative industrial and technological sector, composed mostly of SMEs, Universities and Research Institutes.

Portuguese key competencies in space technologies were based in software developments and applications but more and more, the seamless combination of software and hardware, with cost efficient processes, has led to the creation of a significant portfolio of products. Remarkable hardware technologies have successfully reached the highest Technology Readiness Levels. One example is a magnetometer embarked on the Proba-2 mission and several Sentinel missions. Another examples include radiation monitors, onboard the Alphasat mission, which has been protected through a Multilayer Insulation (MLI) developed in Portugal. This MLI was also used on the entry and descent module of ExoMars, the ESA robotic exploration mission to Mars. Others includes new manufacturing technologies, that enable the development of spherical or cylindrical tanks without the traditional girth welds,

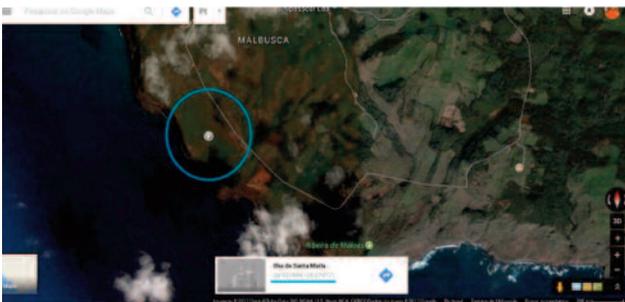
thus enabling the use of aviation grade aluminium as a liner material with significant cost reductions. Recently, a Portuguese Consortia is developing a small satellite, in view of deploying a constellation of satellites, capable to provide low cost services related to the Atlantic, including for Earth Observation

In parallel, Portugal has been strengthening the strategic advantage of its geographical positioning in the Azores, through a partnership with ESA, which has allowed for the installation of an advanced set of antennas capable of tracking of Ariane Launches, facilitating data download for Earth Observation services, or enabling downlink of Scientific Missions data, providing more opportunities for New Space exploitation.

In this context, Portugal has presented a new space strategy, together with an innovative space law, creating a unique landscape to attract more science based investment, from space ports to space enabled services, including the provision of components and services for launchers and satellites.

Encouraged by this progress, FCT has been promoting several studies to assess the technological feasibility and commercial potential of a Space Port in the Azores, particularly in the context of an ESA initiative, whose preliminary results unanimously confirm its potential in the context of the global “New Space”.

With this strategy, Portugal declares its intention to support Europe in its ambition to guarantee, in its territory, competitive access to space as well as the provision of services in orbit.







## **ATLANTIC International Satellite Launch Programme:**

**Launch services to Space from the Island of Santa Maria, Azores (PT)**

### **1<sup>st</sup> PHASE: *An International Call for Interest***

**The Portuguese Science and Technology Foundation (FCT) and the Mission Structure of the Azores for Space (EMA-Space) invite qualified entities worldwide to express their interest to collaborate with Portuguese enterprises and research laboratories to design, install and operate a spaceport in the Island of Santa Maria, in the Azores, associated with the development and operation of a new generation of satellite launch services to space.**

The potential development of a spaceport in the Atlantic aims to stimulate a new generation of space activities oriented towards small satellites. It will extend existing satellite and launcher monitoring and tracking facilities and open a new generation of launcher services and space activities based on small satellites for the benefit of society, at large. It considers the unique location of the Azores in the Atlantic and its centrality in relation to Europe, the Americas and Africa.

It should cater to the growing demand to target specific orbits for small satellites – for such diversified purposes as communication applications, namely space based internet connectivity; Earth observation applications that may range from agriculture and fisheries, ocean, land and air measurements, to infrastructure monitoring, urban development, safety and security, among others – a market that is expected to be worth upwards of several billions of euros in the coming decade and, on the other hand, to generate value from the present trend of growing international initiatives resulting from the *New Space Industry* sector, along with the need to accelerate safety and security initiatives involving the use of micro, mini and small satellites.

This document provides insights into the initiative and provides details for interested parties on how to submit an *Expression of Interest*.

## 1

**OBJECTIVE**

The objective of this *International Call for Interest* is to encourage and invite enterprises and public organizations from around the world to collaborate with Portuguese enterprises and research laboratories to design, install and operate a spaceport on the Island of Santa Maria, in the Azores, in association with the development and operation of a new generation of satellite launch services to space. The ultimate goal is to provide low-cost, frequent and regular access to space for small satellites, as a way to boost the utilisation of space for the benefit of humanity.

The Government of Portugal and the Regional Government of the Azores are jointly engaged in supporting the growth of the current Portuguese space business in close international cooperation and in a way to guarantee the growth of global “*New Space*” industries with the technical support of the European Space Agency (ESA).

The immediate goal is to start sustainable small-satellite launch services from Santa Maria, Azores, in 2021. Its installation should be oriented in a way to open up to new areas of intervention for launch services, including the potential development of a spaceport in the Atlantic, extending existing satellite and launcher monitoring and tracking, as well as accelerating a new generation of space activities oriented for small satellites.

The activities to be developed are to be considered under the overall effort associated with growing international initiatives for the “*New Space*” commercial sector, along with the need to accelerate safety and security initiatives involving the use of micro, mini and small satellites. The overall concept should address the full end-to-end value chain by being associated with the emerging expansion of Earth observation activities to application areas, which may range from agriculture and fisheries, ocean, land and air measurements, to infrastructure monitoring, urban development, safety and security, together with the growth of “*New Space*” entrepreneurship worldwide.

The applicants are invited to express their interest and their views about the operational concept under which they would contribute to the following main objectives:

- a) The development of a low-cost, safe and ideally-located spaceport for Low Earth Orbits (LEO), namely Sun Synchronous Orbits (SSO) and Polar Orbits, where operators can launch small satellites, in a friendly cooperative environment including a modern legal framework supporting the “New Space” industry;
- b) Enabling business opportunities along the full value-chain of satellite and launchers development and operation, as well as “New Space” services opportunities, as provided by low cost satellite constellations and solutions

These Expressions of Interest constitute the first of a three-phase process aimed at setting partnerships between commercial launch service operators and Portuguese enterprises and other institutions for operating launch services from Azores by 2021.



## 2

## WHY ESTABLISHING A SPACEPORT IN THE AZORES – ISLAND OF SANTA MARIA?

In several recent independent studies, all the authors concluded that the Island of Santa Maria offers a privileged geographic location in the middle of the Atlantic, permitting an unobstructed launch trajectory, over the sea, for Polar or SSO orbits, as well as a unique position between Europe, the Americas and Africa, representing a major advantage compared to other space ports in the world.

**ANNEX 1** provides a short description of the launch site location and related characteristics.

The feasibility of establishing a spaceport in the Azores was first assessed in the fall of 2017 by the Center for Space Research of the University of Texas at Austin (UT-Austin) under the UT Austin-Portugal Partnership, supported by *the Portuguese Science and Technology Foundation*, FCT, and released by the end of 2017.

Since then, several key space providers have initiated studies about potential launch sites in the Azores and, in addition, ESA is currently supporting preliminary micro-launcher related studies through its FLPP - Future Launchers Preparatory Program and GSTP - General Studies and Technology Programme (additional information can be provided upon request to ESA).

These have also gained from a new national context launched in Portugal through several related but distinct initiatives, namely:

1. The installation of the Atlantic International Research Centre (AIR Centre; <http://aircentre.org>), presented and building up in the various *High Level Dialogues on "Atlantic Interactions"*, namely in Terceira, Azores (April 20-21, 2017), Florianopolis, Brazil (November 26-27, 2017) and Praia, Cape Verde (20-21 April, 2018);

2. The new Portuguese Strategy for Space - "*Portugal Space 2030*", [www.fct.pt](http://www.fct.pt), launched for public discussion in July 2017 and approved by the Portuguese Council of Ministers in February (RCM 30/2018, *Diário da República*, March 12, 2018). It aims to make of Portugal an institutional customer of launcher services from the Azores;

3. The definition of a new legal context for the operation from Portugal, of international launch services to space and associated satellites, which included the preparation of a “Space Law” (additional information is available at [www.fct.pt](http://www.fct.pt), and can be provided upon request to FCT);

4. The expansion of existing satellite monitoring and tracking facilities in the island of Santa Maria, including the installation of a 15-meter antenna, in parallel with the existing 5.5-meter antenna, that operates in close vicinity to related infrastructures for EUMESAT (EPS-SG) and GSA-Galileo (additional information is available at [www.fct.pt](http://www.fct.pt), and can be provided upon request to FCT);

5. Holding the first “NewSpace Atlantic Summit 2018”, in Lisbon, on May 28<sup>th</sup>-29<sup>th</sup>, which brought together a number of European and worldwide stakeholders in space science and technology with the ultimate goal of assisting in promoting new markets and skilled employment in diverse areas of our economies, as well as to deepening the emerging debate worldwide on small, mini, micro and nano-satellites, with emphasis on Atlantic regions. The summit was organized by the Space Frontier Foundation, SFF, in collaboration with the Portuguese Science and Technology Foundation, FCT, and the Ciência Viva Agency for Scientific and Technology Culture. It was oriented towards opening new areas of intervention for launchers services, including the potential development of an “open” spaceport in Atlantic regions, and extending existing satellite-based monitoring and tracking assets, as well as expanding Earth observation activities (additional information is available at [www.fct.pt](http://www.fct.pt), and can be provided upon request to FCT).

Additionally, a number of other related initiatives have been launched over the last year, including:

- The preparation of the 9<sup>th</sup> *European Framework program for Research and Innovation*, “Horizon Europe” (2021-2027), which considers several space-related research and innovation activities, to be considered in close interaction with the preparation of the *European Space Program* (2021-2027) and the *European Defence Fund* (2021-2027), for which Portugal has significantly contributed ideas including the promotion of “new space” industries and related strategies;
- The expansion of strategic partnerships between Portuguese research organizations and leading US Universities, including the *MIT-Portugal Program*, the *Carnegie Mellon-Portugal Program* and the *UT Austin-Portugal Program*, which were extended for the period 2018-2030 under the “*Go Portugal – Global Science and Technology Partnerships Portugal*” with a specific focus on space related areas and including target areas to deepen research about “Atlantic interactions”;

- The development of new space related international relationships between Portugal and major players elsewhere in the world, under the *“Go Portugal – Global Science and Technology Partnerships Portugal”*, including:

- o The *Indian Space Research Organization (ISRO)*, including initial discussions about potential common interests in jointly developing space related science and technology;

- o The *Brazilian Space Agency (AEB)* and the *Brazilian National Space Research Institute (INPE)*, including initial discussions about potential common interests in jointly developing small satellites with emphases on Earth observation activities oriented towards climate change, biodiversity and maritime safety in Atlantic regions;

- o The *Chinese Academy of Sciences*, including the installation and development of a *“STARLab”* in Portugal oriented towards mini satellite developments in close interactions with Portuguese companies and institutions.



# 3

## THE INSTITUTIONAL COMMITMENT OF PORTUGAL

The Government of Portugal and the Regional Government of the Azores intend to set a financial, legal and technical framework able to attract worldwide enterprises/consortia interested in working with Portuguese enterprises and research laboratories in the development of a spaceport and the operation of international launch services to space from the Island of Santa Maria, in the Azores.

The main components of that framework, to be committed after analysis of “Expressions of Interest”, can include the following:

1. Award **grants for precompetitive research and development (R&D) and innovation projects** up to 10 M€ per year in the areas of micro launcher development and operation, small satellite development and new applications of Earth Observation, to be performed in Portugal and to be made available for the period 2019-2023. The grants will be awarded through the *Portuguese Science and Technology Foundation, FCT* and the *Portuguese Innovation Agency (ANI)*, whilst the establishment of the Portuguese Space Agency, “*Portugal Space*”;
2. Support the **design and building of the basic infrastructures** required to facilitate the access to a spaceport in the Island of Santa Maria, in the Azores, representing an investment around 6 M€ in 2019-2020, including:
  - a. The basic infrastructure in the **seaport of Vila do Porto**, in the Island of Santa Maria;
  - b. Improvements of the existing infrastructure in the **large airport** of the Island of Santa Maria - previously a major hub in transatlantic travel;
  - c. Adequate **road access** between the seaport of Vila do Porto, the airport and the location(s) of the spaceport and launch services;
  - d. Adequate **infrastructure in the spaceport**, in order to facilitate the installation of a control centre, launch pad and specialized hangars/workshops facilities (e.g., energy and communications).

**3. Being and institutional anchor customer for space launches of small satellites dedicated to Earth observation** and including climate, environment and biodiversity monitoring, as part of the AIR Centre initiative and in close collaboration with ESA's related activities, in a way to secure initial launch services operating from the Azores in 2021 and, thus, stimulate the interest from commercial customers from all over the world;

**4. In addition, ESA will consider the development and support of the "ATLANTIC International Satellite Launch Programme" through open competitive processes,** enabling the sustainable development of new systems and technologies oriented towards new launchers, small satellites and new Earth observation applications.

# 4

## THE PROCESS

A three-phase assessment process will be considered, as follows:

- **1<sup>ST</sup> PHASE:** *Call for Interest of Qualified Entities for Launch Services to Space from the Island of Santa Maria:*

- A brief statement (about 4 pages), with a clear description of interest to build, install and/or operate a spaceport and launch equipment enabling launching services from the Azores as of 2021 for small satellites (see details below in this document);

- **2<sup>ND</sup> PHASE:** *Overture of International Call for Tender for Launch Services to Space from the Island of Santa Maria:*

- Publication of the procurement rules, including evaluation criteria;
- Public presentation to an International High-Level Expert Committee (in early February 2019), to be nominated by the Portuguese Science and Technology Foundation (FCT), upon consultation of the Government of Portugal and the Regional Government of Azores;

- **3<sup>RD</sup> PHASE:** *Conclusion of International Competitive Bidding for Launch Services to Space from the Island of Santa Maria:*

By completion of the 3<sup>rd</sup> phase, a contractual period of about two years will be initiated to install launch services to space from the Island of Santa Maria.





# 5

## THE CALENDAR

**1<sup>ST</sup> PHASE:** *International Call for Interest of Qualified Entities for Launch Services to Space from the Island of Santa Maria.*

- **By 24 September** – Publication, announcement and distribution of invitations for “*Expressions of Interest for Launch Services to Space from the Island of Santa Maria*”;
- **24-29 September**, Ponta Delgada, Azores – ESA meeting on Earth Observation and Altimetry, Ponta Delgada, Island of São Miguel, Azores, together with public announcement of the invitations for “*Expressions of Interest for Launch Services to Space from the Island of Santa Maria*”
- **1-5 October, Bremen, IAC meeting, Bremen** – Presentation of a “Breaking News Event” to promote invitations for “*Expressions of Interest for Launch Services to Space from the Island of Santa Maria*”, to be jointly organized by ESA, the Portuguese Government and the Regional Government of Azores;
- **11-12 October 2018, Lisbon** – Presentation at ESA’s GSTP 25th anniversary, including promotion of invitations for “*Expressions of Interest for Launch Services to Space from the Island of Santa Maria*”;
- **25 October 2018, Madrid** - ESA Intermediate Ministerial Meeting, where the invitations for “*Expressions of Interest for Launch Services to Space from the Island of Santa Maria*” will be promoted through the Portuguese Government;
- **31 October 2018** - Closing deadline to submit “*Expressions of Interest for Launch Services to Space from the Island of Santa Maria*”;
- **October-December 2018:** Public engagement initiatives with local population in Santa Maria Island, with the potential participation of bidders

**2<sup>ND</sup> PHASE:** *Overture of International Call for Tender for Launch Services to Space from the Island of Santa Maria.*

- **6 November 2018** - Presentation of ESA’s FLPP studies, at ESA headquarters, in Paris;
- **November 2018** (*date to be confirmed*) – Public announcement and formalisation of the **Call** for the “*International Call for Tender for Launch Services to Space from the Island of Santa Maria*”. It includes the definition of detailed assessment and selection

process by an international high-level expert committee, to be appointed by the Portuguese Science and Technology Foundation, and with the technical support of ESA;

- **27-28 November 2018, Houston, Texas** – “Space Commerce Conference and Exposition” (“SpaceCom Expo”), including promotion of the *“International Competitive Bidding for Launch Services to Space from the Island of Santa Maria”*;
- **January-February 2019** - Closing date for the submission of outline proposals, containing the required essential information, of the *“International Call for Tender for Launch Services to Space from the Island of Santa Maria”*;
- **February-March 2019** – Initiation of the assessment process, including a public presentation of bids.

**3<sup>RD</sup> PHASE:** *Conclusion of International Call for Tender for Launch Services to Space from the Island of Santa Maria.*

- **March-May 2019** - Final Assessment Phase, based on the detailed analysis by an *International High-Level Expert Committee*;;
- **End of April 2019:** Final negotiation with Enterprises/Consortia;
- **April/May 2019** - Establishment of a contract for the development and operation of the Spaceport;

Contractual/grant period: *Installation of Launch services to Space from the Island of Santa Maria*

- **May/June 2019 to May/June 2021 (2 years)** - Implementation phase;
- **Spring/Summer 2021** - First expected launch services operating from the Azores.





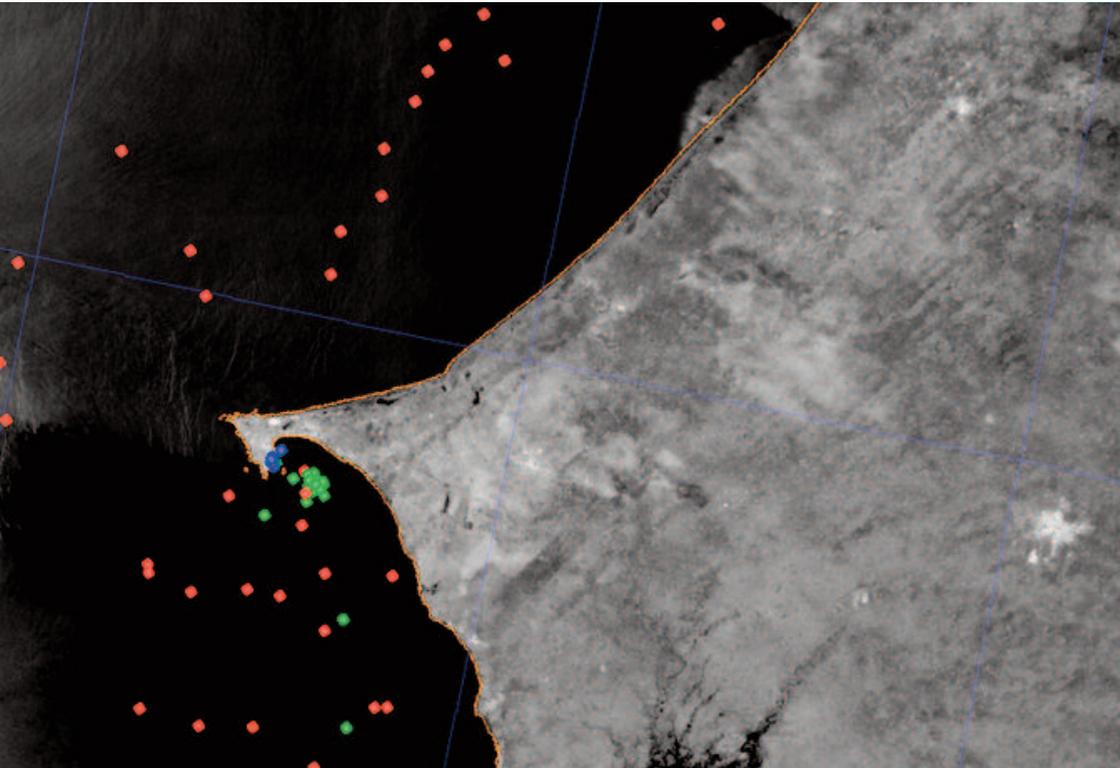
# 6

## **THE EXPECTED CONTENT OF “EXPRESSIONS OF INTEREST” AND THE PRELIMINARY COMMITMENT OF THE BIDDERS (I.E., PROPOSER ENTERPRISE/CONSORTIA)**

For the 1st phase, the expected content of “Expressions of Interest” should include a maximum extent of 4 pages, including the following:

1. A clear statement of interest to build, install and operate a launch base and launch services from the Azores, as of 2021, for small satellites (i.e., smaller than 500 kg). This statement of interest must be associated with the operational concept under which the applicant plans to share responsibilities of the launch base operations, maintenance and associated services;
2. A clear statement on how a commitment will be made to collaborate with Portuguese enterprises and research laboratories to design, install and/or operate a spaceport in the Island of Santa Maria, in the Azores, associated with the development (as applicable) and operation of a new generation of satellite launch services to space;
3. Basic recommendations concerning how best to provide low-cost, frequent and regular access to space for small satellites from Azores, including the process to access the necessary markets for New Space industries, as well as an initial and brief business strategy to establish and run an “Open Spaceport”, by suggesting a potential definition of the operation of such concept compatible with the specifications of selected area(s);
4. A basic technical description of the proposed launching solution, defining minimum service performance parameters and highlighting any competitive advantages or any hazards resulting from the technology used, as well as stating the current and expected level of maturity and launch record at the target date to start the spaceport operations;
5. Basic considerations about the capacity to use and develop systems engineering approaches, perform the necessary analyses, define and apply processes/methods resulting in a reliable written assessment of safety, environmentally safe conditions, geological stability conditions and electrical and water requirements;
6. A nominated single point of contact.

The initial “Expressions of Interest”, regarding the 1st phase of the process, shall be submitted before the **31st of October 2018** (5 pm, Lisbon time), through the website of the Portuguese Science and Technology Foundation (FCT; [www.fct.pt](http://www.fct.pt)).



# ANNEX 1:

Launch site location specifics  
- Short description



The islands of Azores and, in particular, the location of Malbusca in the island of Santa Maria, has been identified as a promising launching site through the feasibility studies performed in collaboration with UT-Austin's Center for Space Research (2017), as well as the preliminary studies conducted under the ESA's Future Launchers Preparatory Program (FLPP; under progress), among other studies performed recently by major international players. These technical studies have shown that an Azorean spaceport offers a wide range of Azimuth and good weather conditions enabling regular and frequent launches. It would benefit from and leverage the current Azorean space infrastructures.

Deeper detailed analyses are now necessary to guarantee adequate safety, low environmental impact, geological stability conditions and sustainable electrical and water usage.

## **ORBITS AND MASS**

The foreseen launch base geographical position has to be compliant with the market demand of small satellites and satellite constellation projects regarding efficient reaching to polar and sun-synchronous orbits (i.e., about 400-1000km altitude / 90-98° or larger inclinations). An indication of expected payload mass should be indicated, preferably in a range up to 500Kg.

## **LAUNCH ANGLE/AZIMUTH**

The launch base position must ensure that in any scenario of operations, a launcher cannot overfly populated areas until the consequences of a failure would become negligible.

## **SAFETY – DOWN RANGE**

The launch base shall cope with safety requirements, including "EC –Expected Casualties", and thus must be implemented close to major bodies of water. Depending on the design of the launcher, safety of the launches must be foreseen in order to have buffer areas, which

may be used as drop zones for the launcher. As a consequence, a launch base is usually built close to major bodies of water to ensure that no components are shed over populated areas. In the absence of detailed local regulations, US Federal Aviation Administration (FAA) regulations should be considered as binding standards.

## **SAFETY - ROCKET RANGE**

The launch base shall be well clear of anything that could be damaged by a failed launch. Typically a launch range spaceport site is large enough that, should a vehicle explode, it will not endanger human lives or adjacent launch pads (if more than one). The range shall be large enough also to accommodate all the buildings with safety distance between them to avoid “domino effect” in case of problems, and during launches human presence is prohibited. The safety range radius to be considered around the launch base must be limited to safeguard the impact on human populations. The launch base must consider other safety variables, including noise, pollution, and radio-electric environment. As an example, rocket exhaust should be carefully assessed to minimise any damage of material on the ground due to acoustic energy (i.e., shock waves, vibration). In the absence of detailed local regulations, US Federal Aviation Administration (FAA) regulations should be considered as binding standards.

## **ENVIRONMENTAL IMPACTS**

A launch base or spaceport must highly regard the importance of environmental protection, including the impact on both wildlife and human populations. Specific local, regional, and national regulations are of paramount importance to be considered on environment and safety (including population, workers, flight safety, transport of dangerous goods).

A diversified set of parameters should be considered for a baseline environmental study, including: habitat destruction (land use), noise (population, fauna), dust from earthwork (flora, agriculture), traffic from launch base logistics (noise, air pollution, infrastructures), (if any) launch emissions (noise, vibration), ground water consumption, waste water discharge and waste water treatment, (if any) chemical uses and pollution risks, infrastructure impacts (electrical grid, water supply, road works and new roads), prospection of sensitive fauna, flora and habitats during a full biological cycle (standard period, 1 year), considerations of

launch base site location versus environmental protected areas in land and sea, considerations on ground operations and limitations of major potential accidents regarding safety of employees, spaceflight participants and third parties, procedures considerations for recurrent public presentations of safety reports.

## **WEATHER CONDITIONS AND NATURAL RISKS**

Meteorological considerations (such as storms, strong and high winds, temperature) and other natural hazards phenomena (e.g., high risk seismic areas) are of prime importance in the choice of the launch base location since it may restrict launch operations and therefore affect the business plan for commercial launch services. The launch rate of a launch base or spaceport will be directly associated to the meteorological conditions that can strongly affect planned launches. Launches are expected to be operated in clear weather conditions and good visibility for safety purposes. In the absence of detailed local regulations, US Federal Aviation Administration (FAA) regulations should be considered as binding standards.

## **ECONOMIC IMPACT OF A SPACEPORT AND ENGAGEMENT OF THE LOCAL COMMUNITY**

The development and construction of a spaceport represents a significant investment and therefore the break-even can take several years or even decades to reach. Therefore, a spaceport must have a long-term strategy to manage a prospective, but still uncertain launch services market and for this is mandatory to engage the local community and economy to succeed.

A diversified and rich set of variables must be assessed concisely, including:

- Direct effects - Activity and employment by the bidder and its key suppliers. Key suppliers are those who directly supply parts to the launch service;
- Indirect effects - Activity and employment by industries that supply intermediate goods and services to the bidder and its key suppliers. Space tourism and launch infrastructure to be accounted within;
- Induced effects - Activity and employment that is the result of spending by those employed directly or indirectly owing to the bidder activities;

- Catalyst effects - Other benefits not counted above where the bidder activities have acted as a catalyst to benefits being realised. Specifically: i) Aspirational effects; ii) R&D spill-overs; iii) technology-business spill-overs, including easier access to satellites for Portuguese industry.

## **BUSINESS SUITABLE ENVIRONMENT**

The spaceport should be planned together with a set of infrastructures allowing the establishment of a cost-effective solutions for both spaceport construction and operations. The proposed infrastructure will comprise: intermodal connections (airport/harbour/accessible roads that ensure population safety), telecommunications and power services (modern and reliable local/regional grid, reliable water facilities and network, state-of-the art internet connections), and minimum local services (hotels, schools, hospitals, fire safety, air and maritime traffic management).

## **POTENTIAL INNOVATIVE ALTERNATIVES AND SOLUTIONS**

The potential use of air-based launching solutions may be considered, given that the island of Santa Maria has great airport facilities and this would also reduce the impact of a launch pad on the ground. It also extends the possible launch trajectories.







AZORES

