"Portugal Space Strategy 2020-2030": Current Implementation Status and a Guide for the Future

Prepared by Portugal Space (the Portuguese Space Agency) in collaboration with the Office of the Minister for Science, Technology and Higher Education

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Executive Summary

Since the creation of the National Space Agency, Portugal Space, the increased ambition of the country has been transformed into an evolved implementation strategy which, anchored through the successful ESA Ministerial Meeting, Space19+ (November 27-28, 2019), has now resulted into an articulated plan involving other funding frameworks, including EU funds, EU structural funds (ANI, FCT, international partnerships), H2020, FCT (grants and projects), and Portuguese investments in the European Southern Observatory (ESO).

The current document, which is split into four parts provides an overview of the current status of implementation of the national space strategy, the main great challenges set as well as a guide for the future.

Disclaimer: The selection of proposals under the "Investing in Industrial Innovation – InCubed Call for Portuguese companies – focused on developing end-to-end spaceborne capabilities to provide commercial products and services related to the Atlantic Chapter of the Blue Worlds" shall be performed impartially through the Investing in the ESA Industrial Innovation (InCubed) programme. Any mention of Portuguese companies in relation to the Atlantic Constellation is in relation to previous or existing national activities.

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Part I: Ongoing actions and future main "Great Challenges"

After 20 years of significant investments in technology development and capacity building in space, Portugal has increased its programmatic and policy ambitions in space systems with great success in recent years. Examples of this process include:

- the definition and promotion of a national space strategy ***Portugal Space 2030***, in 2018;
- the creation of the national Portuguese Space Agency, **Portugal Space**, in 2019;
- the approval of the first legal regime of space activities, ***Portuguese Space Law***, in 2019;
- the definition of an implementation strategy ***+Space in Portugal and Europe with ESA***, for the Portuguese participation in the 2019 ESA´s Ministerial Meeting (November 2019);
- the articulation of the latter with EU funds as well as European Structural funds[1] and national funds and projects, as managed by FCT and through national and international partnerships in terms of the re-orientation of the **Program Go Portugal** (Global Science and Technology Partnerships Portugal, including the MIT-Portugal Program and the UT Austin – Portugal Program), since 2018;
- the definition and promotion since 2016 of an international research and innovation agenda on "Atlantic Interactions", which resulted in the creation of the **Atlantic International Research Center – AIR Center**, in 2017, as an international network research and innovation organisation to explore and exploit space for the socio-economic development of the Atlantic as a multi-disciplinary and multi-national endeavour, including **ESAlab@Azores** at the island of Terceira in the Azores, focused on earth observation related systems and maritime surveillance;
- the definition and promotion of the **Azores International Satellite Launch Program – Azores ISLP**, since 2018, oriented towards the installation and operation of a small and open spaceport in the island of Santa Maria in the Azores, which is expected to be operational before the end of 2023;
- the promotion of additional **space-related infrastructures in the island of Santa Maria**, Azores, including (1) a teleport with a 15 meters antenna (prepared since 2016 and operational since 2020), complementing the existing 3 meters antenna (active since 2009); (2) testing facilities for engines to be associated with micro-launchers (to be operational in 2020); and additional landing facilities and payload preparation for future space aircrafts (to be operational in 2022).

1 As managed and articulated by Agência para o Investimento e Comércio Externo de Portugal-AICEP, Agência Nacional de Inovação - ANI S.A. e COMPETE 2020.

Figure 1 quantifies the increase in the national and European public funds associated with the actions mentioned above, showing that the public investment level more than doubled in the last four years, from about an overall level of 25 million Euro in 2016 to an estimated level above 52 million euros in 2021. In association of with this increase, the sources of funding were considerably diversified, mainly by attracting European centralised (i.e., H2020) and decentralised funds (i.e., structural funds, FEDER, ESF) in addition of ESA related procurement.

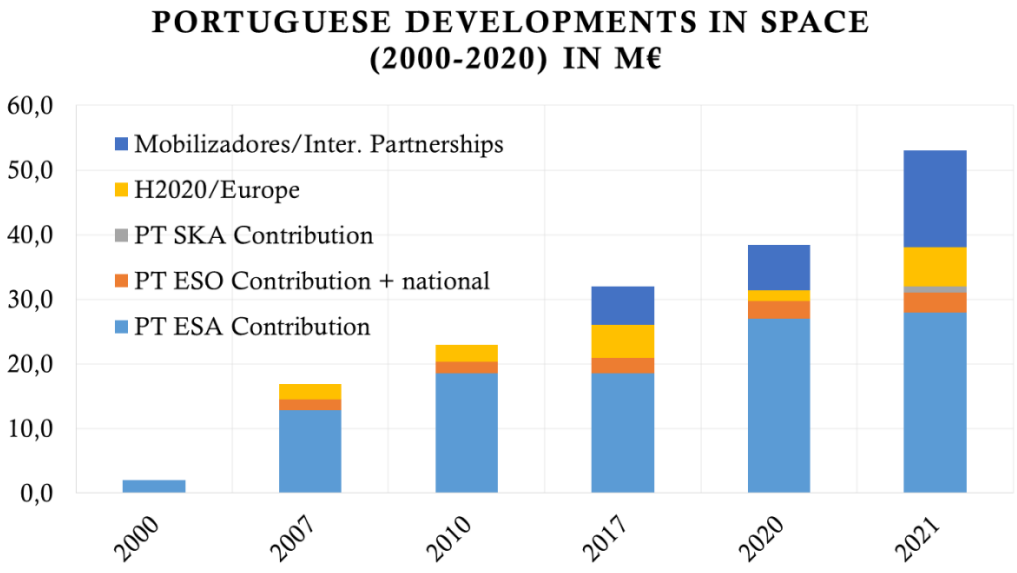

Figure 1. Summary of the evolution of national and European public funds invested in space systems in Portugal

In terms of funding, the overall target is to **multiplying the space sector by at least 10 times, with a distribution of 30/30/30 between national/European/commercial investment (60/30 public/private)**, which requires setting great challenges by Portugal Space in close articulation with the Portuguese government. This target includes the following main challenges:

- Increase the annual outcome of space related activities in Portugal to about 500 million Euro by 2030;
- Create and promote about one thousand skilled jobs in Portugal in the period 2020-2030;
- Attract major players to operate in Portugal and promote new entrepreneurial projects to help promote new high added-value activities;
- Strengthen space research in close cooperation among academia, scientists, the public administration and, above all, the business sector, together with the

development of new skills and the advanced training of qualified human resources.

This set of targets and challenges requires and represent a major collective effort to guarantee the following processes of diversifying and articulating the attraction of funding sources:

1. Global investment level: An overall level of national and European, public and private, investment in space related activities of 2500 million Euro for 2020-2030;
2. Portuguese Recovery Plan, 2021-27: An overall level of investment of 200 million Euro for 2021-2026 in association with a major industrialization agenda oriented towards the four great challenges listed in this document;
3. ESA: An overall level of national investment in ESA of 250 million Euro for 2020-2030 (including about 120 million Euro in 2020-2025), with the related return in procurement activities to main stakeholders operating in Portugal in close articulation with other national and, above all, European funding sources, in a way to guarantee a "multiplication factor" of 10 regarding the impact of ESA in the capacity to raise other sources of funding for space related activities in Portugal;
4. Beyond ESA: the challenge of better using the national investment in ESA to help raise other sources of funding for space related activities in Portugal requires a correct articulation of the national participation in the various ESA programs with the following sources of funding:

    a. Horizon Europe (HE), following the experience with H2020 and the past European framework programs for research and innovation, under the coordination of EC-DGRTD, including:

        i. Advanced training and scientific employment, through doctoral research contracts, to be established under Marie Curie Fellowships and ERC Grants;
        ii. Collaborative R&D projects, involving European networks;
        iii. Research Missions, including above all those in non-space sectors that require space driven data;
        iv. Partnerships, mainly in aerospace;
        v. International cooperation in aerospace.

    b. European Space program (ESP), for 2021-2027, under the coordination of a new EC-DG Space and Defence Industries, to be created by the EC, including:

i. Collaborative innovation projects, involving European networks;
ii. Navigation and Earth Observation main programs;
iii. Transportation, through the development of micro launchers;
iv. Access to space, through a future generation of spaceports, including the potential funding of Azores ISLP;

c. Digital Europe Program (DEP), for 2021-2027, under the coordination of EC-DG Connect, including:

i. Collaborative innovation projects, involving European networks;
ii. Navigation and Earth Observation main programs;
iii. Integration of space data and AI for the digitalization of non-space sectors;

d. European Defence funds, under the coordination of a new EC-DG Space and Defence Industries, to be created by the EC, in close articulation with the Portuguese Ministry of Defence, including:

i. Collaborative defence related projects, involving European networks;
ii. Navigation and Earth Observation activities for security and defence;
iii. Integration of space data and AI for the digitalisation of defence and security sectors;

e. European Structural and Investment Funds (ESIF) and, above all, the design and implementation of the program PT2030 (2021-2027), following the experience of the implementation of PT2020 (2014-2020), which includes national and regional, to be coordinated by the Portuguese Ministers of Planning and Territorial Cohesion, respectively, and involving the national agencies ANI (innovation) and AICEP; (foreign trade), including:

i. Advanced training, through doctoral fellowships;
ii. Skilled employment;
iii. R&D and innovation projects, including “mobilising projects”;
iv. Interface and Innovation Institutions, including Associate Labs, Collaborative Labs and technology centres, through basic and programmatic funding;

f. **Emerging forms of fundraising and investment in Europe** (including the Joint Undertakings, JUs), under development by the European Commission;

g. **FCT: national competitive programs for research and advanced training**, including:

   i. Advanced training, through doctoral fellowships;
   ii. Scientific employment, through doctoral research contracts;
   iii. Research and academic careers, through invited chairs;
   iv. R&D projects;
   v. Research Institutions, Associate Labs and Collaborative Labs, through basic and programmatic funding;
   vi. International cooperation in S&T;

h. **Business expenditure by private firms**, including foreign firms operating in Portugal and Portuguese firms;

i. Other sources of funding, including venture and investment funds.

The following table, Table 1, provides a summary of main targets for the coming decade, which should be considered as a guide for the positioning of Portugal Space, including for the definition of the way Portugal will contribute in the various ESA and EU programs.

PT Space Strategy 2020-2030 (November 2019)		Portuguese Public Investment						European Competitive Funds (centralised mgt, by EC)					ESIF - EU structural funds	Potential JUs	Markets		GLOBAL (million Euros)
		FCT - Portuguese S&T Foundation	Mobilizadores	European Space Agency	SKA	EST	ESO	EU Space Programme (in addition to possible new elements)	EC H2020-Horizon Europe	Economic Recovery	Digital Europe Programme, DEP	European Defence funds	ESIF: PT2020-PT2030	Emerging forms funding in Europe (Joint Undertakings)	Commercial	PT and EU public markets and procurement	
Science and Basic Activities (incl. Prodex)	9%	100		100	30	20	30				10			25			315
Space Exploration	1%	20		5											5	5	35
Space Safety	13%	20		23				30	25		5	20	50	15	60	30	278
Earth Observation	35%	55	30	55				100	40	200	20	35	100	35	110	140	920
Telecom	24%	30		37				60	40		10	20	60	30	90	100	477
Navigation	9%	20		10				40	15		10	10	20	5	80	20	230
Transportation	7%		30	10				20	20				30	5	50	30	195
Technology	2%			10				20	5					5		10	50
Global (million Euros)	**100%**	**245**	**60**	**250**	**30**	**20**	**30**	**270**	**145**	**200**	**55**	**85**	**260**	**120**	**395**	**335**	**2500**
		635						**755**					**260**	**120**	**730**		**2500**
% global		10%	2%	10%			1%	11%	6%	8%	2%	3%	10%	5%	16%	13%	**98%**
		25%						30%					10%	5%	29%		**100%**

Table 1: Prospective analysis of the evolution of investment in space systems in Portugal

Portugal is in a unique position, having achieved a number of milestones as described above in addition to holding now, or in the near future, a number of politically important positions, namely:

- the co-presidency of ESA with France, 2019-2022;
- the upcoming EU Presidency in the first half of 2021;
- the EUREKA Presidency, 2021-22.

With this unique alignment, the dedication to completing such great challenges will bear fruits with significant international impact, contributing not only to strengthening Portugal but also Europe on a global scale.

From a policy and market point of view, the great challenges to be tackled are:

1. promotion of use and uptake of the data, information, and services and development of the space ecosystems and downstream sectors, including the development of new space services oriented to non-space sectors;
2. fostering the growth of "New Space" activities and approaches, as well as fostering the growth of demand for space-based data, which requires the update of the free and open Copernicus data policy towards a system of higher resolution data generation

These issues will frame the Portuguese EU Presidency, in addition to bringing forward conclusions that will result from the November 2020 Space Council.

Portugal has the advantage of being rapid in decision making and being geopolitically well placed strategically. Exploiting its voice in international fora and organisation is a

must. The size of the delegation, compared with larger countries represented by agencies many times the size of the Portuguese network of delegates active in space-related fora and organisations, requires that Portuguese delegates and representatives be very well networked and in continuous contact with the government to ensure sound decision making.

In the context of the national space strategy *Portugal Space 2030* – which sees Portugal developing space capabilities to work towards becoming a globally recognised authority in Space-Climate-Ocean interactions with a focus on the Atlantic and its socio-economic exploitation –, the development of key focus areas which rely on the articulation of efforts and funding across all available sources is a must. In this context Portugal Space has been mandated to implement such articulation on behalf of the government for each of the funding sources – ESA, national (including EU structural funds implemented through national calls), ESO, EU.

From a programmatic point of view, the overarching vision is that before the end of 2025 an open multi-purpose system is established making use of dedicated low-orbit satellite constellation(s) with different types of sensors to provide Earth observation and telecommunication capabilities, in combination to navigation as well as already existing space and in-situ data sources, stimulating scientific research and business growth, thus contributing to the socio-economic development of "Blue Worlds", including the Atlantic Ocean and its sub-areas as well as the in-land Portuguese territory. And to do so in international collaboration.

The FOUR GREAT PROGRAMMATIC CHALLENGES to be tackled are:

1. GREAT CHALLENGE 1: establish, maintain, and guarantee the operation of an "Atlantic constellation[2]", in international cooperation and under the coordination of the Atlantic International Research Center - AIR Center, before 2025.

In order to establish, maintain and guarantee the operation of the "Atlantic Constellation", in international cooperation before 2025, in the form of a single versatile satellite platform to be used for a range of different applications, several elements need to be developed ranging from the flight to the user segments.

The Atlantic Constellation, while being a Portuguese ambition, must be pursued in an international framework, working closely with leading industries that have declared interested as well as with countries that have likewise declared a strategic interest – notably the United Kingdom, Norway and Spain. International companies that have expressed their interest include Clyde Space, Open Cosmos, OHB, ISISpace. To foster and ensure the international dimension, the implementation of the overall constellation should and will be pursued in the frame of the European Space Agency, through the Earth Observation Incubed+ Programme. Working with the AIR Center, the reach of the activities will be expanded to Brazil, Mexico, South Africa, and other countries around the Atlantic (north and south).

[2] The selection of proposals under the "Investing in Industrial Innovation – InCubed Call for Portuguese companies – focused on developing end-to-end spaceborne capabilities to provide commercial products and services related to the Atlantic Chapter of the Blue Worlds" shall be performed impartially through the Investing in the ESA Industrial Innovation (InCubed) programme. Any mention of Portuguese companies in relation to the Atlantic Constellation is in relation to previous or existing national activities.

Main currents projects, implemented through national funding frameworks, that could contribute towards this goal are listed here below.

- INFANTE: pre-operational satellite and first system integration exercise, led by TEKEVER (Funded through PT2020-COMPETE/POR, 2018-2022);
- Magal: satellite platform and system, led by EFACEC (Funded through MIT-Portugal Program, by FCT and PT2020-COMPETE/POR, 2020-23);
- AEROS: nanosatellite platform precursor of future constellation led by EDISOFT (funded through MIT-Portugal Program by FCT and PT2020-COMPETE/POR, 2020-23);
- ASTRIIS: a downstream platform which integrates data from satellite as well as from other sources, led by TEKEVER (funded through PT2020-COMPETE/POR, 2020-23);

Together with new industrial partnerships and setups the projects can be evolved to contribute specific systems and subsystem to the constellation as a whole working under the umbrella of a contractual and programmatic framework provided by Incubed+ as depicted in the figure below. Through the Incubed+ Programme, an industrial consortium will be established to which the projects above will contribute with in-kind elements.

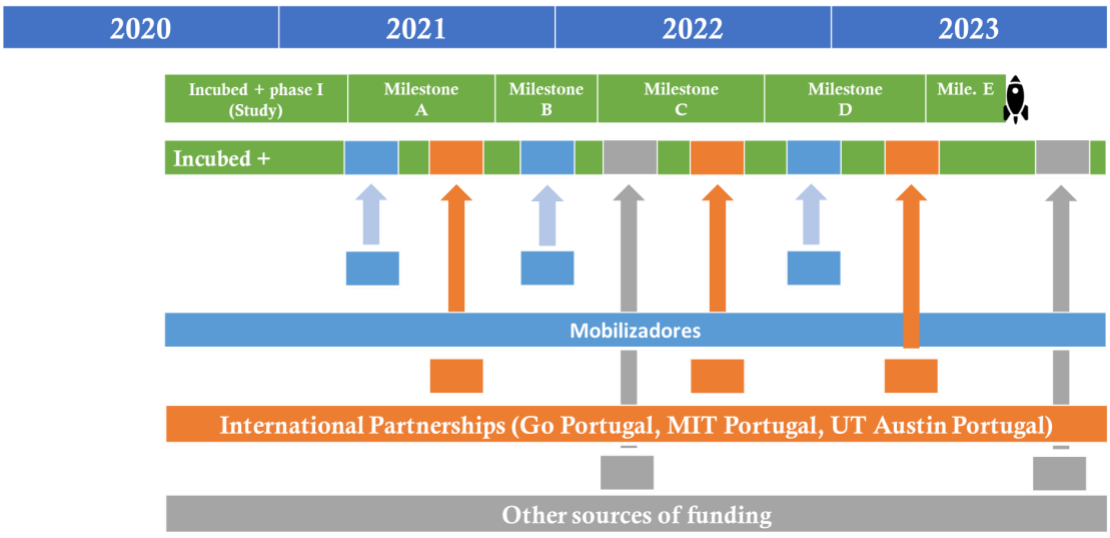

Figure 2. Programmatic Setup for the Atlantic Constellation

Besides, a number of additional projects developing specific technologies and competences could support the constellation development and exploitation; and this includes, for example:

- PROBA 3 Intersatellite Link: led by Tekever (funded through ESA, 2019-2021);
- Blue Economy: Innovation Clusters, Atlantic Natural Resources Management and Maritime Spatial Planning: led by GMV (funded through ESA, 2020-2021);

The launch segment will require to be addressed in a dedicated manner and presents opportunities for the space access activities also pursued.

2. GREAT CHALLENGE 2: Build, promote and operate a downstream digital platform, "Digital Planet", capable of integrating multiple sources of data, including space, and extract information by making use of advanced digital technologies, such as AI, to be put at the service of entities (public and private) across the country.

In the coming months, Portugal Space will be addressing all governmental public sector entities to understand their needs and requirements. The Digital Planet aims to address the latter and will bring together data from different sources to be analysed by advanced data processing tools. The Digital Planet demands an interdisciplinary approach, bringing together competence of various fields to respond to user and customer needs.

The Atlantic constellation will be contributing data to the Digital Planet. International companies have likewise declared, and interest in contributing to this great challenge.

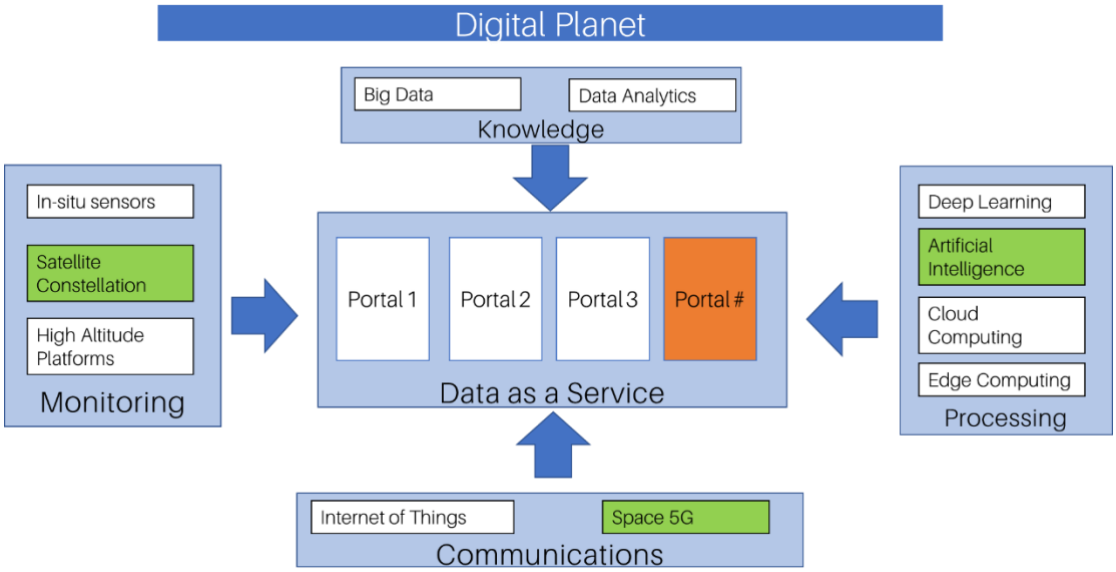

Figure 3. Digital Planet Overview

3. GREAT CHALLENGE 3: Develop a **5G ecosystem** for the development of the Atlantic and innermost regions of Portugal.

The next-generation mobile network, the so-called 5G, aims to achieve three main goals: very high speed, very low latency, and massive connectivity. 5G is more than just

the next generation of terrestrial mobile services, it will drive a convergence of fixed and mobile services, define new standards and create a network of networks, enabling "anyone and anything to be connected at anytime and anywhere"[3]. It is also expected to allow new and disrupt applications. It **promises to be a key foundation of the digital transformation of society and industry**.

Current mass-market mobile networks are mainly deployed using terrestrial infrastructures (such as cell towers). 5G will also rely on terrestrial networks for different use cases. However, the promise to deliver "anytime and anywhere", which implies resilience, requires different implementation strategies. Space can and must also play an important role in 5G.

Satellite systems provide resilience, security, coverage, mobility and cost-effective solutions for remote areas and non-terrestrial areas, i.e. oceans (where terrestrial networks are not economically viable or not viable at all). In the scope of 5G, satellite communication services would be seamlessly integrated into the 5G network and the choice of communications technology.

The aim is to work towards building a 5G ecosystem to be built starting with pilot projects around the following regions of interest such as the Vale do Côa as well as to cover the 200 miles Portuguese Atlantic platform. The ambition is to also establish a 5G operator (new) with HQ in Portugal (considering possible international collaboration if and where appropriate).

4. GREAT CHALLENGE 4: the establishment of a **space innovation ecosystem**, specifically in the Azores, Santa Maria, that may include:
   - the development of a spaceport infrastructure through the ***Azores International Satellite Launch Program – Azores ISLP***;
   - establishing of a landing site and processing facilities for the European **Space Rider**, in close collaboration with ESA, the Italian Space Agency, and leading Italian industry, Avio. Space Rider is an ESA project that will allow Europe to have operational transportation for in-space operations and return from space, whereby empowering European industry to open new markets.

     The Space Rider system, built to be the first European reusable space transportation system, will offer an operational re-entry and landing capacity based on a multi-purpose unmanned free-flyer platform. Italy is leading the flight and ground segments with the support of some other European countries and Portugal is seeking to support the success of this critical project through

[3] https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/573892/EPRS_BRI(2016)573892_EN.pdf

substantial involvement in the ground segment and downstream activities. A central element of the Portuguese contribution to this unique project is the creation of a landing site on Island of Santa Maria, in the Azores, equipped with a landing control centre in addition to payload processing and analysis through well-equipped facilities and expertise;

- the further evolution of a **teleport** to attract both institutional and commercial customers, exploiting the recently installed 15 meters antenna.

Working closely with ESA, the projects above will be pursued.

These four great challenges should be considered in close articulation with the development of new markets for the "New Space"; as well as the major sources of funding for Portugal and Europe in coming years, namely:

- the Portuguese (and European) Recovery Plans, 2021-27;
- The Portuguese Multiannual Funding Framework, through EU decentralized funds (i..e, structural funds, FEDER, ESF), 2021-27;
- The European Multiannual Funding Framework, through EU centralized funds (Horizon Europe, EU Space Program; EU digital Program), 2021-27;
- ESA relationships and procurement, including "ESA Space19+" for 2020-23, which implementation plan defines several priority objectives for an industrial

policy which aim at the development of increased capabilities towards subsystem and system leadership.

From a value-chain point of view to enable the great challenges above as well as develop competence for the strategic positioning of Portuguese entities in new markets, Portugal Space will contribute:

- the creation of one (or more) system integrators for small satellites and high-altitude platforms in Portugal able to relying on Portuguese suppliers and of being a reliable partner for international actors – industrial and otherwise;
- foster system competences in the integration of AI and Earth Observation systems, with high and very high-resolution images;
- the development of system/subsystem competence in key space technology areas, including:
    - versatile in-orbit platform/microlauncher kickstage;
    - guidance, navigation, and control subsystem;
    - structural, mechanical, thermal subsystem;
    - propulsion subsystem;
- the development of operations capabilities combined with a well-developed ground segment;
- position Portugal strategically in the field of space sustainability and space safety to achieve leadership and ensure commercial success in the near/mid-term in specific products and in-space competence (specifically in the domain of Active Debris Removal and In-Orbit Servicing and a low-cost Space Weather radiation sensor for integration on any satellite);
- establishing the necessary mechanism to stimulate the collaboration between academia, scientific and R&D entities with industrial players.

Part II: Summary of Ongoing Projects

The new implementation strategy as presented in *+Space in Portugal and Europe with ESA* and following developments at a national and international level have resulted in a number of projects and initiatives, some of which are summarised here below following the aims prepared for Space19+ and presented in the document mentioned above. A list of on-going projects can be found in the table in Annex 2.

- Towards advancing the **scientific competence and increasing the scientific and technical capabilities** required to develop instrumentation for new discoveries and the advancement of knowledge:

  (a) in the frame of the Scientific Programme at ESA, main missions and elements include PLATO, ARIEL, Comet Interceptor and EUCLID. **Portugal has an active role in these mission by participating in the science teams** and by being responsible for different activities, from GSE and payload to data centre elements;

  (b) in the frame of ESO Portugal has been participating in the **development of advanced instrumentation**, particularly in various instruments for both the Extremely Large Telescope (ELT), and the Very Large Telescope (Interferometer) VLT (I);

  (c) in addition, the **European Solar Telescope (EST), is currently moving forward, and Portugal has recently joined the Board of Directors of the initiative**, reaffirming its support to the enterprise, that is looking to secure funding. Portuguese involvement in the EST has the goal to lead to industrial participation and privileged access to scientific data that will allow advancing in subjects such as solar physics and space weather.

- To lead the effort of **democratisation of access to space data and service**, responding to the great challenge of establishing a constellation for the Atlantic as well as to that of establishing subsystem and system competence:

  (a) through the Incubed+ ESA Programme and via a dedicated call making the first steps towards **the dedicated development of a private-sector driven Earth Observation constellation of small satellites** and associated downstream applications focused on the socio-economic development of the Atlantic (a "Blue World");

  (b) contribution to the **Arctic Weather Satellite programme**;

(c) contribution to the **Space Weather Lagrange 5 mission with a contribution towards the instrument suite**, as well as the development of a super low-cost sensor for integration on all satellites for radiation monitoring;

(d) through multiple projects (please refer to Annex 1 for a complete list) in the frame of ESA as well as through the Copernicus User Uptake activities and also European Financed projects, **Portugal is investing into increasing the awareness of potential users as well as the development of downstream applications** and services connecting space to non-space sectors and engaging into new business models;

(e) the establishment and exploitation of the 15-m antenna on the island of Santa Maria, with the aim of Portuguese companies to provide services to the ESA Proba 3 mission as well as other missions and programmes including Copernicus in the frame of a service contract to Portugal Space;

(f) in the frame of the ESA financed Copernicus Space Component, Portuguese companies have been assigned contracts for 10 M€ to contribute to the six High Priority Missions (that represent at least 12 new European satellites), working along with the six existing Sentinel missions (Sentinel 1 to Sentinel 6);

(g) To **trigger the use of space by larger telecommunications operators as well as develop a new ecosystem** in the country to address European and Portuguese needs. Allowing in this way, Portugal to lead in new topics such as encrypted quantum, optical communication, 5G, and fostering the in-orbit market. Some projects are underway including pre-programmatic activities on establishing a 5G line of activities in the frame of ESA and articulated beyond; including both 5G pilot projects covering the 200 miles Portuguese Atlantic platform and innermost regions as well as a 5G constellation to provide services to augment terrestrial-based services, extending coverage, adding resilience and enable new applications;

(h) in the frame of European Structural Funds, **Portuguese entities are undertaking a series of major projects that can increase national competences in systems and subsystems**, and that will also contribute to the fundamental building blocks of an Atlantic Constellation.

- To **foster the development of demand and markets**: a number of activities and initiatives are underway:

(a) to **stimulate the use of the microgravity environment** by non-space companies and **sectors and foster the exploitation of Space Rider** thereby contributing to the success of the vehicle and to develop payload processing infrastructure and competence to accompany the landing site infrastructure investments, a microgravity workshop will take place early November;

(b) to foster the uptake of Copernicus data through **FPCUP activities a series of initiatives are underway including workshops and training events for Portuguese public entities and private companies**, the preparation of a Copernicus user database and further activities are being proposed linked to educational modules and competitions in schools and universities, international coordinated activities focused on coastal areas and market place instruments or activities aiming at increasing Copernicus user uptake in Africa and the promotion of Portuguese companies in new markets;

(c) to **stimulate links between space and non-space across Europe** (industry, agro-businesses, climate, city councils, among others; involving politics, academia, research entities):

- the extension of the ESA Business Incubation Centre from 3 to 15 centres spread across the country (mainland and islands);
- the support of multiple start-ups and business ideas. A comprehensive list can be found in Annex 1;

(d) a mapping of all public sector entities and their needs is underway to be used at the basis of developments done for "Digital Planet";

- To **lead the effort of democratisation of access to space**, a number of projects and studies have been followed and initiated by Portugal Space:

(a) a study and recommendation conducted with the European Space Agency to assess the safety radius as a function of location and microlauncher size when launching from Santa Maria to support the drafting of final tender documents in the AISLP process;

(b) the first steps, financed through the ESA Commercial Space Transportation Services Programme, towards **industry-led public-private-partnership developments for the provision of launch services by contributing with major subsystems to microlauncher(s) to be launched from the Azores**;

(c) supporting the success of **Space Rider** by ensuring its landing in Santa Maria as well as targeting the vehicle's exploitation by bringing in non-space sectors such as the pharma industry **to foster research and development of products in a microgravity environment, thus leading space into a new era of commercialisation**;

- To **reinforce space as a fundamental infrastructure** that serves economic growth (in-space and on Earth) and that needs to be evolved and protected, by deciding to **co-lead in active debris removal/in-orbit servicing – enabling a world 1st, European leadership and competitive advantage in one of the largest future markets in space,** the following projects are underway:

  (a) the development of the Guidance, Navigation and Control subsystem of ADRIOS, the first active debris removal/in-orbit servicing service mission worldwide – to be furthered as a business;

  (b) de-risk activities to establish new activities and establish a start-up to address collision risk estimation and avoidance as a service;

In the frame of national calls, a number of projects have been approved which, under the overall coordination by Portugal Space will be evolved to work towards the great challenges presented in Part I. A way forward is provided in the following Part III.

Refer to Annex 2 for a complete list.

Part III: Guide for the Future beyond the Great Programmatic Challenges

In the process of tackling the great challenges set above, essential elements that today are missing in Portugal will need to be addressed and established, some of which will require additional attention and effort.

Policy Dimension

European perspectives

In the frame of the **France-Portugal Co-Presidency of ESA Council, 2020-22** the main issues to be addressed are as follows:

- In the continually evolving relationship between governments and industry, which ranges from government leadership to governments merely acting as catalysts, frequent exchanges are fundamental in securing a vibrant and diverse space ecosystem fully interconnected to its users. Portugal should therefore **engage industry and business leaders in a series of dialogues** together with ambassadors, national delegates, space agencies and experts on topics of importance for the future of Europe and the European Space Agency;
- The **preparation of the next Ministerial Meeting in 2022** and working towards it **facilitate major initiatives currently developed at ESA across all its four main programmatic pillars** – Science and Exploration, Safety and Security, Applications, and Enabling and Support;
- **Strengthen the contribution of space in emerging opportunities such as modern 5G communications**, which should consider fundraising beyond public sector funding.

In addition, throughout the co-presidency, **space diplomacy** will help foster Government-Industry dialogues on ***More Space for a better Europe with ESA – boosting the European entrepreneurial space landscape***.

In the frame of the **Portuguese EU Presidency in 2021** the main issues to be addressed have been very briefly mentioned in part I of this document and will be addressed more widely in the final version of this document, which will also include a brief overview of the main lines of action for attracting funds in the frame of the EU Space Programme and Horizon Europe.

To better value the Portuguese contribution to **ESO**, the main issues to be addressed are as follows:

- Increase the participation of Portuguese industry to the development of the ELT;
- Maximise the in-kind contribution in the form of technical experts;

- Foster, through dedicated national activities, a more robust and larger collaborative work between the scientific community and industry in the design and development of instruments.

Addressing the Great Programmatic and Value Chain Challenges

To address value chain challenges presented above a systematic approach across the national projects approved should be implemented. This approach is presented here below in as much as has been developed thus far.

Developing system competence

Other projects contribute to the development of **system competence for versatile in-orbit a platform – kickstage/satellite**. These projects will require a slight re-orientation and are:

- **VIRIATO:** reusable suborbital vehicle to foster research in orbital technologies, led by OMNIDEA (funded through PT2020-COMPETE/POR, 2020-23);
- **CARAVELA:** building blocks for micro-launchers, led by TEKEVER (funded through PT2020-COMPETE/POR, 2019-22);

In addition to:

- **GSTP Building Blocks**

These projects were originally intended as working towards a suborbital first and orbital rocket later. The envisaged re-orientation is towards a versatile in-orbit platform - a hybrid between a satellite and a kickstage (see Photon of RocketLabs as a reference).

This should be on the one hand a satellite but on the other a dispenser for smaller CubeSats that can be mounted on the platform. This will also allow some of the partners that are developing CubeSats to share a ride if a launching opportunity arises.

The development and integration of a complete kickstage in Portugal is underway, and the work conducted with AICEP as well as the activities pursued in the frame of ESA's CSTS Programme must be continued to ensure its success.

Developing technical competence for new markets and a stronger end-to-end ecosystem

The democratisation of space implies the emergence of new markets and opportunities.

- LCRM - low-cost radiation sensor update, led by EFACEC (co-funded by ESA, 2019-2023);

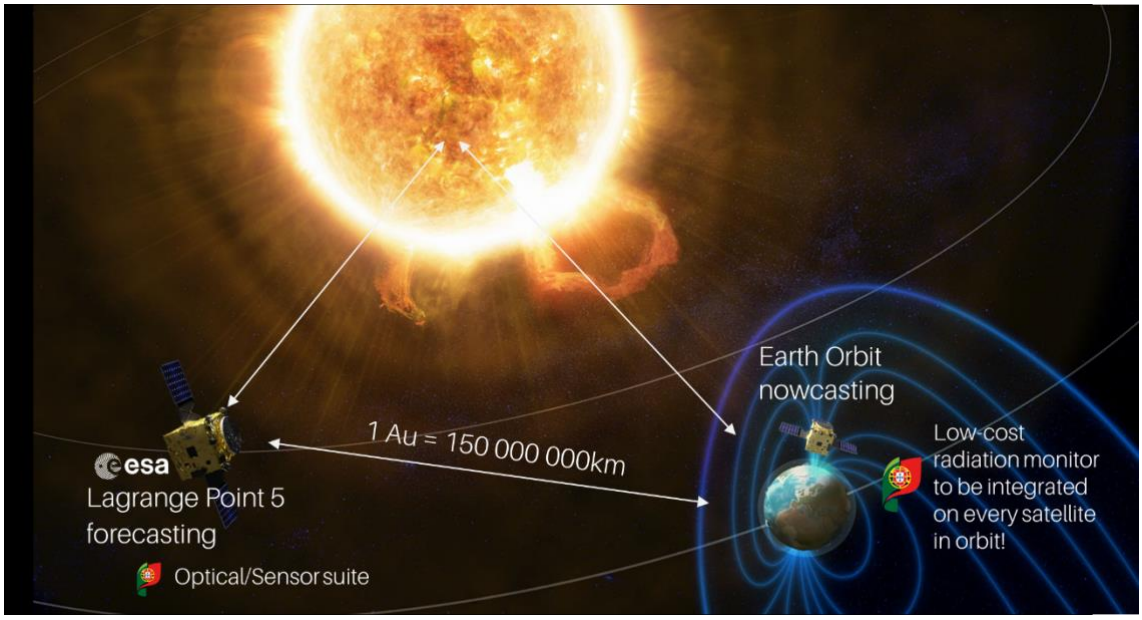

Figure 4. Low-Cost Radiation Monitor for Space Weather

- uPGRADE: development of a CubeSat, led by SpinWorks (Funded through UT Austin-Portugal Program, by FCT and PT2020-COMPETE/POR, 2020-23);
- NewSat: COTS (commercial-off-the-shelf) and development of other innovative elements for CubeSats, led by Stratosphere (former Critical Materials) (Funded through MIT-Portugal Program by FCT PT2020 and PT2020-COMPETE/POR, 2020-23);
- ADRIOS: Portuguese contribution to the first active debris removal and in-orbit service worldwide, led by Deimos and Critical Software (co-funded by ESA, 2020-2025);

To further develop the space ecosystem in Portugal, the following should be pursued:

- The building up of competence in the design, development and operation of instruments: This capability will allow Portugal to discover and investigate into phenomena today not yet explored and develop new products beyond its ability to design, integrate and operate full systems. It will be essential to explore missions of opportunities that will allow Portuguese instruments to fly on larger missions of partnering countries and entities. In this context it will be fundamental to stimulate the growth of the centres of scientific excellence across the country, bringing these together with other centres worldwide and closer to industry to develop cutting edge sensor technologies and digital/IT competences. This would help Portugal becoming a centre of excellence in

topics of unquestioned future significance; as well as stimulate new partnerships between universities across Portugal and industrial and international entities.

- Strengthening of the scientific "mining" of exploration activities;

Longer-term goals should include:

- stimulating commercial activities built on synergies between space and non-space sectors such as sea/deep-sea sectors or Earth mining sectors.

Promote new markets in non-space sectors

The development of a platform responding to user requirements and raising of customers in agriculture, fisheries, city councils (urban registrants), territory (territory and forest registrants), natural parks, mobility, infrastructures (dams, bridges, ports, highways, airports), insurance companies and more will be fundamental. Initial activities through the EO4MAAC initiatives should be pursued across the nation and by the public and private sectors.

Fostering system competences in the integration of AI and Earth Observation systems (but not only), will be a key in this development and the steps made through the AI Moonshot Challenge should be followed by further initiatives and additional applied research activities.

Other possible lines of action

In addition to expanding international partnerships, further actions proposed include:

- Beyond the articulation of funds, the creation of a dedicated Venture Capital fund for space;
- Act as a promoter of awareness and responsible action both towards Portuguese speaking countries and new space actors working together with ESA, the EU as well as other entities such as the Secure World Foundation and in the frame of the UN.

Annexes

Annexe 1: A strategy for attracting and enlarging investments in space: diversification and articulation of funding sources and the role of Portugal Space

Annexe 2: Overview of all projects ongoing

Annexe 1: A strategy for attracting and enlarging investments in space: diversification and articulation of funding sources and the role of Portugal Space

The figure below presents the evolution of funding in space since 2000 across a number of different funding sources.

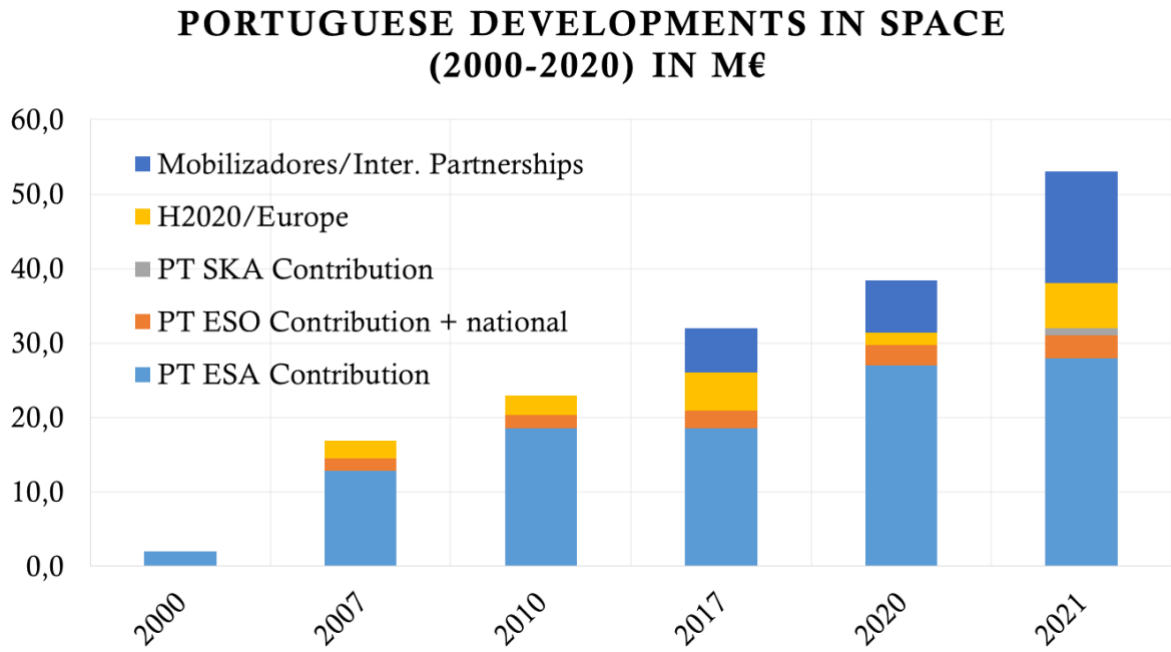

Figure 5. Summary of the evolution of national and European public funds invested in space systems in Portugal

Table 2 provides a brief overview of main targets for the coming decade, which should be considered as a guide for the positioning of PT Space, including for the definition of the way Portugal will contribute in the various ESA programs for 2020-2024. To achieve these targets requires carefully selected priorities as described in the main body of the present document.

Table 2: Summary of main funding targets for space activities in Portugal over the next decade, 2020-2030 (in M€)

PT Space Strategy 2020-2030 (November 2019)		Portuguese Public Investment						European Competitive Funds (centralised mgt, by EC)					ESIF - EU structural funds	Potential JUs	Markets		GLOBAL (million Euros)
		FCT - Portuguese S&T Foundation	Mobilizadores	European Space Agency	SKA	EST	ESO	EU Space Programme (in addition to possible new elements)	EC H2020-Horizon Europe	Economic Recovery	Digital Europe Programme, DEP	European Defence funds	ESIF: PT2020-PT2030	Emerging forms funding in Europe (Joint Undertakings)	Commercial	PT and EU public markets and procurement	
Science and Basic Activities (incl. Prodex)	9%	100		100	30	20	30				10			25			305
Space Exploration	1%	20		5											5	5	35
Space Safety	13%	20		23				30	25		5	20	50	15	60	30	278
Earth Observation	35%	55	30	55				100	40	200	20	35	100	35	110	140	920
Telecom	24%	30		37				60	40		10	20	60	30	90	100	487
Navigation	9%	20		10				40	15		10	10	20	5	80	20	230
Transportation	7%		30	10				20	20				30	5	50	30	195
Technology	2%			10				20	5					5		10	50
Global (million Euros)	100%	245	60	250	30	20	30	270	145	200	55	85	260	120	395	335	2500
		635						755					260	120	730		2500
% global		10%	2%	10%	1%	1%	1%	11%	6%	8%	2%	3%	10%	5%	16%	13%	100%
		25%						30%					10%	5%	29%		100%

Annexe 2: Overview of ongoing projects

Project Name	Year Approval	Funding Source	Domain	Participants	Description/Note(s)
MaGRaTh	2015	H2020	Science	IST	Matter and strong-field gravity: New frontiers in Einstein's theory
C3HARME	2015	H2020	Technology	FHP	Next Generation Ceramic Composites for Combustion Harsh Environments and Space
NextLand	2020	H2020	EO	Deimos Engenharia, UÉvora	Next Generation Land Management services for Agriculture and Forestry, 15 operational commercial midstream agriculture and forestry EO based services leveraging GEOSS and Copernicus data
TREASURE	2016	H2020	Navigation	Deimos Engenharia	Specialist training in the strategic and emerging area of European GNSS.
BETTER	2017	H2020	EO	Deimos Engenharia	EO Big Data intermediate service layer devoted to harnessing the potential of the Copernicus and Sentinel European EO data directly from the needs of the users.

NextGEOSS	2016	H2020	EO	Deimos Engenharia	The NextGEOSS project will implement a federated data hub for access and exploitation of Earth Observation data, including user-friendly tools for data mining, discovery, access and exploitation.
MARINE-EO	2016	H2020	EO	DGPM; FRC	Bridging Innovative Downstream Earth Observation and Copernicus enabled Services for Integrated maritime environment, surveillance and security
EWC	2017	H2020	Science	Fciências	Enabling Weak lensing Cosmology
LEA	2017	H2020	Technology	FHP; INEGI	The first Large European Antenna with a diameter larger than 5 meters
SpaceCarbon	2017	H2020	Technology	INEGI; FISIPE	European Carbon Fibres and Pre-Impregnated Materials for Space Applications
FOCUS	2017	H2020	EO	UC	Forest Operational monitoring using Copernicus and UAV advanced data
MySustainableForest	2017	H2020	EO	RAIZ	Operational sustainable forestry with satellite-based remote sensing
BETTER	2017	H2020	EO	Deimos Engenharia	Big-data Earth observation Technology and Tools Enhancing Research and development

COSMOS2020plus	2018	H2020	Science	ANI	Continuation of the Cooperation of Space NCPs as a Means to Optimise Services under Horizon 2020
spaceEU	2018	H2020	Science	Ciência Viva	Fostering a young, creative and inclusive European Space Community
ForestFlux	2018	H2020	EO	ISA	Forest Carbon Flux and Storage Mapping Service
Our Space Our Future	2018	H2020	Science	NUCLIO	Our Space our Future: making careers in the space industry an inspiring reality for all
RETALT	2018	H2020	Exploration	ACC	Retro Propulsion Assisted Landing Technologies
HiSea	2018	H2020	EO	Hidromod	High Resolution Copernicus-Based Information Services at Sea for Ports and Aquaculture
ORIONAS	2018	H2020	Telecomms	Lusospace	Lasercom-on-chip for next generation, high-speed satellite advanced interconnectivity
2-3SST2018-20	2019	H2020	Space Safety	MDN	Second funding line in Work Programme 2018-2020 for the further development of a European SST Service provision function

ENTRUSTED	2019	H2020	Telecomms	PTSpace; EMSA	European Networking for satellite Telecommunication Roadmap for the governmental Users requiring Secure, advanced, InnovativE and standardiseD services
WaterSENSE	2019	H2020	EO	Hidromod	Making SENSE of the Water value chain with Copernicus Earth Observation, models and in-situ data
CERTO	2019	H2020	EO	Fciências	Copernicus Evolution – Research for Transitional-water Observation
PROMISE	2019	H2020	Technology	IT	PROgrammable Mixed Signal Electronics
Go2Space-HUBs	2019	H2020	Technology	IPN	Generating new sOlutions 2 and from Space through effective local start-up HUBs
NEO-MAPP	2019	H2020	Space Safety	FCiências; GMV	Near Earth Object Modelling and Payloads for Protection
FORCOAST	2019	H2020	EO	IST	Earth Observation Services for Fishery, Bivalves Mariculture and Oysterground Restoration along European Coasts
POINT.IoT	2019	H2020	Navigation	Load Interactive, Lda.	Stimulating the fusion of IoT and GNSS technologies

PERIOD	2020	H2020	Technology	GMV	PERIOD – PERASPERA In-Orbit Demonstration
ECFAS	2020	H2020	EO	Fundação Eurocean	A Proof-of-Concept for the implementation of a European Copernicus Coastal Flood Awareness System
INTAROS	2016	H2020	EO	Fundação Eurocean	Integrated Arctic observation system
4S	2020	H2020	EO	IH	Satellite Seafloor Survey Suite
SCORPION	2020	H2020	Navigation	INESC TEC; IPN; SPI	Cost effective robots for smart precision spraying
RADIUS	2020	H2020	Navigation	Evoleo Technologies; IP	Railway Digitalisation Using Drones
E-SHAPE	2019	H2020	EO	IPMA	EuroGEO Showcases: Applications Powered by Europe
OPTICON	2016	H2020	Science	Uporto	Optical Infrared Coordination Network for Astronomy
SME I – CYBELE	2019	H2020	EO	CybELE	Satellite investigation services for the environmental legal/insurance market
PLMSAT	2019	H2020	EO	Space Mosaic	Power line vegetation monitoring and maintenance optimization with satellite imagery

7SHIELD	2020	H2020	Space Safety	INOV INESC	Safety and Security Standards of Space Systems, ground Segments and Satellite data assets, via prevention, detection, response and mitigation of physical and cyber threats
PLANE	2019	PT2020	Technology	Evoleo Technologies; IT	Design and development of an avionics platform for mini satellites
STRx	2019	PT2020	Telecomms	SINUTA; INESC-TEC; IT	Electronic orientation reception and transmission system for the next generation of satellite constellations
CARAVELA	2019	PT2020	Transportation	Tekever Space; Omnidea; Aeroclube Torres Vedras; CeiiA; FCT-UNL; FEUP; FHP; ISQ; IST-IN+; USIMECA	Development and demonstration of building blocks for microlaunchers.
Findster CareSight	2019	PT2020	Navigation	Findster Technologies	GPS location system for elderly people or with cognitive issues.
INFANTE	2017	PT2020	Technology	Tekever ADS; ActiveSpace Tecnologies; CeiiA; UP-FEUP; ISQ; Omnidea; Tekever Space;	Micro-satellite for technology demonstration and precursor of a constellation.

				Tekever CS; AAG; FCT-UN; GMV; FHP; INL; IPN; IPT; IST; ISR; IT; Spin.works; UBI	
DESARMAR	2018	PT2020	EO	Tekever CS; UP; MDN	Drone advanced with passive SAR for maritime applications
AgroRadar – Pilot Demo	2018	PT2020	EO	Agroinsider	Utilization of EO Satellite data (SAR and optical) for agricultural purposes
ESCUDO	2018	PT2020	Technology	FHP; INEGI	Development of next generation of MLI
GWSTRINGS	2018	PT2020	Science	IA	Probing cosmic stings and other topological defects with gravitational waves
BreakStarS	2018	PT2020	Science	IA	Breaking through outstanding problems in stellar evolution with ultra-precise space-based photometry
G.EANES	2018	PT2020	Science	IA	A Generation of Earth-Analogs Exploration Spectrographs
CosmoESPRESSO	2018	PT2020	Science	IA	Cosmology and Fundamental Physics with ESPRESSO
EPIC	2018	PT2020	Science	IA	Exploring exoPlanets wIth CHEOPS

PULSATION	2018	H2020	Science	IA	Detecting and characterizing exoplanets around evolved stars with NASA's TESS mission
FunFiCO	2017	H2020	Science	Uaveiro; IST	Fundamental fields and compact objects: theory and astrophysical phenomenology
LATTES	2018	PT2020	Science	LIP	An innovative highly energetic gamma ray detector at the Southern Hemisphere
PifotoComSat	2020	PT2020	Telecomms	IT	Portfolio in Intellectual Property concerning photonics advanced applied to satellite communication systems.
MAGAL	2020	PT2020	EO	Efacec; Omnidea; CIIMAR; IT; IST; FGF; UBI; CeiiA; CoLab Atlantic; AIR Centre	Projet to set the cornerstone of a future ocean and climate change monitoring constellation, based on radar altimeter data combined with gravity and ocean temperature and salinity measurements
uPGRADE	2020	PT2020	Technology	Spin.works; INL; Uminho; ISQ	Development and qualification of a 6U nano-satellite to monitor Earth gravitational field

VIRIATO	2020	PT2020	Transportation	Omnidea; CeiiA; Tekever Space; INEGI; Spin.works; ISQ; Edisoft; FEUP; AED; CoLab Atlantic; Uevora; Optimal; EEA	Reusable innovative vehicle for research and fostering orbital technology
ASTRIIS	2020	PT2020	EO	CoLab Atlantic; Tekever Space; CeiiA; ISR; MARETEC; CERENA, LSTS; Ualgarve; Uminho; ISQ; Tekever AS; WavEC; Oceanscan; Abyssal; Hidromod; Spin.works	Atlantic Sustainability Through Remote and In-situ Integrated Solutions
Newsat	2020	PT2020	EO	Stratosphere; eSurface; Clarke, Modet&C; INEGI; INESC-TEC	Development of a compact integrated sensor and satellite for earth observation

AEROS	2020	PT2020	Technology	Edisoft; Spin.works; DSTelecom; Uminho; FCUP; Ualgarve; IST; CeiiA; CoLab Atlantic; IMAR; AIR Centre	Constellation-Development of a nanosatellite platform as a precursor of a future constellation to leverage the Space/Ocean scientific and economic synergies
FP-CUP WP2018	2018	Copernicus	EO	PT Space; DGT	Initiative to promote user uptake of Copernicus
FP-CUP WP2019	2019	Copernicus	EO	PT Space; DGT; AIR Centre	Initiative to promote user uptake of Copernicus
FP-CUP WP2020	2020	Copernicus	EO	PT Space; DGT; AIR Centre	Initiative to promote user uptake of Copernicus
rePLANt	2020	PT2020	EO	Navigator; Altri; Amorim; DS Smith; Sonae; EDP; REN; ForestWISE; INESC TEC; Whereness; UTMAD; UC; ISA; INIAV; Florecha; Trigger; Fravizel;	Implementation of Collaborative Strategies for the Integrated Management of Forests and Fires.

				Tesselo; FEUP; Labelec	
InPairs	2016	H2020	Science	IST	In Silico Pair Plasmas: from ultra-intense lasers to relativistic astrophysics in the laboratory
AHEAD2020	2020	H2020	Science	IST; LIP	Pulling together to pull ahead in the study of extremely energetic cosmic events
VECTRACK	2019	H2020	EO	INSA	Earth observation service for preventive control of insect disease vectors
VITIGEOSS	2020	H2020	EO	Symington; PWC	Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors
PCIF/GFC/0078/2018	2019	FCT	EO	NOVA.ID.FCT; Fciências.ID; ISA/Ulisboa	Influence of forest VOCs (volatile organic compounds) in extreme fire behaviour
PCIF/MPG/0044/2018	2019	FCT	EO	Fciências.ID; Águas de Portugal, Serviços Ambientais (AdP-Samb)	FRISCO: managing Fire-induced RISks of water quality Contamination

PTDC/FIS-AST/30389/2017	2018	FCT	Science	CAUP/UP	Breaking through outstanding problems in stellar evolution with ultra-precise space-based photometry
PTDC/FIS-AST/28953/2017	2018	FCT	Science	CAUP/UP	Exploring exoPlanets wIth CHEOPS
PTDC/BIA-BMA/28317/2017	2018	FCT	EO	Fciências.ID; IPMA	Evolution of harmful algae blooms under ocean acidification and the cascading effects on coastal food-web dynamics
PTDC/BIA-BMA/30278/2017	2018	FCT	EO	CCMar; IMAR	Ecological bases for sustainable management of meagre
PTDC/EME-ESP/32362/2017	2018	FCT	Transportation	Universidade de Aveiro (UA)	Advanced manufacturing of aluminium alloys products for environmentally-friendly transportation
PTDC/EEI-COM/28550/2017	2018	FCT	Technology	ISEP/IPP; Uminho	Secure Runtime Verification for Reliable Real-Time Embedded Software
PTDC/EME-EME/32103/2017	2018	FCT	Technology	IDMEC	Additive manufacturing for large part size
PTDC/EQU-EQU/29533/2017	2018	FCT	Technology	Ucoimbra	High-performance silica aerogel nanocomposites for insulation under

					extreme-temperature Space environments
PTDC/CTA-MET/29233/2017	2018	FCT	EO	Fciências.ID; INESC TEC; UTAD	Weather Extremes in the Euro Atlantic Region: Assessment and Impacts
PTDC/FIS-OUT/29048/2017	2018	FCT	Science	Fciências.ID	Spacetime ripples in the dark gravitational Universe
PTDC/FIS-OUT/28407/2017	2018	FCT	Science	IST-ID	Fundamental Fields and Compact Objects: theory and astrophysical phenomenology
Earth Observation Services for Maritime Surveillance	2018	EU Public Market	EO	Edisoft	Earth Observation Services for Maritime Surveillance for EMSA
EO for FRONTEX	-	EU Public Market	EO	Edisoft	EO service for FRONTEX
SKA	-	Commercial	Science	Critical Software	Science Data Processor, Telescope Manager, Signal And Data Transport
ESO ELT	-	EU Public Market	Science	Critical Software	Verification and Validation activities, Local Control System for M1
Ariane 6 TMSW	-	EU Public Market	Transportation	Critical Software	Launcher telemetry software
ExoMars2020 Contingency	2019	ESA	Exploration	Deimos Engenharia	Project for TAS – I in the context of ExoMars2020 Contingency.

ANITA 2	2018	ESA	Exploration	FHP; Evoleo Technologies	Technology demonstrator for a permanent atmosphere monitoring system for the ISS and exploration. Prime OHB. Launch planned for May 2021.
FLPP 3/NEO Core Component	2018	ESA	Transportation	Edisoft	A study of a launch service making use of a micro-launcher
FLPP 3/NEO Core Component	2018	ESA	Transportation	Deimos Engenharia	A study of a launch service making use of a micro-launcher
VECEP WO4	2018	ESA	Transportation	Deimos Engenharia	The new VECEP programme is proposed to prepare a consolidated version of Vega by the second half of the decade
WO 7 VEGA-E	2018	ESA	Transportation	Edisoft	
SPACE RIDER PHASE B2/C ACTIVITIES	2018	ESA	Transportation	Edisoft; Deimos Engenharia; GMV; Spin.works	Space Rider step 2.1
CSG 2017-2021	2019	ESA	Transportation	Samsic PT, ESQS	Maintaining of the Guiana Space Center (CSG) launch range in oprerational condition for period 2017-2019
BX31 – SARIA	2020	ESA	Exploration	Uporto	Student experiment to fly on stratospheric ballon carring a

					Synthetic-Aperture Radar using an Inflatable Antenna
BX31 – STRATOSPOLCA	2020	ESA	Exploration	Ucoimbra	Student experiment to fly on stratospheric balloon to monitor gamma ray background radiation (STRATOSpheric POLarimetry with Cadmium Telluride Array)
Artemis – SYT	2020	ESA	Exploration	Uporto	Investigation on the effects of hypergravity on mechanisms of intestinal cell permeability. SYT-Large Diameter Centrifuge
ISTSAT – FYS-2	2019	ESA	Exploration	IST	First nanosatellite project developed by students, professors and radioamateurs at the Instituto Superior Técnico
EOLAW	2020	ESA	EO	GMV	EO based analysis of the extent to which illegal waste dumping has increased during and after lock-down period in Europe.
CybELE Lead Product	2020	ESA	EO	CybELE	Development of new EO applications to identify and monitor Lead pollution in soil and water.
Domain Expert Federated Identity	2020	ESA	EO	Deimos Engenharia	Agile approach to ensure maximum flexibility to adapt to feedback.

and Authorisation Management					
E-commerce Platform for Micro-geoservices	2020	ESA	EO	Deimos Engenharia	Platform for small service providers to marker online microservices.
EO Clinic	2020	ESA	EO	2adapt; Uninova	Rapid-response mechanism for small-scale and exploratory use of EO products driven by specific Development Aid project requests.
Blue Economy: Innovation Clusters, Atlantic Natural Resources Management and Maritime Spatial Planning	2020	ESA	EO	GMV	-
Renewable Offshore Wind Energy	2020	ESA	EO	Deimos Engenharia	-
Black Sea Environmental Protection	2020	ESA	EO	Deimos Engenharia	-
BRAT	2020	ESA	EO	Deimos Engenharia	Broadview Radar altimetry toolbox – BRAT – Sentinel-3 surface topography toolbox

SCOOP	2020	ESA	EO	Uporto	SAR altimetry Coastal and Open Ocean Performance
SHAPE	2020	ESA	EO	Uporto	Sentinels Hydrologic Altimetry Prototype
Sentinel5p+ Innovation	2020	ESA	EO	Fciências	SENTINEL-5P+ Innovation – Expro+ - Theme7, Ocean Colour
HYRDOCOASTAL	2020	ESA	EO	Uporto	Sentinel-3 and CryoSat SAR/SARIn Radar Altimetry for Coastal Zone and Inland Water
GSTP – Building Blocks	2019	ESA	Technology	Edisoft; ISQ; Active Space Tecnologies; Deimos Engenharia; Omnidea; CeiiA; Tekever Space	Preparation of enabling space technologies and building blocks – Portugal
GSTP – Spectrometer for Marine Litter	2019	ESA	EO	Imar; INESC-TEC; AIR Centre	
Prodex – ARIEL telescope baffle	2019	ESA	Science	Active Space Technologies; IA	ARIEL Telescope Baffle
GSTP – PROBA-3	2019	ESA	Technology	Deimos Engenharia; Tekever; Omnidea; Others	Proba-3 space segment and flight operations ground segment. Phases C-D-E1

GSTP – ISVV	2019	ESA	Technology	Critical Software	ISVV for evolution's in Software development methods processes
GSTP + BA – EXPRO PLUS	2019	ESA	Technology	Edisoft; Uninova	Multi-mission data exploitation platform
SSA P3-SST-IX	2019	ESA	Space Safety	Deimos Engenharia	SST core software requirements and framework finalisation
GSTP – EXPRO	2019	ESA	Technology	Omnidea; CeiiA	Enabling space technologies: PMLS systems and subsystem studies
GSTP + SSA – HERA Phase B1	2018	ESA	Space Safety	GMV; Efacec; Spin.works; Tekever Space	
Prodex – PLATO (OGSE, PDC, MLI)	2018	ESA	Science	Uporto; FHP	PLATO OGSE and PDC Phase BCD; PLATO CAMERA MLI PHASE B AND QUALIFICATION ACTIVITIES
Scientific Activities – PLATO Design, Development and support to Launch and Post Launch Operations	2018	ESA	Science	FHP; Active Space Technologies; Critical Software	PLATO – DESIGN, DEVELOPMENT AND SUPPORT TO LAUNCH AND POST LAUNCH OPERATIONS (PHASE B2/C/D/E1) OF THE PLATO SPACECRAFT
LADEA	2019	ESA	EO	FHP; INEGI	
CRYOSAT-2	2016	ESA	EO	Uporto	IPF maintenance and evolution support. EOP4 and EOP5.

EO EXPLOITATION SUPPORT CONTRACT	2019	ESA	EO	Deimos Engenharia	
LARGE DEPLOYABLE REFLECTOR FOR EARTH OBSERVATION	2019	ESA	EO	FHP; INEGI	
SPORE	2019	ESA	EO	Uaveiro	Space for Shore.
CCI+ PHASE 1	2019	ESA	EO	Fciências	New RD on CCI ECVS – Ocean Colour CCI
MAGNETIC DAMPING AFTER EOL	2018	ESA	Technology	Lusospace	Design for removal feasibility of magnetic damping after EOL
EO EXPLOITATION PLATFORMS	2019	ESA	EO	Deimos Engenharia	EO exploration platforms common architecture 2018-2022
STANDARD EO PLATFORM STUDY	2019	ESA	EO	Lusospace	
HYDROLOGY THEMATIC EXPLOITATION	2015	ESA	EO	Deimos Engenharia	
OGSE Sentinel 5	2016	ESA	EO	Lusospace	Subcontractor for the OGSE activity within the S5 Airbus Contractual Baseline
SMALL SAT S^3	2018	ESA	EO	Deimos Engenharia	

MONINT	2020	ESA	Navigation	GMV; IT	Cost efficient and flexible GNSS signal quality monitor solution for different markets.
SDX Expansion (SDXPAND) GNSS software defined simulator	2018	ESA	Navigation	GMV	The purpose of this project is to expand the SKYDEL SDX product (a software-defined GNSS Signal Simulator) to cover arising customer needs for GNSS testing solutions.
Kinetikos 4DBS	2020	ESA	Technology	Kinetikos	E-health digital solution for clinical and home-based monitoring of patients with Parkinson's Disease (PD) submitted to Deep Brain Stimulation (DBS) surgery.
EDGE – advanced farming intelligence	2020	ESA	Technology	Nexlys	AI-based decision support system, which allows farmers to make operational decisions based on meteorological, EO, RPAS, robotic and IoT inputs.
CERES and POREWIT EO products	2020	ESA	EO	CybELE	Capacity for the Enforcement of Regulation related to the Soil and Platform for the Observation of Regulation related to Wildlife and Illegal Timber

9E.079 – SAGRESsmart – Smart Support for Geological Prospection at Seabed based in Space Assets	2020	ESA	EO	ISQ	Decision-making support solution that merges EO data with AI predictive big data analytics to improve Deep-sea Mining, prospection and exploration
IAP.PR.FA.010 – AgroRadar	2019	ESA	EO	Agroinsider	Increase efficiency in agriculture by optimising the use of resources, using EO data.
SWAIR – Space Weather and GNSS monitoring services for Air Navigation	2018	ESA	Space Safety	Present Technologies; Bluecover; CITEUC	Services providing information to the aviation sector on the quality of GNSS signals, including space weather.
Fibersail	To be started	ESA	Telecomms	STME	Service and system to predict, control and reduce loads of wind turbines.
IAP.PR.EV.008 – UNDERSEE – Maritime Satellites for Environmental monitoring in rivers, lakes and ocean	To be started	ESA	EO	Matereo Space; INESC	End-to-end service for monitoring water quality based on the integration of in-situ/satellite data and numerical model using AI.
Aquafarm 2.0 – Management of water and food resources	To be started	ESA	EO	Hidromod	Integrate EO data, meteorological models, and in-situ data to provide facts and forecasts about crops and soil health.

and Improvement of the supply chain					
YOUSHIP – Delivery on Demand	To be started	ESA	Navigation	ShipNow Technologies	Delivery platform that aims to find the best transporter, the best route to follow and the most appropriate pick-up and delivery location.
"Port XXI – Space Enabled Sustainable Port Services"	To be started	ESA	EO	INESC TEC; AIR Centre; Moniport Ambibados; Portos dos Açores; David Mendes; IST-IN+	EO data from space assets will be used for water and air quality monitoring.
RESUCIDEMO	To be started	ESA	EO	GMV; Nester	Space based services to reduce the vulnerability of Critical Infrastructure as well as to reduce the stress on the surrounding environment.
Mesh And Associated Carrying Net For Deployable Reflector	2016	ESA	Telecomms	FHP	Develop an engineering model (EM) of a reflective ultralight mesh with the associated carrying net compatible with a large deployable reflector antenna.
Augmented Reality For Telecom Spacecraft Ait	2020	ESA	Telecomms	Lusospace	Augmented Reality tools (SW&HW) that could help procedures designers,

					operators and QA to deal with the AIT/V activities.
Weldless Aluminium Liner For Xe Storage Copvs Employed In Satellite Gas Storage Systems Ccn.	2010	ESA	Telecomms	Omnidea	Functional composite overwrapped pressure vessel, using cold forming process to manufacture the metal liner.
Terminal For Small Satellite Application (Tesla-C)	2014	ESA	Telecomms	Lusospace	Establish a robust direct detection lasercom system for space-to-ground communications from low earth orbit.
Escan Gateway For Mega-Constellations	2019	ESA	Telecomms	C-JET	Ground station concept combining gateway and TT&C services able to track simultaneously several Ka-Band satellites of satellite megaconstellations.
Multifunctional System	2019	ESA	Telecomms	Omnidea	Activity to develop an iodine hall effect electric thruster for small communications satellites.
Wireless Signals Transmission For Solar Array Drive Mechanism	2019	ESA	Telecomms	Active Space Technologies	The objective of this activity is to provide a module to replace signal transmission contact slip rings with a single contactless digital transmission one.

Antenna Deployment Arm With Integrated Elastic Hinges	2017	ESA	Telecomms	INEGI	Develop concept, model, and processes for building ultra-light and lower-cost composite arms for deployable antennas.
CubeSat-Based W-Band Channel Measurements	2017	ESA	Telecomms	LC Technologies	Development of the W-band beacon together with the propagation receive terminal.
MEO Ka Band Propagation Campaign	2018	ESA	Telecomms	IT	Study on MEO KA Band Propagation channels.
Messina – PACIS-1 Tekever AR5		ESA	Telecomms	Tekever	Integration of Tekever AR5 in PACIS-1 System for System live demonstrator. Includes integration of secure satcom link in AR5 platform.
RTEMS EDISOFT LEON3 UPDATE – EXPRO	2019	ESA	Technology	Edisoft	
JUICE PROJECT – IMPLEMENTATION PHASE (B2, C/D, E1).	2015	ESA	Science	Efacec; LIP; Active Space Technology; FHP; Lusospace; Divers PT Systri	
GFC8 WP : M/BESIM/D001 – BEPICOLOMBO	2016	ESA	Science	Critical Software	

SIMULATOR DEVELOPMENT AND MAINTENANCE					
EUCLID - DESIGN, MANUFACTURING AND QUALIFICATION OF THE AOCS SUBSYSTEM	2019	ESA	Science	Deimos Engenharia	EUCLID PH. B2, C/D, E1 – Design, manufacturing and qualification of the AOCS Subsystem
EUCLID – SW VALIDATION FACILITY (SVF)	2016	ESA	Science	GMV	SW VALIDATION FACILITY (SVF)
EUCLID – STRUCTURE AND THERMAL CONTROL SYSTEM	2015	ESA	Science	Active Space Technologies	Structure and Thermal Control System
EUCLID – STRUCTURE AND THERMAL CONTROL SYSTEM	2015	ESA	Science	FHP	Structure and Thermal Control System
EUCLID – SUN SHIELD AND SOLAR ARRAY SYSTEM	2015	ESA	Science	FHP	EUCLID sun shield and solar array system
IPN- ESA Space Solutions – Incubation fee – 2020	2020	ESA	Technology	IPN	IPN incubation fees

IPN- ESA Space Solutions – Ambassador and Broker – 2020	2020	ESA	Technology	IPN	IPN Ambassador Platform and Broker management
IPN- ESA Space Solutions – Events – 2020	2020	ESA	Technology	IPN	Events, Workshops, Training, etc.
IPN- ESA Space Solutions – Incentive Start-ups – 2020	2020	ESA	Technology	IPN	Incentive Start-ups, 25k/startup
IPN- ESA Space Solutions – Incentive Spark4Business	2020	ESA	Technology	IPN	See following rows
Spark4Business – IMS bridge	2020	ESA	EO	Matereo Space	Intelligent Bridge Monitoring System for bridge safety and maintenance optimization. Fusing bridge engineering with AI and InSAR data.
Spark4Business – VMS	2020	ESA	EO	Forging Lab	VMS uses high optical and spectral resolution data to provide valuable information and diagnose of the surroundings of utility companies' assets
Spark4Business – Drone Med	2020	ESA	Navigation	Connect Robotics	fast delivery of medicines making use of drones powered by GNSS

Spark4Business – TransNotes	2020	ESA	Navigation	Mythical Technologies	Full digitalisation of the supply chain in the cross-border transportation of
Spark4Business – GEP Smart Controller	2020	ESA	Technology	Airborne Projects	goods, paving Europe's way towards efficient and sustainable paperless transport
BA – RTEMS Edisoft for arm cortex R5 with asymmetrical multiprocessing	2019	ESA	Technology	Edisoft	
BA – Future Navigation Concepts at Small Bodies	2019	ESA	Navigation	GMV	Future Navigation Concepts at Small Bodies/T710-502GF
BA – Prototyping of Bearings-Only Guidance for Rendezvous in NRO Orbits	2019	ESA	Technology	GMV	
BA – Assessment and Preliminary Prototyping of a Drag Free CS for the L3 Gravity Wave Observatory – EXPRO PLUS	2019	ESA	Technology	Deimos Engenharia	

BA – Augmented reality for concurrent engineering activities	2019	ESA	Technology	Lusospace; Critical Software	
BA – Non-contact NDI for Polymeric composite structures – EXPRO+	2019	ESA	Technology	Optimal Structural Solutions	
BA – Feasibility Study for LED Based Solar Simulation in TVAC – EXPRO+	2019	ESA	Technology	Lusospace	
BA – Artificial Intelligence Techniques in On-Board Avionics and SW	2019	ESA	Technology	Deimos Engenharia	
PLANE – PLataforma Aviónica para NEwspace, código: POCI-01-0247-FEDER-039993		PT2020		Evoleo Technologies	