The potential of international cooperation in the Azorean space strategy

Dissertação de Mestrado

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Abstract

This investigation aims to study the essence of international cooperation in the space sector in the Autonomous Region of the Azores. The study, therefore, focuses on the resulting impacts on the economy, the creation of qualified employment, technological development, the geographic capacity of the Azores and the problems that the Region will face.

Keywords: International cooperation, space, space industry, cosmodrome, outermost regions.

Resumo

Esta investigação pretende abordar a essência da cooperação internacional do setor espacial na Região Autónoma dos Açores. O estudo centra-se, por isso, nos impactos que terão na economia, na criação de emprego qualificado, desenvolvimento tecnológico, capacidade geográfica dos Açores e nas problemáticas que a Região enfrentará.

Palavras-Chave: Cooperação internacional, espaço, indústria espacial, cosmódromo, regiões ultraperiféricas.

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List of Acronyms

AE – Space Authority

EEA – European Economic Area

EGNOS – European Geostationary Navigation Overlay Service

ENA ARM – European North Atlantic – Atmospheric Radiation Measurement

ESA – European Space Agency

ESA BIC – European Space Agency Business Incubation

EUMETSAT – European Organisation for the Exploitation of Meteorological Satellites

EUSST – European Space Surveillance and Tracking

OASA – Observatório Astronómico de Santana

OECD – Organization for Economic Co-operation and Development

RAEGE – Rede Atlântica de Estações Geodinâmicas e Espaciais

SAzS – Strategy of the Azores for Space

VLBI – Very Long Baseline Interferometry

Introduction

The focus of the research will be international cooperation. More specifically, to study the benefits coming from space technological applications in the Autonomous Region of the Azores. These are known for their admirable productivity and wealth generation return. The region's human settlement always came across strong adversities on several fronts. The isolation, dense vegetation that was thinned by pre-industrial methodologies, low literacy, and latency in institutional emergence are factors that dictated the actual state of affairs. Space technologies arise, thus, as an excellent opportunity to compensate for the Region's difficulties.

Previously, to participate in space endeavors, a budget of considerable dimension was an inevitable condition. Presently, technological development, space democratization, and increased accessibility allow the involvement of a greater number of players with reduced budgets - featuring the so-called Space 4.0 (Governo Regional dos Açores, 2021).

Hereupon, the strategy of research, innovation, and growth for Portugal lays on four main objectives:

1. The promotion of economic growth, skilled job creation, services provision, and satellite data and signals in the applicable sectors – some of which are very significant for the region such as fisheries, agriculture, emergency services, overcoming timeless challenges, territorial planning, maritime surveillance, and public health sector.

2. Promotion of satellite data generation through new technologies, space infrastructures in Portugal, and taking advantage of international scientific cooperation.

3. Aid to national development and the strengthening of diplomatic relations. Use of Portugal's geographic location and assistance to countries less developed in space capabilities.

4. Improvement of legal, financial, institutional, cultural, and educational frameworks for the advancement of Portuguese space development, whether with national initiatives or international cooperation.

In the programs' actual state, the region's space strategy is harmonious with the national strategy, and, inherently, with the European space program and all principles for ethical and responsible use of space and implied technologies.

Notwithstanding arises the need for precise adaptation of the regional strategy to the Azorean archipelago's reality to take into account competencies and peculiarities. Once approved the regional strategy for space, it will be possible to harvest its potential, together with the coordination of diverse projects, therefore optimizing efforts.

International cooperation in scientific fields provides enormous benefits to humankind. Cooperation leads to information sharing and knowledge evolution. This sharing many times results in steeper advances in research. The cooperation between Portugal and the European Union in space endeavors already has well-established foundations – as Portugal is one of the space agents of the European Space Agency. As aforementioned, the regional strategy for space is harmonious with European Union and Portugal's space policies and strategies, whereby it will be pertinent to evaluate the relationship between them. By way of example, the referred European Agency presently has active space projects in the Azores.

Space technologies are composed of the most advanced technologies available to humankind. They are technologies of excellence for their level of precision, complexity, and technical, instrumental, scientific, and material and human capacity-building requirements (Portugal Space, 2021). Thanks to the present Era of Information, with its communication technology and transportation capacity building, and space operational effort history, the knowledge involved in space operations is already very solid. A decrease in the required budget to participate in such operations results in the already mentioned democratization. Additionally, the computing equipment technical advances make possible the production of satellites of much more permissive dimensions.

With all of this under consideration, the pertinent analysis for the region is made. There are two types of space activities:

1. Command and control

2. Access to space

The Autonomous Region of the Azores has autonomy and, therefore, authority and concession to manage its space activities by legal assignment on behalf of the State.

With that established, what is the pertinence of the region's involvement in space activities?

According to EMA-Espaço Coordinator, Luís Santos (Santos, 2021), that pertinence dwells in the creation of attractive conditions for private agents. More than space agent by itself, the region would have a facilitating essence by having infrastructure and optimized legislation appealing to space agents.

According to Luís Santos, the most pertinent investigations for the region would be the analysis and focused study of the Azorean socioeconomic development potential specificity through international cooperation in space activities and the study of the real generated pollution in space launches for their demystification. According to the Coordinator, the pollution caused by some space launches, due to used processes, is significantly lower than the resulting one from a medium passenger twin jet engine aircraft take-off – very widespread in airline companies. This additional study would be useful to ease environmental concerns in the region's inhabitants, which, as is common knowledge, have a very worthy concern for ecological issues.

The next question concerns the region's real capacity to assert itself as a significant facilitator. The answer lies in the versatility of the geographic position of the region. While the regional coordinates are not ideal for launches for either polar or equatorial routes, the intermediate latitude, allows the launch, although less convenient, for both types of routes. The preferential procedure is to place launch platforms on equatorial latitudes for equatorial orbit routes launches – such as in the cases of the spaceports in Cape Canaveral in Florida and the French Guiana Space Center. And launch platforms in polar latitudes for polar orbit launches – such as Andøya Space in Norway. The latitude of the archipelago of the Azores comprised between 36º and 39º North means the region is not ideal for none of the launches, being however possible the two kinds of launches with a certain level of operational adversity. One of such will be to reach the required velocity to escape the planet's rotation centrifugal influence.

The next question within the investigation is based on the analysis of improvements possible given the existing infrastructure. According to those involved, there is considerable incoordination between existing projects, which reverts into a waste of applied efforts. It would be of supreme importance to create a synergy between projects to avoid fails in cooperation and even counterproductive initiatives like one predicted to

emerge with the installation of VLBI equipment just 1100 meters away from LEO Labs radar station in Santa Maria Island. There is a strong possibility that the beginning of operations of the new antenna will preclude the operation of the already running receptor – due to the strong signal of the new equipment and the proximity between stations (Santos, 2021).

The region's main limitations are the difficulty in settling the desired workforce and the lack of attractiveness in aspects considered important by skilled workers. To modify, or at least improve, this scenario requires an initial public investment, a significant setback. An aggravating factor is the exclusion of the space sector from the new recovery and resilience plan.

The conditions that must be secured to attract relevant private sector players to the regional aerospace market are lever elements: an attractive tax regime, access to the next operational program of the Azores through public funding, a simple legal regime, and a minimally bureaucratic administration.

One of the most substantial applications of the proposed investigation would be a relevant analysis of the possible socio-economic development in the region and the elaboration of adequate key performance indicators (KPI).

According to EMA-Açores Coordinator, a way to create socio-economic benefits for the Azoreans would be by the creation of university scholarships for related degrees in science, technology, engineering, and mathematics (STEM), and degrees related to space, by the creation of educational conditions for the binding of graduates to the region. Adding to these with value creation, incentives to a highly qualified workforce, and complementing with the settling cycle of these workers would also be fundamental (Santos, 2021).

To be reminded that the national and regional space programs were designed in consonance with the European space principles, and are formulated to scale. The intention is to optimize coordination, to respect the peaceful use of space and the European strategic interests. This stems from strong international cooperation and this spirit will have to continue into the development of programs for a specialized contribution in several areas.

It is intended to evaluate the concrete extension of socioeconomic benefits in the Azores that would arise from a planned and coordinated space strategy. Not only space

technologies can help substantially in the pursuit of prosperity, but they can also do so in a deeply Azorean way: decentralized. This already occurs in the archipelago, being a wide range of space projects – at least nineteen - spread across different islands in the archipelago.

The objective of this research is to have a realistic insight into the present situation, the regional potential, and the possibly reachable results. To study possible *modi operandi*, present eventual solutions, and pinpoint in an unequivocal way how much the Azores stand to gain with the space and educational investment. It is of supreme importance to gauge the steps to take to break the chain of the state of affairs that overwhelms the region into lagging comparatively to Europe. It is necessary to find out what can be done to engage the youth to study, how to increase local remuneration, and avoid the intellectual bleeding from the region.

The research will be based on official investigations of the established programs, space agencies' documentation, private agents, and specialists already employed by the regional government in space technology matters. A review of some successful space programs and spaceports will be carried out for comparison. It will be an inherent part of the dissertation the detection of common factors, the reading of trustworthy primary sources, and the analysis of the state-of-the-art of diverse programs.

In this research's analysis context, the problematic axes to consider are the regional strategy for space, the European space policy, Portugal space 2030, and, possibly, how some information might be hard to access.

The hypothesis intended for validation is how important is international cooperation, and in this specific case, how important is it for the success of the ultra-peripheral region of the Azores in its space projects ambitions.

1. Concepts and contextualisation of space policy and strategy in the Azores

1.1. Concept of space policy and strategy and its pertinence for the Region

Due to the feeling of falling behind expressed by specialists and politicians alike, two entities are constantly used for comparison relative to the progress of the Azorean Space Strategy: Andøya Space and New Zealand Space Agency.

These two projects are well regarded in the scientific community for their competent progression and swift mobilisation. New Zealand Space Agency was established in April 2016. Its duties are similar to those relevant to the Azorean Space Strategy – the oversight of space policy, regulation, and socio-economic development (Ministry of Business, s.d.).

As established in the Introduction, the space sector has been the target of investment by a wider number of countries and even by the private sector and sub-state entities. The ramification of the investments falls both on Space access technology development and the use of Space generated data for scientific, societal, and economic purposes (Estrutura de Missão dos Açores para o Espaço, Strategy of the Azores for Space (SAzS), 2021).

This evolution of the Space industrial sector to its 4.0 version, with the involvement of a greater variety of entities and players, will naturally result in increased direct participation and commercialisation opportunities. In this new landscape, several concepts have shifted. While in the Space 2.0 stage, spacefaring nations engaged in the race to Space needed astronomical budgets for their projects. The agencies involved needed the full backing of a superpower behind them.

Coming a more cooperative spirit in Space endeavours, projects with international efforts came to fruition, such as the International Space Station and the Hubble Telescope – agreed to be Space 3.0. With the eventual, seemingly inevitable, dissemination of knowledge and technology, the cost of producing and acquiring Space related equipment, the size reduction of said equipment, and the capacity of upcoming equipment made Space efforts increasingly more accessible.

At some point, it became possible for private companies to build their lightweight equipment and powerful computing capacity. With the activities becoming cheaper, it was more affordable to apply small-scale Space projects and profitable to sell the data

and products generated by such projects – this led to the next evolution in the chain: Space 4.0. According to D. Little's analysis, its main keywords are Commercialization, Participation, and Innovation. These words come up repeatedly when reading about Newspace.

Other recurring concepts in the study of Space 4.0 are the private sector's efforts, cooperation – many times of international essence - and the participation of society, industry, and academia. These interactions seem inescapable.

Unsurprisingly, the Portuguese Strategy for Space also revolves around the concepts of Research, Innovation, and Growth. The four bases of the strategy focus on promoting economic growth, generation of satellite data, development through international cooperation, and evolution of civilisational and institutional frameworks related to space – that will spill to other sectors.

Regarding economic growth and the creation of skilled jobs, Portugal and the Azores will have to muster efforts to promote Space-related markets in the territory. The specialists working for the national and regional government and many present at the International Conference about the Azores Strategy for Space believe the path is through the exploitation of satellite data. There is concord this will be an efficient way to overcome persistent economic difficulties in the archipelago, with the advantage of the several applications possible in the Region: from agriculture to fisheries, maritime activities and tracking, infrastructure monitoring, urban development and planning, cartography, topography, defence, security, and public health sector.

Relatively to satellite data generation, the Portuguese Strategy wants to promote it through new Space technologies and Space-related infrastructures. To this end, it will rely on "international scientific and technological cooperation" according to the Strategy of the Azores for Space. The Azores will indeed need this international assistance and expertise, for as of the time of writing this dissertation, the Region does not possess the ability to achieve all plans autonomously. One significant challenge will be attracting the new Space industry to the Region.

The investment in the country's development, diplomatic relations, and international scientific cooperation naturally rely heavily on the International Relations aspect. Not only the country needs to recognise its present limitations, but it must also display its strong points. These must appeal to the international actors the country is trying to attract.

Thankfully, Portugal has many strong points to offer. Not only are there many ongoing projects, but the Space sector is also relatively solid and possesses proud achievements. There is another surprising upside: many space scientists have to work in remote, sometimes Polar Regions, for their research and Space projects. For many voices in the Conference about the Strategy of the Azores for Space, Space scientists and engineers would not shy away from moving to Portugal as they consider it an attractive country to live in – even if at the expense of salary loss. Portugal has another convincing argument for the Space players: its geostrategic position. Not all in the Strategy is about receiving. The Portuguese Strategy claims the intention of cooperating with countries not as far down the road in Space capabilities, especially the Portuguese-speaking countries, countries with which Portugal already has several cooperation efforts in place.

The fourth Foundation of the Portuguese Strategy leans on frameworks. The country is heavily bureaucratic, which can pose great adversity to private initiatives. Thus, it is crucial to adapt the procedures to the necessary flexibility to not discourage initiatives without losing or compromising integrity and transparency. This will apply to legal, financial, institutional, cultural, and educational fronts – all closely related to the Space sector's development.

On a continental scale, the European Union's Council and Parliament created a new Space program for 2021 - 2027. The objectives established in the new regulation covet accomplishments such as up-to-date, secure, and high-quality Space-related data and services, more significant socio-economic benefits, increased growth, job creation, greater security and autonomy, and the solidification of the European Union's importance in the Space sector.

One major aspect of the different strategic scales is their coordination. The Space strategy of the Azores is synchronised with the Portuguese national strategy, which in turn is harmonious with the European Space strategy. This is very beneficial to international cooperation. The need for different sizes emerges from the need to have foundational consonance across Europe and still manage to take advantage of regional specifications. Geographical specifications cannot be ignored when applying any strategy. If the full potential is to be achieved, fine-tuning must be applied. The result will be adequate infrastructure and project symbiosis.

The referred symbiosis will manifest in the adoption of the Strategy of the Azores for Space. According to specialists working for the Azorean Government, this coordination is long overdue. The Strategy aims to form a Space-related cluster in the Azores. The specialists in the Region claim some projects with conflicting operational principles are planned too close to each other in the current ecosystem. With the clock ticking on the Strategy implementation, there is scarce room for error, and installing an antenna is no small effort.

Furthermore, according to the Strategy's authors, it "will provide a deliberate and coordinated effort by the Regional Government to capitalise on this evolving industry" (Estrutura de Missão dos Açores para o Espaço, Strategy of the Azores for Space (SAzS), 2021). With the Strategy's ability to install competitive advantages for the space and aerospace sector, the facilitating essence of the framework will attract players keen on using the newly created favourable conditions in the Region. The importance of the conditions made available to potential users is paramount. Without them, bringing development and investment becomes difficult.

With space technology applications spilling onto many different fields, its economic potential is also substantial and admirable. Considering the intent to improve the economic output of the established production sectors in the Azores, the immediate pertinent applications lean on agriculture, fisheries, and tourism. This argument is fundamental to motivating society and the people involved in the existing industries. Not only the application of space technologies and efforts will create a new economic sector, but it will also bring prosperity to many other sectors.

1.2. Space economy, strategic vision and immediate challenges

The space economy is complex, but a simplistic separation of layers can be made: upstream sector, downstream sector, and space-derived activities sector. Foundations of space programs, space industry manufacturing, and the building of space infrastructure characterise the upstream sector. Consumer markets, system operations, and technology reliant on satellite technology or data compose the downstream sector. The space-derived activities, products, and services will form the essence of the next layer in the space economy. This particular sector will differ from the downstream sector because this layer will not be directly dependent on space-generated data but on timely acquisitions.

A commendable factor in the Strategy of the Azores for Space (SAzS) is the medium and long-term vision – 10 to 20 years. A fail-safe attempt to avoid strategy or long-term goal discontinuation by change of government. Another critical side to the strategy is the intention to involve the stakeholders' input persistently. This avoids unilateral counter-productive decisions and helps to ensure the framework and ecosystem are favourable to those who chose the Azores to invest. This dynamic will increase the probability of expanding the space sector's contribution to Azorean society economically, scientifically, and socially.

Despite the admirable progress in space endeavours made in Portugal, international cooperation will be required in abundance if the country is to advance. The national capacity of its scientists and intellectuals is renowned and accredited by international peers. Still, the country will need international knowledge and momentum to boost international relevance. SAzS recognises this and identifies international cooperation as an indispensable key lever.

It does so without abdicating the welfare of people and the respect for the environment. This is a constant in Azorean culture. The deep respect for nature and the environment are solid cornerstones in the contemporary Azorean mentality. Any prediction of a step in the opposite direction is met with open contestation. This is visible in the documents related to legislation (such as articles 7 and 18 of the Decree-Law 16/2019), the space strategy, and the inquisitions made to the population. Acceptance of the space sector will only happen if the environment, quality of life, and population health

are not jeopardised. This is one of the clear reasons for the shift in the attitude of the specialists and politicians connected to the space ambitions in the region to start to involve the population in the debate (Garcia P. , 2019).

In the primary phase, the public was merely informed of the progress and decisions related to space through the media. Feeling a lack of information and fearing the consequences of space endeavours, many voices rose through far-reaching mediums such as radio broadcasts. Many of the questions and declarations showed unfamiliarity with space efforts' implications. At first, many specialists disregarded many comments made by the public, considering their lack of knowledge on the subject.

Nevertheless, time proved that the population could not be ignored and kept out of the information flow and decisions regarding space. Many questions, doubts and fears could be appeased with transparency and open communication. This significant methodological shift marked the beginning of a new phase: the involvement of the public in the discussion. Retrospectively seems somewhat inevitable since the ignition of space efforts momentum in the region needed a public funding kick-start. Furthermore, some active space projects in the Region stand on property ceded by the regional government.

Hence, a precedent was established. Information availability, environmental protection, and the population’s welfare to attain approval for space endeavours. The next step was to frame these principles to the established internationally in favour of responsible use of space and contribution to addressing global challenges.

The strategy involves a 10-year detailed operational plan evaluated by key performance indicators. This plan will allow setting clear objectives. Scrutiny will help determine if targets are being reached and what adjustments need to be made.

Its prime geographic location is a recurrent argument in favour of the Azorean archipelago’s pertinence for the space effort. A long connecting factor between the European and American continents, the Azores have historical proof regarding their positive influence on international cooperation. The remote and maritime essence of the archipelago’s coordinates, the developed communications and transportation infrastructure, temperate climate, the deep sea surrounding the islands, low radio and light pollution levels, and volcanic and geological conditions make it exquisitely adequate for the envisioned projects.

One great ambition for the region is to turn it into a transatlantic hub for the space and aerospace industry. This will require some herculean progress on some fronts, namely in creating the economic and social conditions desirable by the demanding classes of highly skilled workers involved in space matters.

Another enormous challenge is related to capacity building. Leaps must be made to improve the Region's capacity to educate in space, science, technology, engineering, and mathematics. This will very likely take years, if possible. This would imply the ability to attract specialists, experts, and professors worldwide. Major conditions and factors would have to align for such a class to settle in the region.

The more attainable challenge presently is to increase visibility. That is already occurring, either by the International Conference about the Strategy of the Azores for Space and increased tourism, the region has become more recognisable to outsiders.

1.3. Decree-Law nº16/2019

The will to bring space efforts to fruition in the Region meant that specific legal principles had to be established. Portugal is known to be a bureaucratic country with many procedural bumps. To avoid transporting these legal and bureaucratic adversities to the space field, a field where efficiency is wanted, the decree-law nº 16/2019 was enacted and published on *Diário da República* on page 454 of the 1st series, number 15, on January 22nd 2019.

The document states that space activities have assumed growing importance in contemporary societies due to the several benefits from products, services and technologies generated from extra-terrestrial space. These impact positively on the socio-economic development of countries. Thanks to space, communications became more resilient and capable, more mobile, and reached immense levels of use. Earth observation satellites gather massive amounts of data used by a wide range of sectors; some are specified in the document. They are mostly the same stated by all who advocate for the space industry: agriculture, forestry, territorial planning, cartography, meteorology, hydrology, oceanography, crisis management and prevention, and traffic following on land, air, and sea. Space products are also essential for the defence and security of States. The document claims space activities contribute to scientific and research development and the space sector itself became an economic sector. This converges with all the other documents that served as references.

The official document also claims New Space to be part of this international wave of participants in space affairs and new empowered business models. The rising importance of concepts like mega-constellations, the operation of micro and nanosatellites, low earth orbits, and sun-synchronized orbits changed the essence of the game. The document recognises that this opens opportunities for Portugal as it now can afford these new endeavours – the production and use of space generated data for socio-economic activities.

The document claims an economic return superior to 120% for the space business ecosystem in the last decade. By the workforce numbers presented, it is possible to assume the document refers to the Portuguese market – mentioning 1400 jobs, 300 of which are highly qualified engineers. It is stated that the Portuguese space business

ecosystem generated €890 million between 2006 and 2015. As a result, Portugal is increasing its participation in the European Space Agency and stepping up its space strategy through *Portuga*l *Espaço 2030,* approved by the resolution of the Council of Ministers nº 30/2018 on March 12th.

The document declares three main pillars:

- Exploitation stimulation of space signal and data through services and applications made possible by space technologies;
- Development, construction and operation of space equipment, systems and infrastructures and space production services;
- Continuous national capacity building and competence through scientific investigation, innovation, education, and scientific culture.

According to the document, these were the base on which to create the Portuguese Space Agency – formed on March 13th, 2019. Its purpose was to integrate and energise all national programs connected to space. It was also intended with the new law decree to enable an innovative legal regime to facilitate the development of new space activities, products, and services "in and from the country". It also aimed at attracting companies and operations of added value and knowledge-based. Not wanting to interfere with future specific legislation regarding space activities, the law regulating said activities would have to play a central role in promoting new economic activities and in technology-based business development, as well as stimulating research and development in both public and private sectors. The law needed to serve its purpose in a simple, effective, rigorous way while able to be applicable in an ever-evolving industry. Simple is not a Portuguese way of making laws, so the fact that the decree-law allows flexibility enabling unit license is meritorious. This means an operator can apply for the licensing of a single space operation or a global license, applicable to a series of space operations of the same type. These licenses can also be granted to operators acting on their behalf or the behalf of other operators for operations of the same type as well as different types that may include one or more launch and return operations, command, and control of launched space objects, even if conducted by more than one operator.

Additionally, the law decree claims the possibility of establishing a swifter process to license allocation in specific cases and forecasting a mechanism of prior qualification.

The essence of the purpose is to attract new operators with the simplicity of procedures. Another attraction point is set on the liability and insurance system, built to attract business activity related to space. The decree-law boasts its contribution to the democratisation of access to space by stimulating all the public to become part of the spacefaring efforts for the benefit of Humankind.

1.4. Statute n.º 697/2019

Published in *Diário da República*, 2nd *série*, part E, from September 5th, 2019, is *Regulamento n.º 697/*2019, the regulation regarding the access regime and exercise of space activities (Regulamento relativo ao acesso e exercício de atividades espaciais, 2019).

It aims to regulate the exercise, as in practice, of space activities subject to the responsibility, authorisation, and supervision of the Portuguese Republic in accordance with international obligations and practices relative to facilitating and promoting the access and practice of space activities in and from Portuguese territory.

It also ensures space activities respect international principles of peaceful and ethical use of space and protects the political and strategic national interests of the Portuguese Republic.

The document also establishes a legal framework for regulating, overseeing, and inspecting space activities. The information is compiled in a single regulation for a pragmatic treatment. It considers resource optimisation, simplification, celerity, and procedure efficacy to reduce companies' administrative expenses.

This will also facilitate access to a broader number of space operators while safeguarding the safety, preventing damage, and reducing environmental impact. The wording in the document is vague enough to account for the ever-developing essence of space technology and industry and allow flexibility to companies in their economic and technical plans without compromising strict procedure requirements.

1.5. PT Space 19

In collaboration with the Office of the Minister of Science, Technology and Higher Education, Portugal Space published on November 29th, 2019, the document: +Space in Portugal and Europe with ESA (Portugal Space & Office of the Minister for Science, 2019).

The document broaches the subject of methodologies and practices to attract investment in the space sector and industry. It declares the need to diversify the funding sources to foster space economy and innovation in the country. The target is 2500 million euros for 2020-2030 with a 50/50 balance between public and private sectors (Portugal Space & Office of the Minister for Science, 2019).

With the eyes set on increasing the overall investment in space by a factor of 10 until 2030, the main challenges are identified in the document as:

- The increase in the annual outcome of space-related activities in Portugal to about 500 million Euros by 2030;
- The creation and promotion of approximately one thousand skilled jobs in the country in the referred period of ten years;
- The attraction of relevant players to operate in the country and promote entrepreneurial projects to encourage high-added-value activities;
- The strengthening of space research in close cooperation with academia, scientists, public administration, and the business sector – allied with advanced training of highly skilled workers.

As a nation of feeble economic potency, Portugal will benefit from applying for European funds. Many funding frameworks have been prepared to help kick-start space industry sectors, such as the programs addressed in the International Conference about the Strategy of the Azores for Space and the European Structural and Investment Funds. Joint undertakings are another useful tool to keep the momentum going on space efforts.

By the time the document was issued, a big focus was Portugal Space 2030, and in it, the vectors of Earth Observation, space safety, space transportation, and telecommunications. This included downstream activities, as they were more attractive to the country. The bold claim that the nation aspires to become a global authority in

science and economics of Space-Earth-Climate-Oceans interactions can be read in the document.

Among the keywords in the Portuguese approach to space is “democratisation”, a great change from the *mare clausum* during the Age of Discovery. This time, Portugal will need international cooperation and expertise if it wants to become part of a team of spacefaring nations, hence its incorporation into the European Space Agency. In the document is admitted the heavy reliance on public funding, by which it is suggested full integration of space into the economy and society. This will mean a change in mentality and culture that will naturally bring some potential future space professionals to the field.

Another important development to cover is the most ambitious plan undertaken by the 22 European Space Agency (ESA) Member States: a 14.4 billion euros over five years investment. Once again, an argument favouring the recognition of space as added value for society and not a way to flex.

On page 4 of the document, regarding part I: Implementing the strategy “Portugal Space 2030”, it is declared “, Space should be considered as a common good, to be associated with our institutions and collective ambitions (…)”.

Arguing the repeated declaration of consolidated agreement among the scientific and business community that the space sector increases the competitiveness of other sectors, the document also affirms that the space sector is growing. The declarations go further: “The possibilities are beyond what we can imagine today”.

The fulfilment of the space agenda will determine the pace of progress of each society. An example the document illustrates is climate change. Claiming climate change will profoundly impact “natural and human systems” that will require monitoring – e.g. potable water. The capacity of the space sector tools to help monitor important variables will prove invaluable. Not only are the space technologies methodologies important to measure vulnerabilities, but they also provide an objective way to support information-based decision-making on mitigation and policies. Space technologies represent social and economic progress and a gateway for international cooperation, safety, and security. Information has become the tool – or even commodity – on which developed societies depend for their well-being and efficiency.

The document refers to several concepts and ideas that converge with others cited in this work. There is concord in affirming there was a shift in thinking towards space: the recognition of space as more than a way to show technological and ideological prowess – likely between Space 3.0 and Space 4.0. Now, those who are not engaged in shows of force or competition for international superiority can focus on the benefit of Humankind and move to solve global challenges.

It is claimed in the document that space will not only be a passive provider of information but will play an active role in diminishing the human effect on climate change. A good example is the ability to calculate better maritime routes, optimising fuel consumption. Aviation is also ongoing a deep technical change with the performance-based navigation (PBN) and required navigation performance (RNP) procedures. This means navigation, departure, approach, and landing procedures will no longer focus on traditional land equipment such as Very High-Frequency Omnidirectional Range with Distance Measure Equipment (VOR/DME) or Instrument Landing System (ILS). This means more rounded, effective routes and continuous descents without "steps", thus saving fuel and the environment.

The second point of Part I of the document is set on strategy for attracting and enlarging investments in space and the diversification of funding sources. This is a crucial point for Portugal, as it will need to secure substantial international investment.

When it comes to national competitive programs for research and advanced training, the document refers to *Fundação para a Ciência e Tecnologia* (FCT). An anticipated public investment of approximately 245 million euros in ten years, specified on page 6, for:

- Advanced training through doctoral fellowships;
- Scientific employment, through doctoral research contracts;
- Research and academic careers, through invited chairs;
- Research and Development (R&D) projects;
- Research Institutions, Associate Labs, and Collaborative Labs, through basic and programmatic funding;
- International cooperation in science and technology (S&T).

In the document, it is declared the intention to coordinate both ESA and FCT funding and other European funding to guarantee a "multiplication factor of 5 regarding the impact of public resources in the capacity to raise other sources of funding for space-related activities in Portugal". How this is to be done, however, is not specified.

The third point takes us to the need to go beyond public investment. Indeed, it cannot be the public sector to bear all the weight of space ventures. The intention is to create a new sector with new opportunities for the betterment of society. The public funding might give the kick-start needed to get the ball rolling, but the rest is up to the private initiative.

Still, articulation is needed to make the most of the public funding. Portugal will need to be strategic and serious in its projects and participation in the programs. Participants in the International Conference about the Strategy of the Azores for Space often mentioned Horizon Europe as a suitable and desired program. Member of European Parliament (MEP) Carlos Zorrinho and MEP Maria da Graça Carvalho expressed their approval of H2020. Portugal should keep participating in European framework programs, collaborative R&D projects, and getting involved in European networks, research missions, partnerships, and international cooperation in aerospace.

The European Space program for 2021-2027, expressed on the 6th page of +Space in Portugal and Europe with the ESA document, is another excellent opportunity for cooperation and learning. This will comprise innovation projects, navigation and Earth observation programs, transportation, and access to space – in the form of the Azores International Satellite Launch Program.

These programs are usually under the coordination of the Directorate-General for Research and Innovation (EC- DG RTD) or the Directorate-General for Research (EC-DG). European Defence funds and European Structural and Investment Funds (ESIF) are also available. The core of these programs is essentially the same throughout the spectrum: advanced training, doctoral fellowships, skilled employment, innovation projects, and collaborative programs with institutions. Some Joint Undertakings are also expected.

Anything beyond this is expected to fall into the lap of the free market and private initiative. Supply, demand, procurement, and market dynamics will influence the products based on the needs of the public. Many expectations are laid upon foreign firm investment in the country and the deployment of operations of foreign companies in

Portuguese territory. The space sector is also thought to encourage modernisation and influence many sectors. Hybrid business models are expected in terms of upstream and downstream markets. Venture capital will also be a welcomed source of funding.

Part II of the document relates to Portugal in ESA and the France-Portugal Co-Presidency. The focus will be to engage Member States and stakeholders to commit to the European Space Policy. The insistence on close cooperation is valuable to keep all parts engaged and focused on the end game. Indeed the document mentioned that the new co-presidency would propose to the ESA Council the implementation of annual Meetings of the Ministers to increase interaction and presence.

Another intention of the Co-Presidency is to modernise ESA's industrial policy and safeguard positive evolution relative to society's environment, markets, and digital transformation (Portugal Space & Office of the Minister for Science, 2019). It is intended to expand and consolidate 5G communications, stimulate links between space and non-space sectors, consolidate downstream and transfer activities, stimulate the role of Member States, improve the relationship between the European Union and the European Space Agency, and promote the agility of the Agency. Another critical focus that will gain a strong essence as we progress into the future is space diplomacy. The hope is that space will become more of a place of cooperation than conflict.

The future and its potential are filled with possibilities and almost utopic visions. But the ethical implications and improper use are also many. Technology can be used for many purposes, and it is paramount that a watching eye with an adamant moral compass is present. With that established, satellite manufacturing, Industry 4.0, telecommunications, and space transportation foresee an exciting future.

If International coordination remains in place, at least in Europe, some progress will be achieved. The 2016 ESA-EU Joint Statement backs a hopeful promise as it set out to work on the "shared vision and goals for the future of Europe in space". There is the intention to foster a globally competitive European space sector and maximise the integration of space into the European society and economy. All culminating in European autonomy in space matters, naturally increasing its security against cyber threats (Portugal Space & Office of the Minister for Science, 2019).

1.6. Portugal Space 2030

Portugal Space 2030 emerges as a Strategy for research, innovation and growth for Portugal. As noticeable, these terms arise repeatedly. They are undoubtedly some of the strong words for the motivations around space endeavours in Portugal.

Once more, the declared objectives in the documents converge. The +Space in Portugal and Europe with ESA states, on page 16, four priority goals for Portugal Space 2030.

Objective 1 is to promote economic growth and the creation of skilled jobs. Tending into account the main concerns of the Portuguese reality, this tends to come as the first motivation — a pragmatic approach to a practical issue.

Objective 2 relates to fostering the generation of satellite data through new space technologies and space-related infrastructures in Portugal. Building infrastructure seems to be a major concern. In a sense, having buildings dedicated to space affairs might help consolidate the idea that something is taking effect. The document claims this would help leverage international scientific and technological cooperation and turn Portugal into a stronger player. This seems to evidence another factor: this wanting to be relevant again and this hanging on to the historical significance of centuries past.

Objective 3 intends to contribute to the country's development and strengthen diplomatic relations and international scientific cooperation. The document extols Portugal's geo-strategic position in the paragraph and declares the intention to share acquired knowledge with Portuguese-speaking countries.

Objective 4 leans on the development and evolution of the legal, financial, institutional, cultural, and educational frameworks pertinent for boosting the space sector in Portugal through initiatives and international cooperation.

It has become clear that space efforts and technology development are recognised as a national purpose. A paramount interest for countries is to increase their economic output, social progress, and homeland security (Fundação para a Ciência e a Tecnologia, 2018). Being that social welfare depends increasingly on information and technology, it is only natural the urgency of nations to invest in space technologies. This importance is only predicted to rise as society becomes more digital. Space is intertwined with the future

of Humankind. Getting involved in space implies an educated workforce, and education requires collective effort. The upcoming generations of entrepreneurs, scientists, and engineers will contain more mass if the population finds interest in space matters. Combined interests and efforts lead to political and cultural change; these, in turn, can affect the syllabus at all levels of education.

Portugal is considered a successful case due to its fast adaptation and integration of space programs (Fundação para a Ciência e a Tecnologia, 2018). The document on the Portuguese space strategy 2030 claimed an FCT study in 2010 affirmed that each euro invested in ESA space programs generated € 2+ returns to the Portuguese economy. It also concludes that within the scope of *Horizonte 2020*, more than half the investment in space technologies was directly absorbed by the business sector.

The capacity building and recognition of the space sector also reinforced scientific and technological diplomacy and cooperation. When skilfully deployed, these initiatives and policies lead to market stimulation and the development of relevant pilot projects.

2. Overview of the existing space structure and intended projects in the Azores

2.1. Ongoing space programs and projects in the Azores and the need for strategic coordination

With some factors playing favourably for the Region, it is only natural that some projects and initiatives have chosen the Region to come to fruition. This operational settlement gives the archipelago both credibility and momentum for the coveted next evolutionary steps in the direction of becoming a cluster in space-related activities.

The Azores are already equipped with a Space infrastructure ecosystem. Nineteen projects are active in the Region (Estrutura de Missão dos Açores para o Espaço, 2021): one active project on Flores Island (RAEGE Flores); one project is active on Graciosa Island (European North Atlantic – Atmospheric Radiation Measurement) (ENA ARM); Terceira Island has four active projects (SST National Operation Center to map orbital Space debris, AIR Centre, TERINOV – ESA BIC, Weather Radar); Pico Island has one active project (Pico NARE); and active endeavours on São Miguel Island are (Cooperation with the University of the Azores, NONAGON – Science and Technology Park of the Autonomous Region of the Azores – ESA BIC, OASA, Expolab); and Santa Maria being the richest Island in active projects with a total of eight (Santa Maria Teleport – operated by EDISOFT, European Space Agency's GALILEO Sensor Station, EUMETSAT Station, Rede Atlântica de Estações Geodinâmica e Espaciais (RAEGE), Deep Space Telecommunications, Santa Maria NAV – Air Traffic Control, Portuguese National Space Agency Headquarters - PT Space, and INCUBA + - ESA BIC).

The emergence of this immensity of initiatives has made the Azores a central force in the Portuguese space and aerospace ambitions. The interest the archipelago raises comes from its geostrategic location. The advantages of the Islands' locations have proved beneficial not only for Portugal but for European and United States institutions. There is a rich history in the region regarding communications – such as with sea cables - between the European and American Continents, using the Azores as a much-needed stepping-stone. The archipelago's desirability surged once more with the need to install aeronautic infrastructures on the Islands. The effects of this past cooperation have palpable assets still in operation today – very visible on Terceira and Santa Maria Island.

Now, with Space, the combined interest for the Azores emerges again, coming to fruition as the aforementioned projects. The diverse range of study fields and applications of said projects is also commendable. From geodesy, launcher-tracking capabilities, atmospheric radiation measurements, Very Long Baseline Interferometry radio telescopes, GALILEO Sensor Stations, European Union's Optical Sensor for Space Tracking and Surveillance, Operations Center, Deep Space Telecommunications antennas, and stations related to weather satellites are just some examples of the application fields regarding space endeavours in the Region. Copernicus is another program to which the Azores contributes. Some of these projects have subdivisions of applications, third-party use, and implications. The details of these ramifications are available here: EAE_A4_Digital_EN.pdf (spaceazores.pt).

All this investment in the Region's space sector is indescribably vital for the archipelago's development – for reasons already declared regarding the difficulties of the Region, suffering from centuries of distance-related isolation and underinvestment.

The study of the ongoing mentioned projects proves the complexity of the regional system's dynamics. With so many moving parts, it becomes imperative to apply the regional strategy. Without coordination, the efficiency of the system as an organism is compromised – and consequently, all the potential, growth, and economic opportunities and benefits.

Another advantage of a polished coordinated strategy is the increased service/product output – likewise ensuring conflicting projects do not impair each other - demonstrating discipline and seriousness to potential users, a more robust industry and private sector settlement, and desirability. Hypothetically, attracting specialists to work on projects in the region could mean an easier time recruiting intellectuals and auxiliary professors to teach at the local University. Thus, this desirability factor is crucial. In the long run, the Region will need accessible specialists to help the regional academia to form a sustainable, consistent trained workforce.

All this intentioned growth is in jeopardy by the lack of a synchronised applied strategy. Every day without dully-strategic implementation is an effective waste of ability and potential – potential opportunities may be lost even if the Region is unaware of them. Every player that abstains from choosing the Region due to its unpreparedness is a loss in funding and consists of a disservice.

Deploying coordinated effort and gathering space players' compound interests will result in the conscious application of synergies. The intelligent use of infrastructure, projects, and human resources will increase efficiency and yield and reduce waste. The application of the benefits of space technology is long overdue in many Azorean economic sectors, such as agriculture, maritime activities, and forestry.

The strategy will need the constant involvement of those active in space matters. A space strategy is not just some documents to publish to become then passive. A strategy is an operational methodology. It involves action, presence, and dedication. After the strategy and the legal frameworks are in place, constant communication and a certain seduction will have to exist between the Region and potential users of the Region's infrastructure. If successful, this will lead to the development of a strong industry and private sector, research funding, and, on a further level, the solidification of the educational system in space matters in the region – a necessary step to ensure the sustainability of the space sector in the Region.

One of the priority areas of the Strategy of the Azores for Space (SAzS) is the development of applications based on space data. Satellites provide astronomical quantities of data daily. Suppose the Region wants continuity of the space sector. In that case, it can increase the odds by ensuring the applicability of the three different fronts of satellite data generation: Earth observation, navigation, and telecommunication. Beforehand, all of these fronts have strong applicabilities in the Region, and it should not be difficult to set them into motion. This is already done throughout the nineteen projects active in the Region. Many of the factions present in the International Conference about the Strategy of the Azores for Space have services focused on the three operational fronts. Potential players will likely exploit the added value of the data provided to develop their applications transforming raw satellite data into user-friendly and user-ready data or information.

Another significant milestone in the Azorean space structure's global vision is installing test sites for space technologies and integrating in-situ networks (Estrutura de Missão dos Açores para o Espaço, 2021). Test sites are a major component of space activities. Space is an unforgiving operational field in the sense that failure can have high costs or be near impossible to recover material involved in failed or aborted operations. This means testing is of enormous importance. To prevent losses, rigorous tests take place in rather specific locations for their precise characteristics.

The Azores have already been chosen as a test site for space activities. Capelinhos Volcano in Faial Island provides a unique similarity in terms of conditions to the moon, other planets, and even asteroids. The geological and ecological characteristics of the archipelago enhance its desirability to researchers and scientists. Indeed National Aeronautics and Space Administration (NASA) and scientists from Portugal and United Kingdom chose Faial to study the evolution of Mars' surface and train their exploration methodologies.

The deployment of these test sites will also be useful for other scientific fields. According to SAzS, several locations throughout the archipelago are desirable for research fields such as robotics, marine and environmental sciences, material science, information communications technology and the internet of things components, renewable energies, drone technologies, and underwater communications.

Publicising the Azores is an important part of spreading information regarding the archipelago's conditions. Being successful in attracting research to the Region will help in building momentum. As space organisations - always on the lookout for test sites – divulge their work in the Azores, more entities might be inclined to follow. Or even discover the Azores and consider them for the first time.

Technology testing sites are an appealing offer. The Region's volcanic sites, easy access to the deep sea, and geomorphologic characteristics are topped by attractive weather. Being located in the North Atlantic means being relatively close to potential European and North American users.

With initial conditions almost ideal, the region is already placed as a strong candidate for test sites. Coupled with the existing infrastructures, rich in performance capacity in big data storage and optical fibre data transfer, it should be easy enough to get the ball rolling – once that optimised legal framework is in place.

As expressed in the International Conference about the Strategy of the Azores for Space, it is possible to conclude that many scientists hold the Azores in high regard. If this affinity exists as much as it is expressed, the Region has reasons for hope. They are among the people that can boost regional space ambitions immensely. Their experience and activity would also hypothetically cause maturation of the projects active in the region. From in-situ sensors and collected data, both scientific monitoring and the economy would stand to gain.

The Region publicises NONAGON and TERINOV technology parks as its primary tools, together with the Santa Maria business incubator as part of the European Space Agency. These are arguments to help attract investors pertinent to the space market. This will rely heavily on international cooperation and aims to benefit the regional economy.

Naturally, one of the most ambitious steps in the regional strategy is building the spaceport. It is important to remember that having the physical infrastructure will only be the beginning. To leverage the combined effect, the region will have to apply the newly articulated bureaucratic conditions.

2.2. New management principles and approach

Another ambition of the Region is the creation of the technical Office of the Azores for Space. It will be a specialised entity dedicated to space matters. It will possess the power and responsibility to manage the space economic sector, support aerospace activities, coordinate and increase efficiency, and serve as a one-stop-shop department for all bureaucratic requisites, including licensing, incentives, and regulations. Moreover, it will be involved in science education initiatives and encourage cooperation on a national and international level for higher education purposes. This office will also monitor the execution of the Strategy of the Azores for Space.

Adding to this will be the creation of the Space Leadership Council. It will have a less technical essence. It will advise the Government of the Azores about the Strategy of the Azores for Space. The head of the council will be the President of the Regional Government. This entity will establish a cooperative relationship with business and industry associations, social partners, international entities, Universities and Research Units. This dynamic will have one of two essences: regulatory and commercial.

According to the official document of the Strategy of the Azores for Space, the regulatory front will focus on developing government programs and activities in accordance with “existing regional, national and international legislation”. At the same time, the commercial front will procure private investments and projects.

The Azorean public administration has identified some projects of interest that will involve the development of applications based on space data. These projects will use Earth observation data for georeferenced cultural and touristic points of interest, assist in oceanography, mapping of sunken vessels and underwater archaeological sites, research

in carbon sequestration, plantation and harvest management, area supervision and activity monitoring, meteorological monitoring, resource exploitation monitoring, and illegal activity supervision. Other essential projects coveted by the administration are the oversight of risk areas, mapping of the hydrographic network, storm monitoring, soil stability, improvement of aviation communications – with immense implications on flight times and the environment - and aviation safety and geodesy projects.

The diversity of projects coveted by the Region means international cooperation is almost inevitable if the projects are to be done in a timely fashion. They also cover a wide range of areas of expertise, which will require many different specialists.

A major front connected to the compound effort in these matters is the dissemination and scientific education for space. As confronted in the chapter related to the International Conference about the Strategy of the Azores for Space, the essence of the concept of "dissemination" seems to have been lost in translation to the international partners. Specifically, in Portuguese, dissemination refers to knowledge propagation, not technical accessibility. What the strategy's authors mean by dissemination is the education of people in space matters and related scientific fields.

The idea is to foster education development for space as early as possible in traditional education. More deeply will be the approach in the high schools of São Miguel, Terceira, and Flores islands to diffuse information and generate possible interested students and future professionals related to space. This will be an excellent tool for raising awareness (Estrutura de Missão dos Açores para o Espaço, 2021). Other suggestions of the SAzS are teaching the youth about the Copernicus and Galileo programs and "informal youth training through Academia".

While this proceeds, the regional public administration will map companies that rely on space technology, even if indirectly, to operate. It will also be attentive to the environmental implications of the strategy's implementation, insist on cooperation projects, lobby for the integration of space as a priority in future strategic frameworks, monitor submitted projects, and develop information about procedures for outside investors in the space industry.

2.3. Examples of the Azores' desirability

Projects in the Azores like the ENA ARM and RAEGE are present in the Azores by their own choice. These entities recognised the geostrategic position of the Azores and chose the archipelago to settle their stations. This factor is very important for a region that is meant to attract more interest. It shows that the Region's value speaks for itself and that the Region is not trying to "sell" something it does not have or trying to force a belief that does not exist.

To prove this point, the report Radio astronomy and space science in Azores: Enhancing the Atlantic VLBI infrastructure cluster was analysed (Barbosa, 2021). The research study claims "radio astronomy and space infrastructures in the Azores have great scientific and industrial interest" due to the "unique geographical location" in the North Atlantic, allowing a vast improvement in sky coverage. This is important because it is an independent academic entity claiming this instead of the Azores claiming it about themselves.

The pertinence of Azorean Very-long-baseline interferometry (VLBI) stations is that coordinating VLBI stations means a greater spectrum amplitude in data. The added sky coverage means a wider span of collected data. According to the source, this brings very high added value to research, space tracking, communications networks, European, African, and American continents' connection of radio astronomy infrastructures network using VLBI techniques, the small satellite market, space debris and Near-Earth Objects (NEOs) monitoring.

Figure 1 – To help understand the pertinence of the Azorean archipelago in RAEGE's network coverage.

Source: RAEGE Project

The Azores' antenna will possess baselines estimated at around 1900 km to the Robledo and Yebes VLBI stations, approximately 6000 km to Mexico, and almost 11000 km to the stations in South Africa and Eastern China (Barbosa, 2021). This is why it will provide a great contribution to angular resolution. This will help to compensate for the "Atlantic gap" by improving data acquisition and enabling improved cross-correlation studies. According to the study, the conversion of the Earth Station's 32-metre antenna in São Miguel would increase the Archipelago's importance even further (Barbosa, 2021).

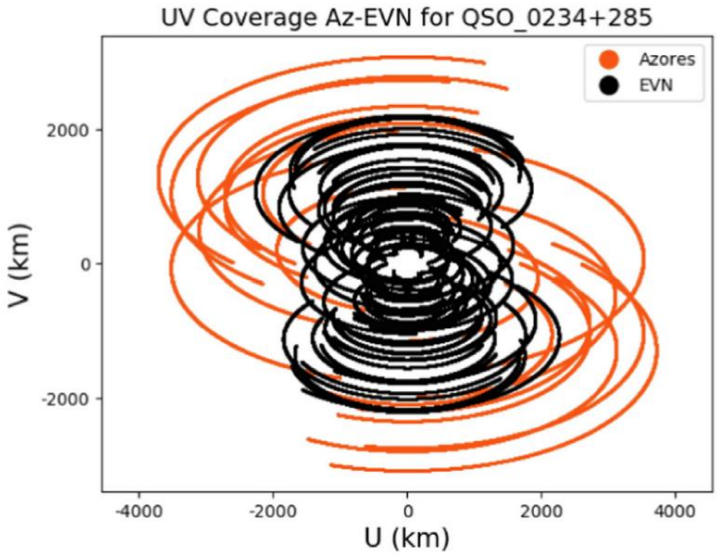

Figure 2 – "UV-plane coverage of European VLBI Network stations + Azores" in orange. As can be analysed, the Azores provide a unique contribution and coverage. It enhances the dynamic range of observations.

Source: Radio astronomy and Space science in Azores: Enhancing the Atlantic VLBI infrastructure cluster – page 6

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Figure 3 – Baselines of European VLBI Network stations + Azores used in simulation. As can be gauged, Azores provide a significant baseline contributing to improving the resolution of the European Network.

Source: Radio astronomy and Space science in Azores: Enhancing the Atlantic VLBI infrastructure cluster – page 6

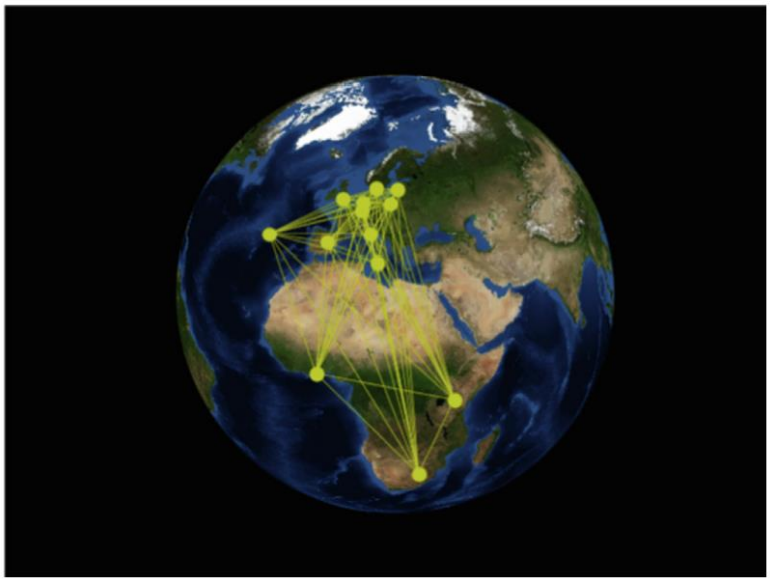


Figure 4 – Baselines of European VLBI Network + Africa VLBI Network + Azores used in simulation.

Source: QSO 0234 + 285

These figures serve as further illustrations of the potential contribution of the Azores to world knowledge. In the source document of *Radio astronomy and Space Science in Azores: Enhancing the Atlantic VLBI infrastructure cluster*, more examples and detailed information can be found in this field regarding the interest in the archipelago. As can be seen, international cooperation is vital for more significant progress in science, and the Azores have their place in this cooperation.

In the document, it is stated on page 6 that if some antennas detailed in the study were modelled as a "homogeneous array", the Azorean contribution "would improve array image sensitivity by 7% (EVN alone) and 8% (for EVN + AVN + TM65).

The importance of this research is that long baselines detect the most compact, otherwise unresolved structures (Barbosa, 2021). These simulations make evident the critical potential of this scientific effort in which the contribution of the Azores will be greatly appreciated. The archipelago will provide intermediate baselines as it is the only place in the North Atlantic able to provide the East-West baselines. It will also stand as a valued partner in the African VLBI Network (AVN) and to the MeerKAT radio telescope and Square Kilometre Array (SKA).

According to experts, the location of the Azores antenna enables the observation of sources below the celestial equator up to approximately 52º. This means it can contribute

to southern sky-deep fields exploration and cooperate with ESO, ALMA, and SKA (Barbosa, 2021).

São Miguel Island has the advantage of possessing a 32-meter SATCOM antenna suitable for integration in advanced VLBI networks, eventually capable of Deep Space Network ground support. The study's experts advocate this antenna's potential if it were to be upgraded into a "world-class infrastructure for radio astronomy and space exploration". They predict it would become a "keyspace facility for data production, promoting local digital infrastructure investments" and "testing of cutting-edge information technologies".

The scientists involved in the study praise the Azores' location and its contribution to "improvements in angular resolution". In the document, the experts explain the scientific and technical details to help understand the intricacies of their interest in the Azores. Moreover, in the 1990s, NASA used the archipelago as an "important geodetic satellite observation site" to improve the GPS in terms of spatial navigation (Bryant, 1993). The 2000s were no different regarding interest in the Azores for science and innovation. So much so that the Region is investing in the Atlantic International Research Center (AIR), an international platform for research and innovation in several areas like "climate change, earth-observation, energy, space, and oceans" (AIR Centre, 2017).

Once again, it is stated that radio astronomy and space sciences benefit profoundly from the "unique location" of the Azores, hence the hype around Santa Maria and Flores stations. Indeed, RAEGE engaged in the deployment of a 13.2-meter radio telescope with VLBI capabilities in Santa Maria. This is another project of international cooperation, specifically between the National Geographical Institute of Spain (IGN-Spain) and the Azorean Government (Colomer, 2015).

Additionally, VLBI networks such as EVN and AVN mean to participate in VLBI and electronic VLBI observations. Good quality delivery service for data transfer is a requirement. This is another aspect in which the Azores are well placed. Besides the Intelsat Standard-A antenna station compound with its 32-meter station, the archipelago also possesses the 12-meter station for SATCOM link with the Azorean western group. Due to historical facts, the Azores are well connected by new submarine cables to the mainland. This enables high-speed connection with appreciable bandwidth. So much so

that the RAEGE station in Santa Maria already participates in electronic VLBI experiments with interferometric fringe analysis for geodetic purposes (Barbosa, 2021).

Several sources also add other possibilities. The archipelago is connected by a fibre ring loop, and the SATCOM antenna could be synchronised after time transfer over fibre from the operating clock master at Santa Maria RAEGE station using White Rabbit technologies. This means resorting to a framework for data transfer with sub-nanosecond accuracy coveted for radio astronomy and space studies (Serrano, 2013). Furthermore, it has been proved that optical fibre submarine cables can be used as deployed seismographs, a predicted valuable addition to instrument infrastructure in the Azores. This stands as another argument of those in favour of investment in radio astronomy in the Azores as space cluster tends to spill their benefits to other sectors, even in the form of "new testbeds".

Furthermore, a SATCOM antenna placed in the Azores has the benefit of being closer to the Equator than most in the EVN and has access to a larger area of favorable sky, allowing it to observe a considerably bigger fraction of the Milky Way – the specific scientific operations can be read in the source (Barbosa, 2021).

This is another reason to consolidate the interest in deploying radio sensors in the Azores. Once operational, these sensors could collaborate with Haystack Auxiliary Radar, worked by the Massachusetts Institute of Technology Lincoln Laboratory (MIT LL) for the NASA Orbital Debris Program Office (ODPO), together with European sensors. The region is in a great position to help in space debris monitoring, contribute to transient sky studies once it hosts a node of the SVOM space mission ground alert network, and on the field of thermonuclear, nova, eruption that occurs on the surface of a white dwarf star (Ribeiro, 2014).

2.4. Strategic and infrastructural base

The Azores are focusing on small satellite markets. It is a safer way to initiate as nano and micro-satellites have seen decreasing production costs. Thanks to leaps in technology, their considerable capabilities make them efficient and desirable.

It is important to note that developing new space-related infrastructures in the Azores requires a lot of international cooperation and know-how. This is an excellent opportunity for the Region to learn how to familiarise itself with this new industry best. Humility to

learn and to be of the best service possible to potential partners without jeopardising sovereignty and dignity. Like the example in the Radio astronomy and Space Science in Azores: Enhancing the Atlantic VLBI infrastructure cluster regarding retrofitting the 32-meter decommissioned Intelsat Standard-A SATCOM in São Miguel. There is nothing wrong with having obsolete infrastructure. The Region is fortunate to have interested parties willing to retrofit and bring built infrastructure to use. This particular Earth Station would be able to cover the Deep Space segment and enable the Azores to "high impact contributions" to Deep Space missions, "enhancing the AIR footprint to potential collaborations with major space agencies (NASA, ESA) on deep solar system space missions (Barbosa, 2021).

These conversions are happening throughout the world, with examples being Ceduna in Australia (McCUlloch, 2005), Atlanta in the USA (Steffes, 1999), Yamaguchi vicinity in Japan (Fujisawa, 2002), Elfordstown near Cork in the Republic of Ireland (Golden, 2005), and the Ventspils Center (VIRAC) in Latvia (Nechaeva, 2013). These converted stations now provide fundamental and valuable data to world research.

These conversions became opportune due to technological advances. The original large dishes were disseminated worldwide in the 70s and 80s. The mid-80s saw the rise of new satellite communication technologies, and increased coverage and bandwidth of modern digital ground optical fibre networks made possible the existence of smaller ground stations (Barbosa, 2021). The principle is that the Intelsat dishes "share a similar design and focal length to radio telescopes" and are relatively cheap to convert.

Another active project is a VHF ground station, St. Maria-PRT1, used by RAEGE as a node of the ground alert system of the Space-based multiband astronomical Variable Objects Monitor (SVOM). This is Franco-Chinese cooperation focused on the study of the "most distant explosions of stars" and "gamma-ray bursts" (Dagoneau, 2020). Once again, international cooperation is at work.

Table 1
Summary of existing and planned Space and radio astronomy infrastructure in Azores.; *Based on FCT/Edisoft-Thales information.; †based on Heliaq information.

Station	Dish Size(m)	Freq. (GHz)	Lat. (deg) Long. (deg)	Capabilities
RAEGE St. Maria (in operations)	13.6	2–40	36.98518 -25.12588	Geodetic VLBI, Geodesy, global change studies, GNSS
RAEGE Flores(in preparation)	13.6	2–40	~ 39.45 ~ −32.2	Geodetic VLBI, Geodesy, global change studies
SVOM St. Maria-PRT1 station (deployed, circa RAEGE)	-	0.137–0.138 (VHF)	36.9858 -25.1262	SVOM space mission Ground segment GRB/ transient sky Alert network
St. Maria ESA Tracking (in operations, EDISOFT)	5.5	2.3, 5, 7–8.5	36.99725 -25.13583	Kourou launch tracking, CleanSeaNet, satellite detection of oil slicks
VLBI SATCOM Station S. Miguel (proposed)	32	5–10	37.79088 -25.66473	VLBI, Very high resolution Astronomy + Space VLBI; Deep space network doppler tracking; Space debris
PTSPACE Ground Station (deployed)	15	2.3, 7.1–8.5	36.99651 -25.13.6514	Proba-3 DSN; LEO polar + helio synchrounous orbits*
LEO Station (planned)	2.4/4.5	2.3 – 4, 7 – 10	St. Maria Island	LEO tracking; Rx-Tz GGSN for cubesat, formation flying†

Figure 5 – Table of summary of existing and planned Space and radio astronomy infrastructure in the Azores (2021)

Source: Radio astronomy and Space science in Azores: Enhancing the Atlantic VLBI infrastructure cluster – page 5

This table above clearly indicates the interest the Azores arouses around those who focus on some space fields.

It is possible to understand how the Azores are gazed upon with interest for their unique contributions to space matters. With the suitable investment and equipment, the Region will have world-class capabilities, and science will be well served with the archipelago covering the Atlantic gap. No doubt, not only would the Region benefit from cutting-edge research and development, but it would also take a recognised place in space exploration and knowledge.

3. Summary of the International Conference about the Strategy of the Azores for Space

The author of this dissertation attended the International Conference about the Strategy of the Azores for Space. With the help of the Conference published Youtube videos – uploaded by SpaceAzores – a document more than a hundred pages long was written with the details of every single presentation. Naturally, the entire content of the document is too long to be contained in this dissertation. Thus, this chapter will be a summary of the Conference. The videos can be accessed through https://spaceazores.pt/sessions/ on the Conference tab and by clicking on "Videos of the Sessions" or directly through Youtube, though they are significantly harder to access that way.

The Regional Secretariat for Culture, Science, and Digital Transition organised, through Azorean Mission for Space, the International Conference about the Strategy of the Azores for Space. Said Conference occurred on November 11th and 12th, 2021, in Teatro Micaelense and highlighted the action of almost sixty speakers of various nationalities and areas of expertise.

This Conference marked a crucial moment for the Region of the Azores. It was a defining action and a declaration of intent. It brought together many specialists in the space field and space-generated data user industries. It was useful for networking and to elucidate all present physically or digitally on projects in the Region – "the last, yet the most challenging frontier", as said by the host Rui Almeida.

One might only speculate about the real intentions behind the organisation of the event. But some motivations can be deduced. There had been a shift in regional politics in the archipelago, and maybe some doubt was cast around the progress invested in the space plans implementation in the Region. There was probably fear that progress would be lost or momentum wasted and that the new government would not be so inclined to invest in space efforts. Organising this conference would appease many doubts and send a message that the new government was on top of things.

The Azores had management authority over space matters, and the Portuguese space agency's headquarters is on Santa Maria Island, even though the building is still under renovation and construction. This did not stop divergences from coming to the public as

the then Minister of Science, Technology and Higher Education, Manuel Heitor, accused the Regional Government of incompetence and lack of humility when referring to suggestions made in 2018. This prompted a response from the President of the previous Regional Government accusing the then Minister of incompetence in projects in the Region. The Regional President in office by the time of the conference and the exchange of accusatory statements defended his position by declaring that efforts were being made. The friction did not stop here. The then Minister of Science, Technology, and Higher Education proposed a new legal regime for space activities. This initiative received immense backlash from the Region's politicians with a unanimous manifestation of disapproval. Emotions got so heated that the Azorean politicians accused this measure of being an attack on Regional Autonomy and even a violation of the Constitution.

Another motivation for the conference might be to appease the public. The mission created to manage and oversee the regional space efforts had begun to become under growing scrutiny, and being the Azores an economically poor region, many would consistently question what effects had the money invested in the mission. Over time, the Regional Government also realised it could not keep the public out of the loop regarding space matters. This was evident in the debate surrounding the projected spaceport for Santa Maria. Many of the doubts voiced and emerging resistance by the population came from not knowing many of the implications of the spaceport operation. To win the public, the government had to become more open with the information and spent efforts in appeasing the fears of the local population. A new strategy was adopted. Instead of disregarding the population's concerns and considering it a product of technical ignorance, the government embraced the new approach of involving the population as much as possible – almost in a motivational nature. The government recognised that the whole space strategy would be too difficult to implement in the face of local resistance and disapproval. Instead, the government is trying to use the spaceport as a new force and incentive to study and publicise it as a new economic opportunity.

Another clear purpose of the conference was to increase visibility. The Azores have increased their visibility worldwide in good part thanks to social media and the internet. If years ago, the archipelago was not widely recognised by many Europeans, National Geographic articles and photographic publications had a changing effect on that. A shift in air traffic exclusivity policies, an investment in tourism, diverse travel agencies'

packages, and publicity, together with steady Erasmus programs, also had a great impact in bringing in more visitors.

Now with the conference's realisation, the advertisement that the Azores are working proactively towards a space strategy and are willingly trying to create a new economic sector is out there. Plus, it was a way to demonstrate receptivity to establishing links, protocols, and much-needed international cooperation.

The conference had interventions of different essences. It was evident that not all participants had the same agendas or motivations. These seemed to be mainly political, commercial, or academic.

The political interventions focused a lot on arguing about the Region's aptitude in pursuing space endeavours, showing results, assuring the audience about its progress and merit, and trying to create partnerships and use the event for networking.

Many of the companies at the conference scheduled to speak used their time as an opportunity to publicise their capacities, their achievements, increase their network, and become targets of interest to get new customers possibly. They also frequently spoke of their progress in the Region. Naturally, their interventions had a commercial inclination.

The other more prominent type of intervention was academic. Research and higher education entities used their time to inform the audience of their research and established partnerships. Some of these entities have been conducting research in the Region for decades. They were also heavily invested in explaining why the research they were responsible for was important. One easily concluded fact regarding research on the Region is how cherished, valuable and important the archipelago's contribution is, especially because the islands provide a platform on an oceanic area where there are no other alternatives.

Thus, research is a natural attractor of the Region. While the Region might have to convince some players to develop their programs in the archipelago, many research projects chose the Azores of their own volition. When it comes to space geodesy, atmospheric studies, space object surveillance, and satellite tracking, many entities actively chose the Region – as what happened with the ENA ARM (Eastern North Atlantic Atmospheric Radiation Measurement) station in Graciosa of the United States Department of Energy, Office of Science and RAEGE station of Santa Maria. So even if

the future presents challenges in attracting more players to the Region, at least in the research realm, the Azores provide considerable benefits to Humankind thanks to their unique geographical position. These unique contributions are evidenced in the research products – as detailed in the RAEGE's research.

The conference had a system of instantaneous translation for Portuguese English and English to Portuguese with headsets provided by the organisation. The Conference was live through streaming on several platforms.

Some projects addressed initially were the space launch tracking from French Guiana in service of the European Space Agency and the European global navigation satellite system – Galileo, a system of undeniable importance and serves millions of Europeans daily. Some emphasis was given to Santa Maria Island's infrastructure, a product of the course of historical episodes involving the History of Aviation in the Region, the two World Wars, and the Cold War – reinforcing the importance of the archipelago since times of primacy naval crossings. As a result, one of the most important NAV infrastructures is based there. Together with Atlantic Air Traffic Control, they perform support and air traffic control functions in Santa Maria Oceanic Control – Europe's largest Flight Information Region (FIR) and one of the largest in the world.

RAEGE's leading tech project was also mentioned thanks to the tutelage that studies the planet and the changes to its form and rotation axis. It does so by using radio astronomy, gravimetric, and satellite positioning systems.

Air Centre was mentioned with headquarters on Terceira Island and an international Atlantic research centre. Detection and mapping of debris and active equipment in orbit over the Atlantic are also carried out there. Santa Maria and Terceira were selected as hosts for telescopes, and the National Operational Centre of the Portuguese network SSD. Santa Maria will also host the PT Space headquarters.

In the Azores, *Instituto Português do Mar e Atmosfera* (IPMA) also launches atmospheric balloons for climacteric studies. These studies allow the immediate study of the atmosphere and the interactions between space, weather, ocean, and energy in the Atlantic.

The Region seems to be well aware of the adversities ahead as the great challenges for implementing a robust and concrete space synergy were addressed, such as settling

and educating qualified personnel. With this in mind, the cooperation of vocational schools, the University of the Azores, of Science and Technology Parks of São Miguel and Terceira Islands, and the business incubator network of the Region is summoned. The involvement of these institutions' strong fronts will create a business, scientific and industrial system in the Azores.

The speeches of the Regional Secretary for Culture, Science, and Digital Transition, Madam Susete Amaro, and the President of the Government of the Azores, José Manuel Bolieiro, had a more political and advertising essence. They both extolled the importance of the Conference as a platform for understanding and shaping partnerships and presented their arguments on why investors should choose the Azores. The intention to promote national and international cooperation was clear.

Mentioning the democratisation of space was an important detail to explain why the Azores can become relevant in Space 4.0. Probably, before Space 4.0, it would be tough to explain how the Azores would be convenient for several space endeavours – as, in the past, space ambitions were only accessible to economic and technological giants. Nowadays, that restriction is no longer present. So much to such an extent that broad is the influence of private companies in the space sector.

The fact that the sector is no longer just accessible to a restricted range of operators naturally led to an acceleration of its development. This argument, of easy concord, is a reason for generalised rejoices to all those who have space activities as passion or enthusiasm. This reality is an excellent reason for optimism and joy in the Region of the Azores, for it allows the involvement in the sector and the harvest of its benefits.

The reduction in technical obstacles and the consequent larger involvement of a wider number of space actors resulted in huge innovation. This, in turn, diminished the costs associated with space efforts – namely the "integrated business models processes". This factor is a comforting one for the Region, as it stands as a proven record paved by others who ventured into space endeavours.

As defended by some speakers, space became a lab and one of the foundations of communications capacities such as tracking aeroplanes and sea ships. In truth, increasingly, procedures that were mostly radar-based already rely much more on satellite technologies – such as the case of ADS-B transponders for air traffic.

Methodological evolution itself has taken us towards space. Humankind has engaged in a certain technological dependence relative to space. Still, the convenience associated with satellites and the ease with which they convey information in gigantic quantities is too important to neglect.

The politically motivated speeches mentioned the financing programs, start-up incubation, and acceleration – possible in the Azores through Terinov, Ilhas de Valor, and Nonagon. This reference has a significant meaning. The Region is not abundant in terms of wealth. Therefore, funding aid is many times resorted to for many different purposes. The Azores have been a recipient of European funds since 1986 and later fell under the Convergence Objective due to its tenuous economy compared to the EU average. Intentions of regional mobilisation were a pattern in the speeches, together with the creation of cooperation conditions for the socio-economic development of the Azores. The political class knows they will need the help of the population. Without a workforce and their will and skills, it will be impracticable to deploy space projects that truly benefit the local population. An often used argument is the estimate carried out by Bank of America, asserting the annual average growth of 7% in the space sector. This opportunity in the space sector offers a regional specialisation possibility. It is not simple to realise, but the much-magnified idea is that, in a successful outcome, much prosperity can be created in the Region. Knowing that the archipelago has several adversities on that front, it is easy to understand the enthusiasm among the most optimistic.

A commonality among the speeches was the recognition of the need for international cooperation. Most participants seemed willing, sometimes eager, for this far and wide symbiosis. In turn, the defence for an efficient bureaucratic articulation was voiced several times. The private players seemed very wary of bureaucratic impediments and appeared to want them minimised as much as possible to avoid degradation of investment attraction. According to the government, the call for agility and assurance of smooth bureaucratic flow will not supersede safety concerns. The most demanding patterns will be adhered to.

One of the statements from ANACOM's President, João Cadete de Matos, holds particular importance. One of the first licensing actions carried out by ANACOM was to a consortium between companies from Portugal and the United States – evidencing the international cooperation in space matters – to install two radars in Santa Maria to track space debris.

The digital participation of Matthias Petschke from the European Commission, Directorate-General for Defence Industry and Space (DEFIS), and Space Director helps consolidate the notion of international involvement. A great dedication was given to praise the Copernicus and Galileo Programs and how they contributed to greater unity and security. The information gathered is available to State Members and contributes profoundly to Earth observation and monitoring worldwide. The speaker went further and considered it "a European success under the leadership of the Commission, European Space Agency and other institutional partners (…). It is an example of Europe at its best". It praises international cooperation and its results – including strategic economy, resilience, and stability. The digitalisation of the European economy and the achievement of community objectives, like the Green Deal and the Digital Agenda, also depend heavily on space technologies. The Director claimed that providing high-quality data, information services, and knowledge in a useful time serves well not only Europe but the global public and the future of our planet as well.

Initiatives emerge as energising tools. One such is CASSINI. A one-billion-euro European Space Fund to boost start-ups and space innovation (European Commission, 2021). "A key factor to modernise the Union's Space program to achieve a better commercial uptake of satellite services to allow Europe's space industry to take a more prominent role. The Director added that this will affect how Europe designs, develops, implements its space program, and interacts with the industry. "This is a change of direction that is overdue", he added.

Mr Petschke's intervention highlight concerns related to the economy, security, cooperation, and communication. If Europe is to maintain its technological autonomy, it must remain safe from outside interference. It is also noticeable that the high European hierarchies are well aware of whom they are dealing with when interacting with the Azores. They are perfectly aware that the Region depends on external funding to complete more ambitious projects. Interventions from high European officials and Brussels tended to mention funds for which the Region could apply.

For the European Union, the successful operation of a cosmodrome in Santa Maria Island would mean a space infrastructure in European territory which could be used for operations. This would be advantageous for the Union as some specific operations could be conducted closer to the continent.

The CASSINI initiative also comes with a matchmaking tool and business accelerator. They are intended to connect start-up companies with large industrial corporations and improvement on business, expansions and networks. Hackathons and mentoring activities will continue in the context of the CASSINI initiative to “promote Europe’s space program and to raise interest in becoming an entrepreneur” - with CASSINI prizes included.

Another declared purpose of the launcher alliance and updated space strategy is to gather all agents, regardless of their dimension, to work together to achieve “a globally competitive cost-effective and autonomous EU access to space”. This autonomous European access to space is a strong point of the community’s ambitions.

It is also safe to assume that the Azorean progress in space matters is being watched and that European institutions seem to be rooting for its success.

Interventions such as by Carlos Zorrinho and Maria da Graça Carvalho, both Members of the European Parliament, emphasised the progress made and remembered all the political investment of approximately two decades. They defended that there was always a consensus between pro-European groups relatively to European space strategies and the will to have a Europe with a relevant voice in space matters.

There were challenges in coordinating agendas and budgets, and hard battles were fought by those who wanted to see space prioritised in community efforts – such as maintaining the funding for the European Space Program. The central institutions pride themselves in what they consider “winning strategies” and the prestige of the European Union. With highly political and social motivations, the cry for sustainable development and the reconfiguration of the social and economic tissue resulting from the “profound technological acceleration” and combat of climate change is noticeable.

The interventions and speeches leaning more on the political essence clearly show a strong will to be relevant and to lead in space matters. Said speeches also shared concerns, namely the deconstruction of the generalised idea that the programs are very technocratic. Presently, the new defended perspective is that the programs are very political and profoundly social - even allowing the European Union to solidify its values on those programs. MEP Zorrinho exemplified some concepts in which such happens: respect for the Rule of Law, Human Rights, the centrality of people, ecological balance and biodiversity maintenance.

The political class now advocates strongly for the power and necessity of education and how societies that neglect it will fall behind. Furthermore, many voices in the conference defended that space education needs its own curriculum in Portuguese education. If the youth is to be attracted to space, an earlier contact with space needs to occur, and school is an effective tool to make that happen. One example is the ESA's CanSat competition. It is a great way to attract and involve youth in space activities. It is evident to all who study societies and civilisations that a skilled, educated workforce will safeguard a prosperous future. Any country that has banked on not educating its population will probably face a tremendous challenge in reversing the situation. Technology has achieved too high an importance to be ignored. Those with politics as their primary concern also want to strengthen space as an arena for cooperation as it is a door to geopolitical and geostrategic competition and frictions.

One of the concerns expressed by the then Coordinator Engineer Luís Santos was the subject of the brain drain. He claimed that highly skilled job vacancies might help bring back some of the emigrated educated youth, helping the regional prosperity generation. If conditions are not created, it will be very difficult to attract this highly skilled workforce. Another addressed topic was exposure and its importance. Without it, there is little way to promote external interest.

Economic growth, capacity building, and increase in exposure were a constant in the political interventions. The economy and prosperity are clearly the main arguments directed toward the people. The importance of exposure denounces the depth of international dynamics. The three main objectives rely heavily on macro-scale relations. This is possibly why the Region is so devoted to generating outside interest. This combined interest and joint effort will build the momentum needed for the Region to catch up and become relevant in space ventures.

On the subject of strategic levers, an agile administration on space matters is paramount. Without agility, this system will move too slowly to be relevant. Abroad, these processes are built not to create unnecessary obstacles for those working hard to improve technology, the economy, and other people's lives. The Portuguese system will have to adjust to this. There will also be a new juridic framework in place and a revised economic system.

When put all together, these steps start evidencing their importance and how challenging they will be to surpass. This led to the analysis of the impact chapter of the strategy: to lever the potential of a new economic sector in the Region, develop an industrial and scientific cluster, attract companies, create highly skilled jobs, and install education and training for a new generation of Azoreans connected to space.

As for partnerships, there are three fronts concerned:

- Public regional administration;
- Regional, national, European, and American private sector;
- Regional, national, European, and American Research and Development sectors.

This will enable awareness of space matters, boosting funding opportunities, dedicated support, more partnerships, and more proactivity. This dynamic needs to represent concrete progress and culminate with public consultation, final approval for the strategy, implementation plan development - laid on flagship projects - and readiness for business with the completion of the spaceport, commercialisation of space-related activities, and business development support in the several priority areas. This whole process is no simple task.

One point drawn by the coordinator emphasised the need for the public to participate actively in the consultation and development of regional space activities so that the final strategy really favours all Azoreans. The implementation plan would then take place, accompanied by a strategic environmental assessment to safeguard the people and their quality of life and to safeguard the protection of the environment. If the people are caught distracted or without their oversight, even if innocently, some of their interests might suffer harm.

As the sessions progressed, it was quite clear the heterogeneous essence of the participants and how far and wide partnerships and participants can come from. One of the topics addressed was the role of the regional authorities in European space policies. It is essential to be aware of the two-way influences in international dynamics.

The presentations also became more commercial and academic in nature, advocating for the importance of international academic cooperation and networking. A good

proportion of the speakers studied outside the Region, either on the Portuguese mainland or abroad in foreign Universities. International research cooperation is also a constant. They usually occur because of agents outside the Region who possess more means to carry out their projects.

The advantages of Earth observation services were repetitively argued in presentations, proving their importance. It was also established how it link fields like academia, research, public and private sector, ocean productivity and space-time variability, climate change, marine pollution, and the development of new algorithms. So, a vast world of possibilities in international cooperation is possible when compound interest is in effect, and joint research topics are considered – and the Azores can be a natural part of them.

Once again, space capabilities and present-day technology allow for a wide range of operations. The archipelagic essence of the Region probably prompted many speakers to remind of maritime capabilities made possible by space technologies such as Maritime Search and Rescue, customs activities, fisheries control, anti-piracy, marine pollution monitoring, naval border control, vessel traffic management, and anti-drug trafficking.

These systems operate with space, land, and sea equipment of different dimensions, typologies, and purposes – vessels, antennas, telescopes, buildings, satellites, drones, and even helicopters. Inside these systems, we can even have more implications: Automatic identification systems, AIS, long-range tracking, vessel monitoring system, optical imagery, synthetic aperture radar, remotely piloted aircraft system, and more.

One peculiar detail of the Eastern North Atlantic Atmospheric Radiation Measurement Station in Graciosa Island is that the station is supported by the US Department of Energy. Its system has both mobile stations and fixed stations. The mobile stations deploy to specific missions around the globe. Of the three fixed stations, two are in the continental United States, and the other is Graciosa Island in the Azores. The purpose of these stations is to study the ocean/atmospheric interactions, clouds, precipitation, and the Earth's energy balance. The Azores presented ideal conditions for this kind of research, and Graciosa Island was specifically chosen for the installation of the ENA's ARM station.

The archipelago is well suited to study overcast stratus/stratocumulus to broken trade cumulus transitions. Graciosa Island was chosen for its minute dimension and low terrain.

This results in minimal landmass interference in the atmosphere and greater study precision.

Stephen English, Deputy Director for Research at the European Centre for Medium-Range Weather Forecasts (ECMWF), was present at the Conference. ECMWF is one of six members of the coordinated Organisations – the remaining ones being NATO, CoE, ESA, OECD, and EUMETSAT, spread through the United Kingdom, Italy, and Germany.

ECMWF is relevant because it was established in 1975 in order to pool resources for extended weather forecasts, which no country could do on its own – for technological and scientific reasons. Thus, being a very pertinent case of international cooperation. As a "European multi-site organisation", ECMWF addresses the highest-level problems in medium-range Numerical Weather Prediction (NWP). This requires cooperation. Atmospheric and oceanic mathematical models are used in NWP to produce weather forecasts based on current weather conditions.

Meanwhile, some companies started their presentations, and their expositions had a commercial essence. They were extensively used to showcase capacities, services and achievements. Some slides of said presentations seemed overt publicity. Once again, key operational domains are forestry, precision farming, maritime activities and surveillance, emergency services and operations, security, climate resilience, land use and land cover. Other mentioned services were decision support, early warning, Cloud Data Acquisition and Processing, Geospatial Data Science, and Artificial Intelligence Analytics.

The downstream services were referred to repeatedly as they are considered most pertinent for the Azores. They included maritime services, law enforcement, detection of illegal activities in the security domain, prevention and mitigation, readiness, response, and recovery in the emergency management domain.

The large oceanic surroundings of the Region, its exclusive economic zone, state-of-the-art aeronautics and communications infrastructures, easy access to the deep ocean, and low light pollution heavily influence the essence of suggested services. Specialisation is only natural. Some of these suggestions had a more futuristic deliberation, such as meteorological parameters retrieval and ocean parameters retrieval - predicted to generate economic impact. Director Campbell even added information considering the Azores a "very good testbed for these types of technologies" while naming services to support an

expansion of renewable energy sources, deep-water aquaculture, carbon sequestration, tourism, marine ecosystem, maritime security, and autonomous shipping.

Project Officer António Rocha contributed to the debate by explaining further how satellite maritime vigilance contributes to better fishing and how cooperation between EMSA and ESA increases efficiency and coverage – another example of cooperation.

According to a survey, Researcher Ana Martins affirmed that the surveyed's main interests were fisheries and marine protected areas. Still, she added that she would like to see an improvement in downstream services.

GMV Director Madam Teresa Ferreira's contribution made it clear that the Azores still lack many technological features and that shared dialogue and cooperation are the most important in the way forward.

The debates at the Conference were beneficial in exchanging ideas and perspectives and calling attention to undiscussed problems. The affirmed examples were that the regional market was developed as a push, not as a user-driven pool, and the need for a better connection between users and providers and more tailored services. The panellists corroborated this. Even though there are more than enough potential users in the Region, according to João Romana, Researcher Ana Martins shared that attempts to educate potential users were made with limited success. These potential users revealed they found the process and data too complicated and wanted it to be processed by a specialist first. So, it seems a step to present ready-to-use and read data is missing. This detail holds importance. The services are meant to be useful. This requires that the final user can interpret them. Either the population needs to be better educated, or the specialists must simplify the final product to make it user-friendly and ready to use.

Here there was some discord. It seems this problem arises only depending on the users. Project Officer António Rocha stated that specialised users pushed for the evolution of the services provided thanks to their expertise and demands.

This shows that a feedback procedure must be implemented so clear communication between user and provider can occur and information presented can be adapted according to the public it intends to serve.

A question posed by the moderator João Romana was directed to Station Director Eduardo Brito de Azevedo and was related to in situ networks and test sites. Is there room

for expansion in the Azores? The Director replied positively. Not only the services provided are on high demand, but the existence of the station also implies high levels of skill. Good news for the Region as it can invest efforts in space more confidently, also knowing other parties have interest in this progress.

The Work Session 2 – corresponding to the Conference's 5th session – titled "Promoting wider and safer access to Space", was especially pertinent. It counted with the presence of Danny Olivas as moderator, PT Space's Board Member Hugo Costa, CEIIA's Director of Ocean and Space Unit Tiago Rebelo, Director of Aerospace Facilities Design and Planning Michael Miller from Jacobs Technology, Carlos Valadão Santos as Managing Director of Rocket Factory Augsburg AG and ILEX Space Director Bruno Carvalho. This session addressed current trends and market developments in access to space and how attractive the Azorean archipelago became with the advent of Space 4.0.

The speakers vocalised the importance of incorporating space education in general education, the problem of space debris, artificial intelligence in Earth Observation, cooperation of several layers in the aerospace and aeronautical sector, ocean-space dynamics, the economic viability of space endeavours, The "perfect place" the Azores represent for logistics and operations, the shortage of highly qualified human resources, the importance of perseverance, environmental footprint, direct investment predictions, employment opportunities, publicity, space tourism, tax revenue, stakeholders, and mindset.

The debate allocated time was rich in discussion with the topic of government oversight, restrictions, and budgets being debated. The need to be efficient was highlighted, and the need for adequate funding. Orbital congestion was once again brought up. This discussion solidifies the arguments by force of repetition. Their conclusions converge with previous insights at the Conference.

The concept of timing was analysed and considered one of the paramount factors in a space strategy implementation. Some flaws in this regard were pointed out relative to the development of the space progress in the Region. Careful calibration was advised. Coordination between market, technology, and political motivation is essential to achieving success. There was also a call for motion. Because time was slipping and the Region was falling behind. These interventions were very assertive and were great insight from the participants, thanks to their experience in space efforts.

The many discrepancies in opinion and vision for the future were also noticeable in this debate. The several failures and inefficiencies of the Azorean space effort were also voiced here: gaps in the procedures, inability to issue licenses, and decrees missing for liabilities and insurance - problems some considered severe. Then comparisons were made regarding bureaucracies and how European nations tend to complicate unnecessarily.

There was also ambiguity in terms of the initial strategy. Some participants believed in going all in, while others advocated for starting small and negotiating with reality. Also, some stated that the Azores were already losing opportunities and several clients carrying out their operations abroad, which could be deployed in the archipelago. These believe the Azorean Space Project is not materialising fast enough.

Another topic addressed again was brain drain and co-location. Some believe Portuguese wages cannot compete with more affluent nations. Others believe some youth will not care if Portuguese salaries are lower because the country has excellent weather and living standards for those who are well-off. This is the argument the most optimistic use when defending that co-location will be easy. The topic of generation of critical mass, internal project sabotage, internal competition, and project scattering was also discussed. Possible solutions were advanced, and a call for scientific unity.

The ghost of the shortage of qualified human resources was addressed again. It is clearly a major concern between the managers and directors. From technicians to engineers, some entities have only 10% of the skilled personnel they would like to have. They all agree that time is being wasted.

From this point forward, all sessions and interventions came to strengthen what can be concluded so far. Some repeated concepts were research, development, innovation, social-economic impact, academic institutions, potential, funding, education, competence, policy-making, results and skilled workforce.

Another insistence of several participants was the need to educate the public on their reliance on space technology. They claim that too many people still see space endeavours as an extravagance that does not affect their lives while they make use of more than one hundred satellites. One person to express this view was panellist Miguel Bello, AIR CENTRE’s CEO. The orator’s foci were dissemination, policymaking and innovative procurement. The orator argued that not enough effort is being put in explained to the

public the importance of Space. From the weather forecast, which is extremely important for nautical and aeronautics, to road traffic, which is indispensable for timely deliveries and improved logistics, and telecommunications - for communications, television and telemedicine. These examples forwarded by the orator give a clear picture of how Space has become such an indispensable investment. Thus, he considers it of the utmost importance to educate the public about the use of Space and how it is deeply connected to them, even if some do not see it.

He went as far as to claim that human life without space applications would become miserable, and he affirmed: “nobody realises it”. The orator also affirmed that there needs to be better coordination, and this one can be improved with better information dissemination.

Researcher Professor Domingos Barbosa of *Instituto de Telecomunicações* shared his expertise on funding profiles and how one needs to set the right pace. The technology readiness level is also a factor to consider. For all this, the speaker considers it fundamental to align the digital agendas and remember that “the critical mass” for many space products is based on information technologies, communications, and computing sectors. Therefore, he advises agility. He too suggested the creation of advisory bodies with the “right mix of the private sector, public sector and policymakers”. Another step the speaker advocates for is exposure in the right circles; he exemplified this with S3.

This session had space for debate and proved the existence of discord as PT Space Board Director Hugo Costa posed a question to CIO Brendan Quine. Here two very different methodologies clashed. On one side, we have those who believe in one big system and on the other side, those that believe in compartmentalisation and fragmentation. While Mr Quine believed in small, focused groups and precise efforts, Mr Costa argued that fragmentation scatters budgets and weakens impetus. There was an exchange of perspectives in differences of opinion. It is important to consider that these differences need to be addressed sooner or later, and a methodology should be chosen.

Cláudio Gomes, a researcher in theoretical physics, advanced the next question. He inquired about what he considered the insufficient presence of research in space sciences in the Azorean Space Strategy. From analysing these sources, one can conclude that there is a disparity in approach preference. Some claim it is best to attract companies and jobs and let academia follow, others declare academia should take the initiative and

prominence. Some claim the creation of significant critical mass, while others prefer lean organisations.

Researcher José Afonso stepped forward to comment on Researcher Gomes' remark. He shared that, in his opinion, the strategy's priority is to bring entities together first. To create communication and sharing of expertise. In his view, for the strategy to last in a long-term essence, it will need partners to be involved. He claims that there is already enough knowledge and research nationwide to support the coveted projects. "Fundamental research by itself could not reach this stage". He defended that the presence of companies related to space is needed first to show production. Only after being able to attract such companies does the speaker believe there is a possibility to produce high-impact research. In conclusion, the orator declared he felt bringing "everyone" together to talk and share perspectives was the right stage at that point.

Therefore, two mindsets are present here. One believes in creating conditions in order for interest/demand to appear. The other believes in creating results before more interest/demand can emerge.

Session 8, equivalent to work Session 4, was related to funding. In this session were explained several budget envelopes for different programs, such as 15 billion for the European Union Space program between 2021 and 2027, 9 billion for Galileo, five and a half for Copernicus, and 500 million for SST and GOVSATCOM.

The Regional Director for Aid to Funding and Competitiveness, Ana Margarida Reis, was the first to speak. It was stated that the distribution of European Funds would strongly focus on the capacity development for intelligent specialisation strategies. The intention is to invest in the most promising vectors and ensure sustainable development while still harnessing the specific strengths of the Region. This is deeply rooted in RIS3. Priorities are clearly defined regarding the endogenous capacities through economic transformation agendas and with international specialisation in sight. This part cannot be neglected as the Region will likely need help and funding to start some projects.

The Director's speech repeated some ideas shared by other thinkers at the Conference: The archipelago has ideal characteristics for Earth observation and atmospheric studies, and encouraging Space activities will attract highly qualified specialists to the Region. So far, so good. This confirms what most agree upon, which is favourable news for the Region.

Mauro Facchini, DG DEFIS Unit Chief from the European Commission, presented the European Union Space Programme Financing Opportunities. Its primary purpose is to “foster a strong and innovative Space industry” and maximise the economy. To that end, it comprises a total budget of 14,88 billion Euros.

The details of Horizon Europe were also specified. It relies heavily on cooperation, development, and research. It has three main pillars: Excellent science, global challenges, European Industrial competitiveness and innovation in Europe. These unfold into their foci comprising many fields such as health, culture, innovation, civil security, environment, industry, and others. The speaker gave an extensive explanation of the ins and outs of the funds.

Reinhard Blasi of the European Union’s Agency for the Space Programme (EUSPA), Coordinator of the Office of the Executive Director and Acting Head of Communications, declared his focus was to give insight into what EUSPA could bring to the Azores. He also stated that the Azores contribute to EUSPA with the “important” ground sensor Station and search and rescue reference beacon. Once more, an orator mentioned the “unique” conditions of the Azores.

He then gave numerical data on the avoided waste of resources thanks to the technological application. The numbers presented are either of industrial or astronomical dimensions and clearly show the vast potential of cooperation from these projects. With this argument brought forward, the orator stated, in concord with previous speakers, that the Azores can benefit from European Space efforts with “safer, efficient maritime operations and ocean protection, sustainable and smart agricultural practices and emergency response management and resilience”.

ESA Space Solutions Coordinator Jorge Pimenta’s focus was start-ups, the private sector and access to funding. He introduced the ESA Business Incubation Centers concept and its technical support, expertise, funding, office space, customised assistance, and business development support. He broached the concept of technology brokers and the potentially productive symbiosis between the space and non-space industries. These tools could be very helpful to the Region. Lastly, he informed on the business applications with access to network and partners, tailored project management support, zero-equity funding and more technical support and expertise. As can be concluded, another front relying heavily upon cooperation.

Hélder Silva, Head of Space Software and Incorporated System of EDISOFT, explained the "collab" concept in his context. He considered it an instrument to "provide an interface between industry, academia and the markets" and even create highly skilled employment. He declared, "we should cooperate because we need to play on the global stage". He also advocated for "close coordination and alignment" as he categorised them as "extremely important". Once again, critical mass was mentioned, so it seems as another central concern of most parties involved in the Conference. This speaker added that he finds it pertinent to make data easy to transfer so that information and knowledge can circulate and encourage cooperation.

Some other speakers advocated for practicality, some argued in favour of prioritising what the final product is according to the client – "listen to the market", others advised that influencing projects is more important than financing start-ups.

Pedro Garcia from *Observatório Astronómico de Santana* (OASA) considered scientific education and dissemination crucial in the Space field and defended the importance of creating a system and community related to Space. The contribution of Artur Gil from the University of the Azores follows a similar line. His presentation's title was "Main Potential Contributions of the University of the Azores to the Strategy of the Azores for Space". The regional University is part of the Copernicus Academy Group and created the "Working Group for the Promotion of Space Sciences".

The goals of these established milestones are to incite cooperation between institutions. According to the presentation, the Copernicus Academy initiative connected 174 universities, research institutions, business schools, and private and non-profit organisations. It was also stated that the purpose of this network is to link academia with authorities and service providers. To "facilitate collaborative research, develop lectures, training sessions, traineeships, and education". Therefore, a strong emphasis on cooperation is noticeable.

Moderator Mr Garcia took the liberty to connect the previous answer to the panellist Artur Gil. "Do the Azores have already people with these kinds of skill sets to take full usage of Earth observation, or is our academia prepared to give those kinds of skill sets at least for now or in the future?".

Speaker Artur Gil responded by stating this ambition to be a process that required time. He claimed that a computer scientist would still need someone of the natural and

exact sciences to evaluate the harvested information. He admits it would be beneficial for a geographer, engineer, environmental scientist, and geologist to be more versed in coding, programming, and computing. In short, to invest realistically in capacity building.

Researcher Artur Gil concluded a chronological review of the Space project in the Azores. The overall sense is optimistic but aware of adversities. There is a reconciliation that the Santa Maria Spaceport is already late. There are several fully operational spaceports around the world completely able to deliver what the Azorean Spaceport will be able to provide.

One advantage some partners and potential users look forward to is the Azores being part of European Union territory. The experts involved in the strategy are fully aware of the difficulty in convincing skilled workers to settle in the Region and the challenge of paying them a fair wage. Nevertheless, the benefits the archipelago can offer seem to be appealing enough to attract several players.

4. Comparative analysis of space projects in French Guiana.

The relationship between international cooperation, socio-economic development, and a well-implemented strategy has more details, and implications than a single person alone can know. It should be noted that it is possible to come across opposing views and dichotomies regarding the perceived benefits. As research is done in several fields, such as meteorology, engineering, diplomacy, and safety, specialists place their concerns on various factors or different hierarchies. A blatant case was French Guiana's cosmodrome.

Although Arianespace – through its contemporary Head Roger Solari – ensured in 1999 that "a very precise environment and safety regulation" was followed with the end to preserve people, there is still scepticism surrounding the pollution generated in launches – especially from environmentalists (Journeyman Pictures, 1999). This is due to the tonnes of aluminium, carbon dioxide, and soot released at each rocket launch. Mr Solari added that a safety organisation was present in the facilities, every operation had due process, and appropriate measurements in the launch surroundings were carried out for environmental surveillance. According to the source, lab tests in animals affected by the aforementioned elements and compounds showed pulmonary damage. Details of the experiment are not disclosed in the source, and how they compare to the real-life scenario and dispersion in the open. The source also claims acid rain resulted from the launches and, at the time of the documentary, had not been investigated. On the *Centre Spatial Guyanais*' (CSG) website (Guiana Space Center, 2022), there is a tab dedicated to environment and safety with seven subtabs. In these tabs, they argue they care about the ecological impacts of space activities and declare they supervise and measure said impacts. They provide details of how they proceed to oversee these impacts and where they are reported to. On the site is also claimed that the *Centre national d'etudes spatiales* (CNES) – one of the responsible actors in the space activities in CSG – is "subject to regulations" for "the protection of the environment". On the site is also stated that partnerships are in place to protect biodiversity. Already detectable a split in the perception of reality between agencies and environmentalists; this is just one.

Another tab that is pertinent to evaluate, as the issue has come up in the concerns of the inhabitants of Santa Maria Island, is the industrial risk reduction and launch procedures. These two fronts are coped with mandatory personnel training and specific before and after launch checklists and procedures. Emergency plans are also prepared in

case of an accident, and a procedure checklist for the population to increase their safety. More specifically, according to the source, the before-launch procedure involves launcher trajectory analysis, flight corridor calculation, security forces deployment, and establishing a security cell. The website does not specify details about the deployed armed forces. This detail will prove crucial later on.

During the launch, there is real-time rocket monitoring and eventual destruction of the rocket in case of dangerous adversity.

Another example of deeply sensible friction between the locals and the space players relates to jobs and implied history. Before the ’40s of the twentieth century, French Guiana was a French colony – not only, but a penal one. The aggravating fact that locals do not mostly take skilled jobs in the local space industry adds substantially to the discontent. Not only do the locals feel the weight of the colonialist past, but they also feel they do not benefit from the space economy.

The insinuations of this situation are enormous. With so many millions at stake, and several reported trespassing incidents on-site, as of 1999 (proved by the video documentary “Why Does French Guiana Not Fully Benefit From Its Space Station?” (1999)), the French foreign legion is called to defend the perimeter of the cosmodrome. The parts involved in the launches come to the region by boat and are then very slowly transported to the cosmodrome. While this happens, road traffic is severely impaired. Also to note is that the parts are fabricated in Europe.

The Center is on the coast, a few kilometres from the harbour. Also, when describing the colony prison, the narrator infatuates a sense of inescapability only to contradict herself, immediately declaring that many escapees would be found dead in the jungle days after their escapes. An interviewed local also seemed anachronistic in her remarks – between her age and the practice abolishment. The interviewed Historian stated that prisoners had no way back to France even after their sentence (8:09). This is not entirely true as in the Dreyfus affair, being that Alfred Dreyfus was exonerated, reinstated into the French Army and served in World War I. A peculiar case, of course, is not representative of the majority. However, a point that diverges from the statements provided in the video documentary. Not to be overly thorough or discredit the documentary and the people involved. The Historian herself refers to Dreyfus, and as a specialist, she most likely did

not mean a return to France was impossible, just unlikely. The video itself is quite informative, but some prior context might be needed before watching it.

With the first launch in French Guiana dated in 1968, there has been plenty of time to change the status quo. While there seems to have been some improvement, statistically, at least, more also appears to be possible. The numbers in sources have some amplitude in variation. The documentary, dated 1999, states that 500 people worked daily on the cosmodrome, with 2500 people working there on launch days. The Wikipedia article on the Guiana Space Centre's (Infobox, 2022) infobox declares 1525 direct jobs and 7500 indirect jobs – 2011 statistics. A more recent source (Institut D'Émission des Départements D'Outre-Mer, 2020) dated 2020 declared that the space sector (not only the cosmodrome) employed 4620 people in Guiana, with estimates claiming as many as 9000 direct and indirect jobs (Henry, 2018).

The French 10 million euros investment in French Guiana strongly proves that more can be done. It was not accidental. It happened after a major local protest. The protesters blocked the Guiana Space Center for five weeks to make themselves heard on the topic of inequality in standards of living between French Guiana and mainland France. According to the referred news article (Henry, 2018), between 2014 and 2020, CNES provided funding for educational programs and economic contributions to local society. The same article declared an unemployment rate of 20%, referring to the European Commission figures, with more than 40% of the population being younger than 20 years old.

In a demographic document of the French *Institut national de la Statistique et des études économiques* (économiques, 2022), regarding population estimation by region, gender, and age, French Guiana raised from 155 760 in 1999 – date of the video documentary - to 294 436 in 2022.

This brings many factors into consideration regarding the social state of affairs and the return of space endeavours to society. Did the space industry, with all the millions in return, fail the local people and favoured a select few skilled outsiders? Or did the population grow too fast for the space industry contributions to be felt? Did the space entities fail to give the locals more opportunities, or did the locals not invest efforts in their education? Or was it the education system that failed to provide an appropriate response and approach? These questions are still very superficial compared to all the

details and other implications involved. Nevertheless, they are critical to evaluate the real return of the space industry to their local region. The question sure bears weight among the inhabitants of Santa Maria Island.

The protests at the French Guiana Cosmodrome proved a point: protests and blockades are to be avoided. The five-week protest halted three launch campaigns, and time allocated for maintenance had to be used to compensate for cancelled launches. This is not an ideal procedure by any chance.

The situation was appeased by signed agreements favouring the University of French Guiana. The intention is to boost higher education, research, and innovation, develop laboratories, and infrastructures, modernise the university, and oversee doctoral grants and research contracts. “Primary and secondary schools”, probably translated to elementary and high schools, respectively, will work together with CNES and the Guianese Education Authority to encourage scholarships and apprenticeships locally, according to the news article.

The article also claims approximately 9000 jobs are generated by the cosmodrome and represent 40% of the “territory’s private wages, according to Arianespace estimate” and that in 2017 the director of the GSC, Didier Faivre, claimed 70% of the cosmodrome’s staff were local hires. The information provided by the *Institut D’Émission des Départements D’outre-Mer* claims the space sector employs 4620 people in Guiana, which corresponds to under 10% of the territory’s wages. These estimates are too different for concord. There is also a difference in percentages of GDP attributed to the space sector in time. From 28% in 1990 to 15% in 2014, it is speculated that this is due to growth in the overall economy, but it remains hard to make verified conclusions.

Europe is notably highly invested in space efforts, and this is visible in the investment made in CSG. Nevertheless, the locals affirm Europe’s interests in Guiana stop at the cosmodrome. Local voices went as far as to accuse the French state of colonial practices (Redfield, 2000). Colonial tension is not predicted to occur in the Azorean situation, the archipelago is Portuguese territory, but for some, the innuendo might be there. Even if not directly related to colonialism per se, some Azoreans feel that the region might only get the disadvantages of space efforts while the rest of the country gets to reap the benefits (Garcia P. J., 2019).

As seen, socio-economic benefits and the implementation of space strategies, programs, and policies are not automatically harmonious. Far from it, the existence of some prestige and well-paid limited positions will cause tensions and sociocultural speculation and scrutiny. Another comparison can be made between French Guiana and the future application of the Azorean space strategy. The success of the strategy will depend highly on advanced and skilled jobs. At first, most specialists will not be locals, and that probably will not change for some time as first, the education system has to be changed, and locals have to be attracted to space and STEM-related degrees. Many specialists will be foreigners or Portuguese from the mainland. It is important to remember that Azoreans have a historical record of being xenophobic and discriminatory, such as on occasions of the first World War with German prisoners of war being stoned after release, discrimination, and threats to non-natives, separatist movements, and prejudice towards immigrants. While this is not the majority of the population, this small demographic slice is predicted to pose friction when mainlanders and foreigners come to the region to work highly paid-jobs.

These frictions also happened throughout time in the CSG. Tensions between workers have been reported as European engineers accused Guianese workers of a lack of professionalism (Redfield, 2000). Taking into account that Azoreans might have a lower level of literacy in space sciences, they will probably work jobs lower in the hierarchy. It would be naïve to assume collisions of personality and of a socio-cultural nature will not occur.

The picture painted by ESA, CNES, and the French government is predictably more cheerful. Their argument leans on the investment made in the region. They invest in the CSG, the military, security, surveillance, economic development report, road system, air and sea links, power generation, telecommunications, and water supply systems (European Space Agency, s.d.). The report on the impact of space activities in French Guiana thoroughly explains the multiplying effect of each euro invested in the space industry in the region, with the final table illustrating figures in the billions.

	Increased by
Domestic output across all sectors outside of space	€ 11.30 B
Domestic capital goods output	€ 0.72 B
Domestic intermediate goods output	€ 0.68 B
Domestic construction output	€ 0.70 B
Domestic transport output (excluding space)	€ 0.73 B
Domestic real estate output	€ 2.10 B
Domestic business services output	€ 5.00 B
Total wages and salaries in Guiana	€ 2.00 B

Table 7 – Estimated (Type II multiplier) impact of CSG expenditure on the economy of Guiana. Source: https://www.esa.int/About_Us/Business_with_ESA/Global_Space_Economic_Forum/Impact_of_space_activities_in_French_Guiana

This clear divide in perspective, evaluation, and situational awareness is one of the reasons behind the occupation of the centre on April 4th of, 2017. Despite the optimistic views among those responsible for the space efforts in French Guiana, the population feels that historical inequalities are being perpetuated. The locals feel the drag of underinvestment and the continuation of what they still consider colonialism (France 24, 2017).

The use of the land for the benefit of European interests without the local improvement in quality-of-life set the argument for local discontent. Indeed, French Guiana stands as one of the poorest French territories. With approximately 7000 kilometres separating Paris from Kourou, and the demographics showing a 250 000 strong population with a 15 000€ per capita income (France 24, 2017), "less than half the average on mainland France", the local arguments seem rather strong. The distance, the disparity in benefits, and the comparison of the local economy with the mainland economy helps those establishing similarities with colonialism.

Still, despite the effective blockade of the CSG, the ensuing economic injection was below the demanded sum.

Adding to high unemployment rates, higher crime rates, and lack of infrastructure, a part of the population also lacks access to potable water, and medical and educational facilities (Fernholz, 2017). This contrasts with the CSG infrastructure – comprising some of the world's most advanced complexes. With Arianespace, one of the primary users of Guiana's cosmodrome, claiming €1.25 billion in revenues in 2021 (Arianespace company profile, 2021), it can be stated that this prosperity is not so visibly spilling into the local

society, despite tables mentioning multiplier returns. It is not just necessary to prove a return to the local population; this return must also be felt. Otherwise, protests are bound to emerge. Public opinion and morale are important for space efforts. Arianespace also claims a 2021 operational record of 15 launches. This is a remarkable performance. Of course, just a few select entities cannot realistically carry a whole society. However, when confronted with these results, the population is probably overwhelmed with a sense of injustice.

The cosmodrome has become a cleavage in understanding and a resentment issue. The local populations feel their needs have been disregarded and only the space centre really matters to those in power. Not surprisingly, the cosmodrome is now a powerful negotiation tool, if not the perfect hostage for locals to feel heard. According to them, it is unacceptable to have top-tier, state-of-the-art facilities next to underdeveloped land lacking electricity, potable water, and transportation capacity. If there are means to transport satellites by rail, there is no excuse for the same conditions being non-existent for the welfare of the people.

Arianespace chief executive officer, Stephane Israel and director of the Guiana Space Center, Didier Faivre, were interviewed in 2018 about the protests, and their opinion on the resurgence of frictions was very different (Teffer, 2018). Director Faivre declared protests could happen again, as the region's main problems had not been addressed – such as high unemployment and low economic diversification. He also noted that the space centre itself cannot be the foundation of the local economy.

On the other hand, Chief executive officer Stephane Israel declared the episode to be behind them and that many launches have occurred since. He even claimed to have forgotten they happened until asked about them in the interview.

A clear dichotomy in opinions. This is a striking indication of disharmony. If the local population is ever to share Director Faivre's opinion, tensions will rise again. The article mentions the UK space agency's decision to build their spaceport in favour of the A'Mhoine peninsula in Sutherland county. One insinuation is the expectations of the people regarding the spaceport. Isolated settlements may struggle financially and look to spaceports with expectations regarding economic benefits. This might come later as a disappointment as spaceports tend to bring outside expertise and financially benefit a

select group of people. Time will tell if local resentment will resemble other regions where cosmodromes have been built.

Since there is insistence and value in having a cosmodrome near the equator for operational reasons, such as taking advantage of the planet's rotation to achieve geostationary orbits and the need for less fuel, there is also interest in keeping the locals happy. Its location near the ocean and surrounded by the sparsely populated jungle is also another huge plus. The importance of preserving such a privileged position on the globe for a cosmodrome is related to latitude. If we take the example of the Russian Soyuz rockets when being launched from Baikonur in Kazakhstan, they can transport a payload as heavy as 1.7 tonnes into geostationary orbit. If the same launch is to take place at Guiana Space Center, the possible payload is increased to 3 tonnes (Wiegand, 2017).

5. Evaluation of the socio-economic benefits for the Azores resulting from the implementation of a successful space strategy

Returning to the Azorean case, and bearing all the previous analysis in mind, some of the intended benefits of the Strategy of the Azores for Space are (Estrutura de Missão dos Açores para o Espaço, Strategy of the Azores for Space, 2021):

- The safeguard of the territory and its environment;
- Creation, attraction, and retention of a highly skilled workforce for the benefit of the local economy;
- Development of critical infrastructure related to space;
- Coordination of space-related activities;
- Promotion of space and aerospace-related activities;
- Promotion of crossover effects into other industries existent in the Region, namely some already mentioned – agriculture, maritime, and tourism;
- Encouragement of space education;
- Development of the space ecosystem into a space cluster with the involvement of science and research players and the aerospace industry;
- Intelligent articulation with other technological investments.

The fruition of all these entries is dependent on strong international cooperation. Thankfully, the good relations with European and North American nations will influence this favourably. The keywords regarding the cooperative concept are synergies, partnerships, industry, academia, value, effectiveness, competence, development, and prosperity.

The Region's visibility has increased due to tourism, social media, and even the Conference held in November 2021. The Region applies public funding, public policies, and public mandatory services too heavily. Too many of the Region's intricacies and problems are approached with an overboard sense of offer and service while economic sustainability and profit are treated with remarkable disregard. In truth, the Azorean citizen is too demanding relatively to the wealth it generates.

This substantially increases the importance of the private sector. Thankfully, the regional government of the Azores is putting effort into making the Region seem

attractive to the private players and their investment. Otherwise, the Region will fall into its habits, and the space sector risks becoming another expense.

There is a clear need to be smart about the methodology of strategic implementation. The archipelago comprises nine islands, and they are very competitive with each other when it comes to amenities. This led to a vicious cycle of political promises, the overloading of public companies in terms of human resources, and mounting debt. Positive net impacts are not only expected; they are direly needed if the Region is to go forward. Without economic prosperity, enduring societal Azorean problems like low education will persist. The political class has had evident ineffectiveness in trying to convince Azoreans to study more.

In the Strategy of the Azores for Space document, page 18, the authors claim space technologies and applications have a considerable spillover effect potential to other market sectors. The Region's experts and politicians seem to be counting on this and are using the argument to convince the people of the strategy's usefulness.

It is important to note the likelihood of tensions similar to those studied in French Guiana. The immediate economic benefits to the locals will not mostly result from the wages of the most wanted job positions in the space industry as, in general, the Azoreans do not possess significantly high academic qualifications. These high salaries will mostly go to experts from outside the Region. The Azoreans can only hope for the spillover or the less favourable jobs created by the space industry. And here, the problems and tensions are expected to begin.

Only with time and predicted painful delay will more Azoreans attain academic skills related to space and be eligible for the most coveted and well-paid jobs. In the meantime, some Azoreans will be able to apply for jobs in research, engineering, and positions of similar essence. Maybe even in indirect jobs and services, then possible by using space-generated data. Until then, the situation will bear some resemblance to French Guiana, even though not expected to be as dire.

This study of Azorean regional statistics brings to light some factors that will impose delays in popular gratification and generational lagging. A part of the able-bodied and working-age population is idle and low levels of education significantly handicap the population. It is also important to note that the unemployment levels seem deflated. This is most likely due to established government internships and programs. Some can even

be considered precarious or temporary activities. Still, because the government considers them to be jobs, it prevents the people enrolled in them from being presented as unemployed in the statistics.

To analyse this, a comparison between the official regional statistics is prepared below. First, a nationwide comparison between the years 2015 and 2019 in five different factors: Investment in Research and Development, unemployment rate, activity rate, criminality rate, and political participation factor of abstention rate. Four regional statistical published tables will be added. They will enable the analysis of the active population, employed population, total population and employment rate. These factors will be considered against age, gender and academic qualification.

A detail (2010-2020) of the continuous statistic table related to unemployment, active population and activity rate between 1981 and 2020 will also be inserted for analysis. These factors were chosen to illustrate some tendencies of the Azorean society and to help draw some details of the population.

Indicadores de Investigação e Desenvolvimento (I&D), 2016
Research and Development Indicators (R&D), 2016

	Despesa em I&D no PIB *GERD as precentage of GDP*	Despesa em I&D nas empresas *Business enterprises expenditure on R&D*	Despesa em I&D no Estado *Govermment expenditure on R&D*	Pessoal (ETI) em I&D na população ativa *R&D personnel (FTE) in active population*	Despesa média em I&D por unidade *Average expenditure on R&D per unit*
	%	%	%	‰	milhares de euros *thousand euros*
Portugal	**1,29**	**48,4**	**5,3**	**9,7**	**608,2**
Continente	**1,34**	**48,8**	**5,1**	**10,1**	**615,7**
Norte	1,37	49,9	5,2	9,0	532,9
Centro	1,27	52,0	1,8	8,6	424,3
A. M. Lisboa	1,61	47,5	6,7	15,3	945,1
Alentejo	0,54	49,6	0,7	3,8	383,6
Algarve	0,36	16,4	2,2	3,7	404,5
R. A. Açores	**0,30**	**7,4**	**21,3**	**2,7**	**218,8**
R. A. Madeira	0,31	22,5	22,2	3,1	390,0

Fonte: Ministério da Educação e Ministério da Ciência, Tecnologia e Ensino Superior - Direção-Geral de Estatísticas de Educação e Ciência; INE, I.P., Contas Regionais.
Source: Ministry of Education and Ministry of Science, Technology and Higher Education - Directorate-General of Education and Science Statistics; Statistics Portugal, Regional accounts.

Image 1 – Portuguese Research and Development indicators (R&D), 2016

Source: As stated in the image – page 55

Indicadores de Investigação e Desenvolvimento (I&D), 2018
Research and Development Indicators (R&D), 2018

	Despesa em I&D no PIB *GERD as precentage of GDP*	Despesa em I&D nas empresas *Business enterprises expenditure on R&D*	Despesa em I&D no Estado *Govermment expenditure on R&D*	Pessoal (ETI) em I&D na população ativa *R&D personnel (FTE) in active population*	Despesa média em I&D por unidade *Average expenditure on R&D per unit*
	%	%	%	‰	milhares de euros *thousand euros*
Portugal	**1,35**	**51,4**	**5,3**	**11,1**	**653,4**
Continente	**1,40**	**51,8**	**5,2**	**11,5**	**660,7**
Norte	1,51	54,3	5,6	10,8	603,5
Centro	1,30	52,3	1,9	10,1	446,6
A. M. Lisboa	1,62	50,1	6,6	16,6	1011,1
Alentejo	0,67	58,1	0,6	4,9	399,1
Algarve	0,33	16,6	3,8	3,5	342,8
R. A. Açores	**0,32**	**13,8**	**8,8**	**2,9**	**375,5**
R. A. Madeira	0,38	32,1	23,8	4,0	316,8

Fonte: Ministério da Educação e Ciência - Direção-Geral de Estatísticas de Educação e Ciência; INE, I.P., Contas Regionais (Base 2016).
Source: Ministry of Education and Science - Directorate-General of Education and Science Statistics; Statistics Portugal, Regional accounts (Base 2016).

55 **CIÊNCIA E TECNOLOGIA / SCIENCE & TECHNOLOGY**

Image 2 – Portuguese Research and Development indicators (R&D), 2018.

Source: As stated in the image – page 55.

The Azores stand as the poorest Portuguese region. So not only it spends less of its GDP on research – 0,32% versus 1,35% national average -, its Gross Domestic Product (GDP) is also inferior, at 4.421 billion in 2019 (SREA - Estatísticas dos Açores, 2020). Even though spending on research increased slightly from 2016 to 2018, 653.4 thousand Euros for a country with the dimension of Portugal seems rather insufficient.

Indicadores de justiça, 2017 (Unidade: ‰).
Justice indicators, 2017 (Unit: ‰).

TAXA DE CRIMINALIDADE POR CATEGORIA DE CRIMES / *CRIMINALITY RATE BY TYPE OF CRIME*

	Total *Total*	Crimes Contra a integridade física *Assault*	Furto/roubo por esticão e na via pública *Theft/purse snatching and robbery in public road*	Furto de veiculo e em veiculo motorizado *Theft of/in motor vehicles*	Condução de veiculo com taxa de álcool igual ou superior a 1,2 g/l *Driving a motor vehicle with a blood alcohol equal or higher than 1,2 g/l*	Condução sem habilitação legal *Driving without legal documentation*
Portugal	**33,2**	**5,2**	**1,0**	**3,2**	**1,9**	**0,9**
Continente	**33,0**	**5,0**	**1,0**	**3,3**	**1,9**	**0,9**
R. A. Açores	**38,0**	**9,1**	**0,1**	**2,1**	**2,5**	**1,1**
Santa Maria	24,1	5,8	0,0	1,4	3,0	...
São Miguel	41,5	10,7	...	2,5	2,9	1,2
Terceira	32,6	7,2	...	2,0	1,8	1,0
Graciosa	31,4	8,4	0,0	1,2	1,2	...
São Jorge	26,0	7,0	0,0	0,7	2,7	...
Pico	32,7	5,5	0,0	...	1,5	2,2
Faial	36,1	7,2	0,0	1,2	2,3	1,0
Flores	38,5	9,8	0,0	...	1,4	0,8
Corvo	32,5	8,7	0,0	0,0	0,0	...

FONTE: Ministério da Justiça, DIrecção Geral da Política de Justiça.
SOURCE: Ministry of Justice, Directorate-General for Justice Policy.

Image 3 – Criminality Rate in Portugal, 2017.

Source: As stated in the image – page 61.

Indicadores de justiça, 2019 (Unidade: ‰).
Justice indicators, 2019 (Unit: ‰).

TAXA DE CRIMINALIDADE POR CATEGORIA DE CRIMES / *CRIMINALITY RATE BY TYPE OF CRIME*

	Total *Total*	Crimes Contra a integridade física *Assault*	Contra o património *Against patrimony*	Furto de veiculo e em veiculo motorizado *Theft of/in motor vehicles*	Condução de veiculo com taxa de álcool igual ou superior a 1,2 g/l *Driving a motor vehicle with a blood alcohol equal or higher than 1,2 g/l*	Condução sem habilitação legal *Driving without legal documentation*
Portugal	**32,6**	**5,5**	**16,7**	**3,0**	**1,6**	**0,9**
Continente	**32,1**	**5,4**	**16,6**	**3,1**	**1,6**	**0,9**
R. A. Açores	**37,6**	**8,9**	**16,2**	**1,6**	**2,0**	**1,1**
Santa Maria	21,0	4,8	8,9	...	2,1	0,5
São Miguel	40,7	9,9	17,2	2,1	2,2	1,3
Terceira	32,4	8,2	14,3	1,2	1,9	1,0
Graciosa	33,3	8,6	14,3	0,7	2,4	0,7
São Jorge	33,1	8,1	11,1	0,5	2,5	1,0
Pico	33,3	...	18,2	...	...	1,5
Faial	36,7	7,2	17,4	1,2	1,8	0,3
Flores	40,2	10,2	12,1	0,8	...	0,0
Corvo	23,7	...	8,6	0,0	0,0	0,0

FONTE: Ministério da Justiça, DIrecção Geral da Política de Justiça.
SOURCE: Ministry of Justice, Directorate-General for Justice Policy.

61 **JUSTIÇA / JUSTICE**

Image 4 – Criminality Rate in Portugal, 2019.

Source: As stated in the image – page 61.

Concluding upon analysis of the two tables concerning the criminality rate of 2017 and 2019, it is possible to gauge that the numbers are not atypical. The use of two different years is to avoid randomly picking a year out of pattern. From these two tables, it is also possible to conclude that the Region of the Azores has a criminality rate above the national average.

Indicadores da participação política, 2015 e 2017. (Unidade: %).

Political participation indicators, 2015 and 2017. (Unit: %).

	Eleição para a Assembleia da República 2015 *Election to parliament 2015*		Eleição para as Câmaras Municipais 2017 *Election to Municipalities 2017*		
	Taxa de Abstenção *Abstention rate*	Proporção de votos do partido/coligação mais votado *proportion of votes the most voted party/coalition*	Taxa de abstenção *Abstention rate*	Partido/coligação mais votado *Party/Coalition most voted*	
Portugal	**44,1**	**36,9**	**45,0**	**37,8**	**PS**
Continente	**42,4**	**38,4**	**45,0**	**38,4**	**PS**
R. A. Açores	**58,8**	**40,4**	**46,6**	**45,0**	**PS**
Santa Maria	61,5	44,1	48,8	68,4	PPD/PSD
São Miguel	61,3	40,2	49,8	49,6	PPD/PSD
Terceira	57,2	42,0	48,6	54,7	PS
Graciosa	55,2	49,8	35,9	49,3	PS
São Jorge	54,2	32,9	35,0	32,2	GRUPOS CIDADÃOS
Pico	53,2	39,0	32,5	46,8	PS
Faial	52,0	37,4	36,8	47,1	PS
Flores	51,7	40,9	28,1	61,3	PS
Corvo	44,1	56,6	23,9	61,9	PS

FONTE: Secretaria-Geral do Ministério da Administração Interna - Administração Eleitoral.

SOURCE: General Secretariat of the Ministry of Home Affairs - Electoral Administration.

63 **PARTICIPAÇÃO POLÍTICA /** POLITICAL PARTICIPATION

Image 5 – Political participation indicators 2015 and 2017.

Source: As stated in the image – page 63.

Indicadores da participação política, 2017 e 2019. (Unidade: %).
Political participation indicators, 2017 and 2019. (Unit: %).

	Eleição para a Assembleia da República 2019 *Election to parliament 2019*		Eleição para as Câmaras Municipais 2017 *Election to Municipalities 2017*		
	Taxa de Abstenção *Abstention rate*	Proporção de votos do partido/coligação mais votado *proportion of votes the most voted party/coalition*	Taxa de abstenção *Abstention rate*	Partido/coligação mais votado *Party/Coalition most voted*	
Portugal	**51,4**	**36,3**	**45,0**	**37,8**	**PS**
Continente	**44,9**	**36,7**	**45,0**	**38,4**	**PS**
R. A. Açores	**63,5**	**40,1**	**46,6**	**45,0**	**PS**
Santa Maria	67,2	46,4	48,8	68,4	PPD/PSD
São Miguel	66,2	39,8	49,8	49,6	PPD/PSD
Terceira	61,1	41,0	48,6	54,7	PS
Graciosa	53,8	51,5	35,9	49,3	PS
São Jorge	59,6	35,1	35,0	32,2	OS CIDADÃOS
Pico	60,1	38,4	32,5	46,8	PS
Faial	56,2	37,1	36,8	47,1	PS
Flores	56,5	43,2	28,1	61,3	PS
Corvo	46,3	48,3	23,9	61,9	PS

FONTE: Secretaria-Geral do Ministério da Administração Interna - Administração Eleitoral.
SOURCE: General Secretariat of the Ministry of Home Affairs - Electoral Administration.

63 **PARTICIPAÇÃO POLÍTICA / POLITICAL PARTICIPATION**

Image 6 – Political participation indicators 2017 and 2019.

Source: As stated in the image – page 63.

This is another hot topic when it comes to the Azores. The high abstention levels. The citizens of the Region are usually criticised for their political passivity and misconceptions.

Q1 - População total por grupo etário, sexo e nível de escolaridade completo

População total	Sexo	Região Autónoma dos Açores								
		Valor trimestral					Média Anual	C.V.	Variação	
		4º T - 2019	1º T - 2020	2º T - 2020	3º T - 2020	4º T - 2020	2020	4º T - 2020	Homóloga	Trimestral
		Unidades							%	
1	2	3	4	5	6	7	8	9	10	11
População total	**HM**	**241 862**	**242 518**	**242 463**	**242 436**	**242 498**	**242 479**	-	**+0,3**	**0,0**
	H	**117 422**	**117 717**	**117 635**	**117 567**	**117 547**	**117 617**	-	**+0,1**	**0,0**
	M	**124 440**	**124 801**	**124 828**	**124 869**	**124 951**	**124 862**	-	**+0,4**	**+0,1**
População 15 e mais anos	HM	204 284	205 384	205 623	205 888	206 186	**205 770**	-	**+0,9**	**+0,1**
	H	98 289	98 698	98 725	98 769	98 827	**98 755**	-	**+0,5**	**+0,1**
	M	105 995	106 686	106 898	107 119	107 359	**107 016**	-	**+1,3**	**+0,2**
Menos de 15 anos	HM	37 578	37 134	36 840	36 548	36 312	**36 709**	-	**-3,4**	**-0,6**
	H	19 133	19 019	18 910	18 798	18 720	**18 862**	-	**-2,2**	**-0,4**
	M	18 445	18 115	17 930	17 750	17 592	**17 847**	-	**-4,6**	**-0,9**
Dos 15 aos 24 anos	HM	30 632	30 765	30 704	30 639	30 578	**30 672**	-	**-0,2**	**-0,2**
	H	15 573	15 594	15 551	15 509	15 469	**15 531**	-	**-0,7**	**-0,3**
	M	15 059	15 171	15 153	15 130	15 109	**15 141**	-	**+0,3**	**-0,1**
Dos 25 aos 34 anos	HM	33 660	34 122	34 136	34 148	34 165	**34 143**	-	**+1,5**	**0,0**
	H	17 056	17 151	17 105	17 055	17 012	**17 081**	-	**-0,3**	**-0,3**
	M	16 604	16 971	17 031	17 093	17 153	**17 062**	-	**+3,3**	**+0,4**
Dos 35 aos 44 anos	HM	38 303	38 144	37 977	37 806	37 648	**37 894**	-	**-1,7**	**-0,4**
	H	18 885	18 838	18 767	18 695	18 630	**18 733**	-	**-1,4**	**-0,3**
	M	19 418	19 306	19 210	19 111	19 018	**19 161**	-	**-2,1**	**-0,5**
Dos 45 aos 64 anos	HM	65 713	65 976	66 211	66 455	66 704	**66 337**	-	**+1,5**	**+0,4**
	H	31 727	31 881	31 975	32 072	32 175	**32 026**	-	**+1,4**	**+0,3**
	M	33 986	34 095	34 236	34 383	34 529	**34 311**	-	**+1,6**	**+0,4**
Com 65 e mais anos	HM	35 976	36 377	36 595	36 840	37 091	**36 726**	-	**+3,1**	**+0,7**
	H	15 048	15 234	15 327	15 438	15 541	**15 385**	-	**+3,3**	**+0,7**
	M	20 928	21 143	21 268	21 402	21 550	**21 341**	-	**+3,0**	**+0,7**
Dos 15 aos 64 anos	HM	168 308	169 007	169 028	169 048	169 095	**169 045**	-	**+0,5**	**0,0**
	H	83 241	83 464	83 398	83 331	83 286	**83 370**	-	**+0,1**	**-0,1**
	M	85 067	85 543	85 630	85 717	85 809	**85 675**	-	**+0,9**	**+0,1**
Nível de escolaridade completo (População 15 e mais anos)										
Até ao básico - 3º ciclo	HM	142 309	143 086	138 512	133 560	135 246	**137 601**	2,9	**-5,0**	**+1,3**
	H	72 330	72 159	70 731	69 082	70 092	**70 516**	2,9	**-3,1**	**+1,5**
	M	69 980	70 927	67 781	64 478	65 154	**67 085**	3,5	**-6,9**	**+1,0**
Secundário	HM	39 205	39 686	41 097	42 665	41 606	**41 264**	6,1	**+6,1**	**-2,5**
	H	19 033	19 500	20 136	20 273	19 947	**19 964**	8,1	**+4,8**	**-1,6**
	M	20 172	20 186	20 962	22 392	21 658	**21 299**	6,9	**+7,4**	**-3,3**
Superior	HM	22 769	22 612	26 014	29 663	29 334	**26 906**	8,9	**+28,8**	**-1,1**

Image 7 – Total Azorean Population by age, sex and education.

Source: SREA – Labour Market from 2011 to 2020

As it is possible to assess, considering citizens aged 15+, 137 601 inhabitants (approximately 56,7%) of the Azorean population only went as far as the 9th grade. This means portions of this statistic have less than the 9th grade. 41 264 (approximately 17%) completed secondary education, and 26 906 (approximately 11%) achieved higher education.

Unfortunately, it was impossible to compare statistics with the published data of the European Union. The tables illustrated belong to the labour market statistics. They reductively compare every citizen aged 15 and more and the total amount of citizens with tertiary education. Eurostat provides tertiary educational attainment statistics for the population aged 25 to 34.

The Azores score poorly education-wise. Maybe that explains why the Education and Culture section of the Regional Statistics website only contains five documents related to cultural events and not a single one regarding education. But in the Tourism tab of the same website, there are 46 different documents to examine (SREA - Serviço Regional de Estatística dos Açores, 2021).

This academic reality will pose a major obstacle in securing some frontline space industry jobs for the local population. There are many arguments advanced to explain this academic reality. Some of them argue about the harsh economic context of the archipelago. In the Azores, for many decades of the 20th century, it was common for people to walk barefoot, ride horses and carriages for work purposes, for some residential buildings to lack running water or electricity. According to the Research for REGI Committee report on the economic, social, and territorial situation of the Azores carried out by the European Parliament, “Until the early 1990s, the per capita GDP of the Azores was 42% of the EU average”, and household internet connection rate was of 37% in 2006, increasing to 70% in 2014. According to the same source, by the end of the application of the European Regional Development Fund of 2007 – 2013, an additional 100 727 inhabitants had running water than before the Community fund contributions (Azevedo, 2017).

Q2 - População ativa por grupo etário, sexo e nível de escolaridade completo

População ativa	Sexo	Região Autónoma dos Açores								
		Valor trimestral					Média Anual	C.V.	Variação	
		4º T - 2019	1º T - 2020	2º T - 2020	3º T - 2020	4º T - 2020	2020	4º T - 2020	Homóloga	Trimestral
		Unidades						%		
1	2	3	4	5	6	7	8	9	10	11
População ativa	**HM**	**120 659**	**120 736**	**118 316**	**123 950**	**121 652**	121 164	**2,0**	**+0,8**	**-1,9**
	H	**65 776**	**64 948**	**64 290**	**66 656**	**65 775**	65 417	**2,3**	**0,0**	**-1,3**
	M	**54 883**	**55 788**	**54 026**	**57 294**	**55 877**	55 746	**3,1**	**+1,8**	**-2,5**
Dos 15 aos 24 anos	HM	10 512	10 051	8 978	10 148	10 691	9 967	8,3	**+1,7**	**+5,3**
	H	6 086	5 541	5 173	5 428	5 795	5 484	8,5	**-4,8**	**+6,8**
	M	4 425	4 510	3 805	4 721	4 896	4 483	12,5	**+10,6**	**+3,7**
Dos 25 aos 34 anos	HM	28 931	29 548	27 780	29 169	27 807	28 576	3,0	**-3,9**	**-4,7**
	H	15 705	15 908	14 628	14 618	14 272	14 856	4,8	**-9,1**	**-2,4**
	M	13 226	13 640	13 152	14 551	13 535	13 720	4,3	**+2,3**	**-7,0**
Dos 35 aos 44 anos	HM	32 123	32 127	32 228	32 982	32 752	32 522	2,3	**+2,0**	**-0,7**
	H	16 828	16 661	17 098	17 572	17 024	17 089	2,3	**+1,2**	**-3,1**
	M	15 295	15 465	15 130	15 410	15 728	15 433	3,5	**+2,8**	**+2,1**
Dos 45 aos 64 anos	HM	46 743	46 712	46 370	48 487	47 449	47 255	2,9	**+1,5**	**-2,1**
	H	25 283	24 926	25 021	26 367	26 434	25 687	2,8	**+4,6**	**+0,3**
	M	21 460	21 786	21 349	22 120	21 015	21 568	4,8	**-2,1**	**-5,0**
Com 65 e mais anos	HM	2 350	2 298	2 959	3 164	2 954	2 844	15,4	**+25,7**	**-6,6**
Dos 15 aos 64 anos	HM	118 309	118 438	115 357	120 786	118 698	118 320	2,0	**+0,3**	**-1,7**
	H	63 902	63 036	61 920	63 985	63 524	63 116	2,2	**-0,6**	**-0,7**
	M	54 406	55 401	53 437	56 801	55 174	55 204	3,0	**+1,4**	**-2,9**
Nível de escolaridade completo										
Até ao básico - 3º ciclo	HM	71 827	70 704	65 823	66 976	65 457	67 240	3,8	**-8,9**	**-2,3**
	H	44 772	43 359	42 388	43 266	43 613	43 157	4,4	**-2,6**	**+0,8**
	M	27 054	27 344	23 435	23 710	21 844	24 083	6,2	**-19,3**	**-7,9**
Secundário	HM	30 019	30 936	31 395	32 296	31 583	31 552	6,7	**+5,2**	**-2,2**
	H	15 279	15 898	15 861	15 681	14 993	15 608	9,0	**-1,9**	**-4,4**
	M	14 740	15 038	15 534	16 615	16 590	15 944	8,1	**+12,5**	**-0,2**
Superior	HM	18 813	19 097	21 098	24 678	24 612	22 371	9,1	**+30,8**	**-0,3**
	H	5 725	5 691	6 041	7 709	7 169	6 652	15,4	**+25,2**	**-7,0**
	M	13 088	13 406	15 057	16 970	17 443	15 719	8,4	**+33,3**	**+2,8**

Image 8 – Azorean Working Age Population by age, sex and education.

Source: SREA– Labour Market from 2011 to 2020

From the total yearly average of 2020, and from a total of 242 479 inhabitants, 121 164 (approximately 50%) were active population – as in working age. Of these 121 164 inhabitants, 67 240 had the 9th grade tops. This means approximately 55% of the Azores' working-age population is limited in education attainment. 31 552 people in this statistic (approximately 26%) had secondary education, and 22 371(approximately 18,5%) people with tertiary education were part of this working-age population.

Q4 - População empregada por grupo etário, sexo e nível de escolaridade completo e População desempregada

População empregada	Sexo	Região Autónoma dos Açores								
		Valor trimestral					Média Anual	C.V.	Variação	
		4º T - 2019	1º T - 2020	2º T - 2020	3º T - 2020	4º T - 2020	2020	4º T - 2020	Homóloga	Trimestral
		Unidades						%		
1	2	3	4	5	6	7	8	9	10	11
População empregada	**HM**	**111 530**	**112 022**	**112 522**	**115 599**	**114 975**	**113 779**	**2,1**	**+3,1**	**-0,5**
	H	**60 367**	**59 691**	**60 610**	**62 303**	**62 498**	**61 276**	**2,7**	**+3,5**	**+0,3**
	M	**51 164**	**52 331**	**51 912**	**53 296**	**52 477**	**52 504**	**3,0**	**+2,6**	**-1,5**
Dos 15 aos 24 anos	HM	8 036	7 757	7 288	7 579	8 422	7 762	9,6	+4,8	+11,1
	H	4 387	4 031	3 992	4 184	4 646	4 213	10,2	+5,9	+11,0
	M	3 649	3 726	3 296	3 395	3 776	3 548	14,3	+3,5	+11,2
Dos 25 aos 34 anos	HM	26 810	26 730	25 596	25 772	25 392	25 873	3,7	-5,3	-1,5
	H	14 393	13 999	13 271	12 855	13 242	13 342	6,1	-8,0	+3,0
	M	12 417	12 731	12 324	12 917	12 150	12 531	5,5	-2,1	-5,9
Dos 35 aos 44 anos	HM	30 118	30 104	31 379	31 537	31 584	31 151	2,9	+4,9	+0,1
	H	15 859	15 614	16 475	16 809	16 525	16 356	3,3	+4,2	-1,7
	M	14 258	14 490	14 903	14 727	15 058	14 795	3,8	+5,6	+2,2
Dos 45 aos 64 anos	HM	44 216	45 132	45 300	47 547	46 661	46 160	3,0	+5,5	-1,9
	H	23 853	24 135	24 501	25 783	25 833	25 063	3,0	+8,3	+0,2
	M	20 363	20 997	20 799	21 764	20 828	21 097	4,8	+2,3	-4,3
Com 65 e mais anos	HM	2 350	2 298	2 959	3 164	2 916	2 835	15,5	+24,1	-7,8
Dos 15 aos 64 anos	HM	109 180	109 724	109 562	112 435	112 059	110 945	2,1	+2,6	-0,3
	H	58 493	57 780	58 240	59 631	60 246	58 974	2,6	+3,0	+1,0
	M	50 687	51 944	51 323	52 804	51 812	51 971	3,0	+2,2	-1,9
Nível de escolaridade completo										
Até ao básico - 3º ciclo	HM	64 676	64 859	62 204	61 766	61 774	62 651	4,1	-4,5	0,0
	H	40 319	39 931	39 975	40 240	41 379	40 381	4,7	+2,6	+2,8
	M	24 357	24 928	22 229	21 526	20 395	22 269	6,4	-16,3	-5,3
Secundário	HM	28 481	28 684	29 593	29 851	29 189	29 329	6,5	+2,5	-2,2
	H	14 485	14 371	14 787	14 616	14 079	14 463	9,2	-2,8	-3,7
	M	13 995	14 313	14 806	15 235	15 110	14 866	8,1	+8,0	-0,8
Superior	HM	18 374	18 479	20 725	23 982	24 012	21 800	9,3	+30,7	+0,1
	H	5 562	5 389	5 848	7 447	7 040	6 431	15,7	+26,6	-5,5
	M	12 811	13 090	14 877	16 535	16 972	15 369	8,6	+32,5	+2,6
População desempregada	**HM**	**9 128**	**8 714**	**5 795**	**8 351**	**6 677**	**7 384**	**14,8**	**-26,9**	**-20,0**
	H	**5 409**	**5 257**	**3 680**	**4 353**	**3 277**	**4 142**	**19,4**	**-39,4**	**-24,7**
	M	**3 719**	**3 457**	**2 115**	**3 998**	**3 400**	**3 242**	**19,7**	**-8,6**	**-15,0**

Image 9 – Employed Azorean Population by age, sex and education.

Source: SREA– Labour Market from 2011 to 2020

The statistics claim that 113 779 people are employed in the Azores. 62 651 (approximately 55%) of these have, at most, the 9th grade. 29 329 (approximately 25,8%) have finished high school, and 15 369 (approximately 13,5%) have a college degree. It seems several thousands of college graduates working age people are unemployed.

Q5 - Taxa de emprego por grupo etário, sexo e nível de escolaridade completo e Taxa de desemprego

Taxa de emprego	Sexo	Região Autónoma dos Açores								
		Valor trimestral					Média Anual	C.V.	Variação	
		4º T - 2019	1º T - 2020	2º T - 2020	3º T - 2020	4º T - 2020	2020	4º T - 2020	Homóloga	Trimestral
		%								
1	2	3	4	5	6	7	8	9	10	11
Taxa de emprego	**HM**	**54,6**	**54,5**	**54,7**	**56,1**	**55,8**	**55,3**	**2,1**	**+1,2**	**-0,3**
(15 e mais anos)	**H**	**61,4**	**60,5**	**61,4**	**63,1**	**63,2**	**62,0**	**2,7**	**+1,8**	**+0,1**
	M	**48,3**	**49,1**	**48,6**	**49,8**	**48,9**	**49,1**	**3,0**	**+0,6**	**-0,9**
Dos 15 aos 24 anos	HM	26,2	25,2	23,7	24,7	27,5	25,3	9,6	**+1,3**	**+2,8**
	H	28,2	25,8	25,7	27,0	30,0	27,1	10,2	**+1,8**	**+3,0**
	M	24,2	24,6	21,8	22,4	25,0	23,4	14,3	**+0,8**	**+2,6**
Dos 25 aos 34 anos	HM	79,7	78,3	75,0	75,5	74,3	75,8	3,7	**-5,4**	**-1,2**
	H	84,4	81,6	77,6	75,4	77,8	78,1	6,1	**-6,6**	**+2,4**
	M	74,8	75,0	72,4	75,6	70,8	73,4	5,5	**-4,0**	**-4,8**
Dos 35 aos 44 anos	HM	78,6	78,9	82,6	83,4	83,9	82,2	2,9	**+5,3**	**+0,5**
	H	84,0	82,9	87,8	89,9	88,7	87,3	3,3	**+4,7**	**-1,2**
	M	73,4	75,1	77,6	77,1	79,2	77,2	3,8	**+5,8**	**+2,1**
Dos 45 aos 64 anos	HM	67,3	68,4	68,4	71,5	70,0	69,6	3,0	**+2,7**	**-1,5**
	H	75,2	75,7	76,6	80,4	80,3	78,3	3,0	**+5,1**	**-0,1**
	M	59,9	61,6	60,8	63,3	60,3	61,5	4,8	**+0,4**	**-3,0**
Com 65 e mais anos	HM	6,5	6,3	8,1	8,6	7,9	07,7	15,5	**+1,4**	**-0,7**
Dos 15 aos 64 anos	HM	64,9	64,9	64,8	66,5	66,3	65,6	2,1	**+1,4**	**-0,2**
	H	70,3	69,2	69,8	71,6	72,3	70,7	2,6	**+2,0**	**+0,7**
	M	59,6	60,7	59,9	61,6	60,4	60,7	3,0	**+0,8**	**-1,2**
Nível de escolaridade completo										
Até ao básico - 3º ciclo	HM	45,4	45,3	44,9	46,2	45,7	45,5	3,1	**+0,3**	**-0,5**
	H	55,7	55,3	56,5	58,2	59,0	57,3	3,7	**+3,3**	**+0,8**
	M	34,8	35,1	32,8	33,4	31,3	33,2	5,3	**-3,5**	**-2,1**
Secundário	HM	72,6	72,3	72,0	70,0	70,2	71,1	3,2	**-2,4**	**+0,2**
	H	76,1	73,7	73,4	72,1	70,6	72,5	4,6	**-5,5**	**-1,5**
	M	69,4	70,9	70,6	68,0	69,8	69,8	4,7	**+0,4**	**+1,8**
Superior	HM	80,7	81,7	79,7	80,9	81,9	81,0	2,7	**+1,2**	**+1,0**
	H	80,3	76,6	74,4	79,1	80,1	77,5	4,4	**-0,2**	**+1,0**
	M	80,9	84,1	81,9	81,7	82,6	82,6	3,1	**+1,7**	**+0,9**
Taxa de desemprego	**HM**	**7,6**	**7,2**	**4,9**	**6,7**	**5,5**	**6,1**	**14,5**	**-2,1**	**-1,2**

Image 10 – Azorean Employment Tax by age, sex and education.

Source: SREA– Labour Market from 2011 to 2020

In this table, it is possible to ascertain that the most skilled people have a higher level of employment in their categories. The unemployment tax, as mentioned before, seem deflated.

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
População Empregada nº	HM	109 721	106 382	101 800	99 183	101 769	106 715	107 345	111 246	111 799	113 665	113 779
	H	64 889	60 706	58 100	54 357	56 447	57 993	57 562	59 493	61 227	62 516	61 276
	M	44 832	45 676	43 700	44 826	45 322	48 723	49 783	51 753	50 572	51 150	52 504
População Desempregada nº	HM	8 010	13 583	18 200	20 283	19 815	15 600	13 452	10 963	10 514	9 734	7 384
Taxa de Desemprego %	HM	6,8	11,3	15,1	17,0	16,3	12,8	11,1	9,0	8,6	7,9	6,1
População Activa nº	HM	117 731	119 964	120 000	119 466	121 583	122 315	120 797	122 209	122 313	123 400	121 164
	H	69 503	68 733	69 500	67 504	67 333	67 716	65 592	65 825	66 712	67 497	65 417
	M	48 228	51 231	50 500	51 962	54 251	54 598	55 205	56 384	55 602	55 903	55 746
Taxa de Actividade %	HM	47,7	48,6	48,5	48,2	49,1	49,4	49,3	50,0	50,4	51,0	50,0
	H	57,2	56,5	57,1	55,4	55,4	55,7	54,7	55,3	56,6	57,4	55,6
	M	38,5	40,9	40,2	41,3	43,1	43,4	44,2	44,9	44,6	44,9	44,6

Image 11 – Detail (2010 – 2020) of the Employment and Unemployment statistics between 1981 and 2020

Source: SREA – Long Series – Labour Market – *Mercado de Trabalho.*

All these statistical considerations are useful in considering how the space efforts will land in the Azorean society. The space industry is a relatively advanced socioeconomic civilisational state. It is safe to say that the Azorean society, even though it might be ready to host space efforts in its region, is not ready to be the main beneficiary of all the most desired advantages. As mentioned, hopes are that the spillover will be enough to benefit the Azoreans and keep them happy while they get up to speed on their academic qualifications. Nevertheless, the SAzS remains optimistic, claiming permanent local jobs related to supply chain, management, operations, and maintenance will be created in the meantime. An essential step in their coveted creation of an industrial and scientific cluster in the Region.

Another target of the SAzS is space tourism. Indeed, the archipelago is well equipped for this end. Due to its geostrategic position, it was the recipient of vast investments from the United States. Before airplanes could cross the Atlantic in a single flight, this insufficient autonomy/range meant that airplanes needed a stepping-stone in the Atlantic Ocean to refuel. This stepping-stone was the Azores. More so, the archipelago was an oceanic buffer zone for the security of the United States. Excruciating were the lengthy, hard negotiations between Salazar's *Estado Novo* and the Government of the USA. Not only was Salazar not politically and ideologically aligned with the North Americans, but

he also disliked them. He deliberately delayed diplomatic responses in order to keep the United States hanging and more "at his will".

This lengthy cooperation led to the construction of then state-of-the-art infrastructure in Terceira and Santa Maria Islands. Even today, they possess the longest runways and the largest airports in the region by area. Throughout the decades, their dimension allowed them to achieve cultural significance. These conditions led to the existence of the Santa Maria Flight Information Region - the largest oceanic Flight Information Region (FIR) in Europe and among the largest in the world. They provided adequate stations to stop and refuel iconic airplanes such as the Concorde. They allowed Lajes Airport to serve as an alternate airport for space shuttle operations and a lifesaving alternative to Air Transat Flight 236, providing a long runway to land after fuel exhaustion.

This means the Azores are well suited for departure and return of Horizontal Take-off and Landing (HTOL) for space tourism in a "high value-added niche market", – stated by the SAzS.

The fourth entry in the priority areas of the SAzS is fostering research, development and innovation in space. To this end, the Region will have to focus on capacity building of the population, attraction and retention of skilled workers and jumpstarting economic growth and industrial development. This will be no simple feat. Attracting meaningful players will be just the beginning. The Region will need to keep them happy. And then trying not to get too involved in supporting the expenses of doing in the long run. The private sector will need to gain its autonomy in the Region.

The fifth entry relates to the propagation of scientific education on space affairs. This is long overdue already. This should have been the first step applied by the Region. Unfortunately, it seems the Region's population prefers favourable conditions to exist first and then act upon those conditions instead of sometimes creating those conditions.

Because of this, the fourth chapter of the SAzS has to be considered, The Strategic Pillars: Levers. On page 29 of the document (page 37 of the total file), point 3 of the chapter can be found. Its title is "dedicated funding and support opportunities". "Greater participation in EU programs" is something the Region will need because it lags too far behind in wealth generation to be able to kick-start the whole strategy by itself. Luckily, the European Union recognises the importance and need to apply space technology as fast

as possible and take the European nations forward – thus the existence of dedicated funds such as EU Horizon Europe, INTERREG, Copernicus, Galileo, and EGNOS.

Another initiative referred to repeatedly, in the many referrals in the Conference about the Strategy of the Azores for Space, is the CASSINI program. It will be of tremendous importance regarding the acceleration, incubation, seed-funding and commercial procurement for 2021 – 2027 (Estrutura de Missão dos Açores para o Espaço, Strategy of the Azores for Space, 2021). Securing all areas of the EU Space Program, the program enables €1 billion in funding, from seed stage to development, to hackathons, mentoring awards, business accelerator, partnership, matchmaking and in-orbit demonstration.

The SAzS claims it will encourage entities to partner up, cooperate and participate in the programs. Even so, the strategy still claims ambitions of excellence, innovation and competitiveness of the involved researchers and organisations. The contemplated funds in the strategy are:

- Horizon Europe;
- INTERREG;
- EEA Grants;
- EU Space Programme;
- ESA funding;
- Eureka;
- The European Southern Observatory.

To synergise with these, the Government of the Azores will "allocate specific funds and support mechanisms to boost current and future aerospace activities in the regions" (Estrutura de Missão dos Açores para o Espaço, Strategy of the Azores for Space, 2021).

It would also be important to engage the education system in these activities. The strategy mentions the vision of establishing specific technical training programs in IT, computing and electricity for post-secondary and technical education. This would be a victory in the whole process. More engagement in the Erasmus program and Post-doctorate research funds would be a plus – another argument presented in the strategy. A protocol with the University of the Azores is also mentioned. It is the institution for tertiary education in the Region. It is very pertinent for closer cooperation to exist between

the institution and space efforts. Indeed the strategy counsels in favour of training senior management in the space field – even resorting to scholarships.

The author Manuel Paiva defends in his book (Paiva, 2016) that “Space exploration can also inspire the youth to address studies in the domains of science and technology”. “The cooperation between the researcher that will use a certain instrument and the company that builds it can be a boosting element of the high-tech industry”. Cooperation and high-tech industry are two concepts that constantly re-emerge throughout the research on space research and space projects. In the chapter dedicated to the International Conference of the Strategy of the Azores for Space, one of the speakers informed that at the start of operations, the company he belongs to provided only some services with what was considered the standard information on vessel traffic tracking. It was the increasing information demands from clients that imposed an evolution in provided services. Now, this company provides highly detailed information on several factors and overlays for client scrutiny. It is safe to say the mere relationship between client and provider results in cooperation – in a sense. The client ignites evolution and development. Cooperation can take even other proportions when two entities or more decide to cooperate. This leads to leaps in research, products available, services available, technological breakthroughs, and policy changes.

This converges with other interventions in the aforementioned conference. It was thanks to activities such as rocket-building challenges and educational initiatives related to space that many among the youth decided to follow higher studies related to space instead of more conventional pre-established academic paths.

One crucial factor to remember is that the industry involved in creating, idealising, manufacturing, producing, servicing, and maintaining everything needed for space efforts is immense; we are definitely not talking just about developers and engineers.

This whole universe requires synergies between science, industry, and politics. It sometimes requires herculean efforts to motivate all parts and engage them in coordination. If the industry feels lacking in resources, or there is a lack of political will, or researchers are more inclined towards other research areas, it can sabotage projects. You need all parts feeling enthusiasm for these synergies to be fruitful. In the present state of affairs, there is enough political will to carry these ambitions forward. The researchers also seem eager, and companies and entrepreneurs entertain the idea of investing and

progressing in the Azores. However, these first steps will need industry from outside the Region.

The regional industry is barely familiar with Space essence. Manuel Paiva is very knowledgeable about his home country. When he refers to Portuguese public-private partnerships, he immediately reminds us how these national projects tend to have substantial budget drifts and slips. He even hints at the public perception of their national rulers. Whether we like to admit it or not, it is a Portuguese pattern.

The author affirms that the triangle between science, politics, and industry is not equilateral, nor would it be desirable. Moreover, he defends that this unequal ratio must always be respected. Once again comes to light the great importance that the media play in mobilising the public and spreading awareness of Space efforts.

The author considers the Portuguese universities' ranking to be "modest" despite their progress and cooperation with the industry to be "limited", – resulting in a low number of registered patents. Still, the author elaborates a defence affirming he thinks the work done so far to be admirable when considering the dimension of Portugal. Furthermore, he claims international data in science quality evaluation corroborate this.

If, by one hand, Portugal has many political, bureaucratic and collective mentality limitations, on the other side, it possesses quite a praise for its success when joint effort and devotion are applied. The results might fluctuate, but considering the dynamics between Portuguese GDP, population and literacy, some commendation might be in order. It is also important to take into account the chronological reality between the present day and the day in which the affirmations were made. As for Manuel Paiva's referred book, it is important to remember that it was published in 2016. Six years might not seem like much difference, but many of the speakers of the Azorean Conference refer to the last twenty years with great pride. Six years then become a significant chronological slice.

Nevertheless, the author countered these setbacks with two pros: the youth among the scientist pool invested in space and the internationalisation of space domain research.

Once again, the best the public can hope for at the beginning of the space efforts establishment is the economic spill to other economic areas outside space. It is, in fact, the best the Azoreans can hope for at first, considering the low literacy levels in the

regions that will not have an upgrade overnight. This hope might still facilitate society's engagement in space efforts – this is a recurrent conclusion.

There is another important converging conclusion between the author and the many speakers at the Conference: the considerable benefits of satellite technology are so deeply embedded in our lives that we lose awareness of them. Some examples are navigation, weather information, and communications.

Another pattern across all sources studied is the profound relationship between space and education. Being the space tools and technologies so specific and demanding, education becomes a requirement instantly. It is vital to evaluate methodology. Beyond correspondence, the way scientists and space-related agents communicate: through scientific publications and conferences to allow peer supervision. However, another recurrent factor is the seemingly interdisciplinary essence of space projects. space endeavours are rarely just about space. Whether it is quality of life on Earth, commodities, military objectives, and even exobiology, there is an immensity of purposes in space studies and projects.

Once again, attention needs to be drawn to a painful truth: the disparity between the longevity of a political term and the time between the conception of an idea for experimentation and its completion. Being the latter much longer chronologically. In the context of the triangular cooperation of politics, science, and industry, it becomes paramount to incline politicians to establish plans for the long run, facing them with the possibility of continuity in their absence. Without this uncomfortable touch in the hypothesis, risks are taken, and triangular coordination can be jeopardised. Continuity becomes a concept of uttermost importance. After all, it is the welfare of people, science, knowledge, progress, and prosperity at the front, priority-wise, for those who care about space efforts – not necessarily caring about who governs politically.

This brings about a possible dilemma. Though politicians influence and exert gravitas to ensure funding to space-related entities, many defend that research needs to be as independent as possible from politics. Well, we all know nothing is gratuitous in this world, and a dance must be carried out in this matter. Politicians will always want credit for the good things that happen, and compromises will probably have to be made in this regard to ensure continuity and the establishment of what is not always appealing to politicians – long-term results.

And what about real international cooperation? Whether in academia, business, industry or large-scale projects, how really efficient is it? One study example of international cooperation is related to the International Space Station and antimatter. It involved three Agencies and five hundred investigators from sixteen countries. Unfortunately, and predictably, it is not all smooth sailing (Paiva, 2016). Proof of this is the "complicated" relationship between European Space Agency and the European Union and the delays in the Galileo program. It demonstrates complications in cooperation. In the realm of hindrances in cooperation, it is important to keep working on leaning the distance between academia and corporations.

Another significant conclusion convergence is the affirmation that most researchers still work for academia instead of the Space Industry. Such is the conclusion of Manuel Paiva and several speakers at the Azorean Conference and is statistically corroborated by the Portuguese entity *Direção Geral de Estatísticas da Educação e Ciência* (DGEEC). Additionally, doctoral researchers in Portugal seldom work for companies, with almost totality working for academia. This is seen by some experts in the space field to be disadvantageous. The wealthiest countries that are best ranked in space endeavours have this dynamic the other way around, with most researchers working for industries and companies.

The state of affairs in Portugal is usually described as "university inertia" and is in great contrast with the growth and fast pace of companies – embedded in a very competitive market.

An important detail of international cooperation is the number of start-ups and companies that are multinational. Many companies merge or have bases in more than one country. Maybe due to the complexion of the space projects and their advanced requirements in specific fields. This leads to reflection on the importance of associations. Many companies join associations as these are valuable tools for clients in the space field to turn to. Instead of having to search and examine diverse companies individually for certain products, final clients or Agencies can turn to an association composed of several companies and present their idealised final product. The association will summon adequate companies to produce the intended result.

In fact, as of the year of publication of Manuel Paiva's book, the author claimed *Associação Proespaço* represented 95% of the volume in contracts of the Portuguese

space industry. The association claims to defend the interests of the Portuguese national space industry, to have proximity with the government, to have an integrative role, and to be even a player in the formulation of the National Strategy for Space.

As for the economic return, the industry boasts enormous growth. There is a discrepancy in published evaluations, but for the sake of example, we can compare The Space Report and Euroconsult.

The Space Report 2021 Q2 affirms that the Space economy rose to 447 billion in 2020 from 428 billion in 2019 – a 4.4% increase. The report also states that 447 billion is 55% higher than the previous decade and showed five years of uninterrupted growth. The information goes further and claims commercial Space activity grew 6.6% to almost 357 million in 2020, representing nearly 80% of the entire space economy. These numbers imply enormous returns on Space endeavours (Space Foundation Editorial Team, 2021).

Euroconsult analysis is more cautious, and on its 8th edition of Space Economy Report for 2021 (Euroconsult, The Space Economy Report, 2021), it estimates the global space economy at $370 billion. They breakdown this number into two by declaring the space market to comprise $337B – including commercial space revenues and government procurement - and other spending from government organisations to comprise $33B (Euroconsult, Euroconsult estimates that the global space economy totaled $370 billion in 2021, 2022).

Euroconsult also claims that out of these $370 Billion, $278B (75%) have a commercial client, 8% have a defence client, 8% have Civilian Government as a client, together they form $59B, and lastly, there are $33B, comprising 9%, as other government spending.

These differences in estimates might come from different criteria of evaluation. On July 18th, 2012, Proespaço's President António Neto da Silva, affirmed that the space sector in Portugal had a per capita added value four times superior to the national average and that each euro invested in Space had a return of two euros in the national economy. Are these numbers particularly impressive considering the global statistics? Maybe not, but for an economy like the Portuguese one, especially in the years following the economic scare, this must have been compelling enough to share.

The business aspect and international cooperation factor of space cannot be ignored. So much so that the Nova School of Business and Economics and ESA signed a protocol with the creation of a master's degree with the intent to cultivate the business potential of space technology (Paiva, 2016).

Contrary to Portuguese Universities, Portuguese Business Schools are well placed in the rankings, specifying the example of *Universidade Nova de Lisboa*. According to an estimate of the *Organização para a Cooperação e Desenvolvimento Económico* (OCDE), the business volume of the space sector in 2013 was 201,9 Billion Euros. So, the growth from 2013 to 2020 was, indeed, suitably astronomical.

As for the Portuguese progress back in 2010, 10 years after Portugal joined ESA, Minister Mariano Gago spoke about his perspective on the ongoing times. In his view, the times were interesting, and synergy between industry, the scientific community, and the space sector could be noticed. Moreover, ESA's Director-General from 2003 to 2015, Jean-Jacques Dordain, manifested his surprise at the young age of the Portuguese agents present in the 10th-anniversary ceremony. Many of them were aged less than 35 years. He viewed this detail with good eyes.

Regarding scientific cooperation and education, the author Manuel Paiva affirms that Portugal suffered from a "paralysing parochialism" that negatively affected the Portuguese adhesion to the European Space Agency. He praised the illustrious ex-Minister of Science and Higher Education José Mariano Gago, whom he credits for the Portuguese integration into ESA. It seems a Portuguese pattern, the strangulation of its own development in the name of private and particular interests. The author reminded in his words that there was even a proposition to work with the near-defunct Soviet Union. Such is the ideological bias of some people in the country.

José Mariano Gago applied modern ideas to investigation structures; he highlighted the need for scientific growth in the country as well as the need to create a scientific culture. For this, science needed to be taken to the citizen in the most efficient manner. Hence the Agency *Ciência Viva* was implemented in the name of scientific and technological cultural promotion with centres spread across the country. The call to spread scientific awareness is a front some voices insist on firmly. According to these voices, involving and motivating the public is paramount. Without this involvement, there will be increased difficulty in attracting the public to these fields. This concept also needs

some coordination in translation. Once more, another respected and considerable person shares the same opinion as the ones studied so far.

Still, the concept also needs some coordination in translation. As in the Azores Conference for Space, the word "divulgação" in Portuguese was misunderstood in its English meaning, which was noticeable in the presentations. *Divulgação's* most suitable meaning in this context is propagation, divulgation, spread, and awareness instead of dissemination. The dissemination was interpreted as leaning more on the availability aspect. As in how easy it was to access the services space science and technology offered. Thus, it helps to understand why some presentation on the dissemination work session of the Conference was so focused on how to access information provided by satellites instead of population scientific awareness and education.

Infrastructure also exerts influence on the public. Take, for instance, the positive effect of the examples of *Pavilhão do Conhecimento* located in *Parque das Nações*, Lisbon, and *Planetário do Porto*, Oporto, for their excellent design, features, and number of visitations. We can speculate the immense importance these buildings have played in educating and stimulating the population. From observatory domes, interactive presentations, video calls to the International Space Station, and events open to the public, it seems to be of concord that these factors play positively in immersing the public in the space interest. It seems a good strategy for increasing future recruitment in the space field. It is pertinent to consider the many activities carried out by institutions of space education propagation. Even if some are age-specific, many encompass all ages – allowing families to debate their experiences.

Manuel Paiva makes reference to CanSat too. It seems hard to have any meaningful discussion about the youth and preparing the workforce without mentioning CanSat. He, too, believes in the importance of this activity. It is a great initiative, after all, to foment the spark for space science and activities. It is a great opportunity to be deeply involved in a space project experiment – playing into the excitement of successfully launching a rocket and CanSat that actually recovers data and is functional after landing.

The author solidifies his arguments for the pertinence of CanSat by stating this competition requires knowledge in physics, technology, and programming and declares that these specialities "should be part of part of the school curriculum". CanSat is known

to have influenced many students to choose Space sciences as their intended Higher Education path.

One can only imagine if programming and coding became widespread among the youth. Many more tools could be created. People are creative, if they possess the knowledge to materialise their visions and projects through software development, many useful applications would find their way into the light.

In short, Cansat revolves around teamwork and requires the device to be launched to a thousand meters in height above ground level by a mini rocket – the author adds that in some instances, an airplane or balloon is used. The controlled descent must be assured by a chute built by the students, and the speed of descent must be 10 meters per second. During the controlled descent, the CanSat must measure air temperature and barometric pressure and transmit the information by telemetry. The teams must analyse their recovered data.

The intended objectives of each launch have some freedom of choice – some teams may choose to gather data on temperature-altitude ratio, accelerations, or GPS.

Each team is evaluated on several fronts, including the “didactic value” of their project, teamwork, a capped budget of 500 euros, and even how the project was communicated to the school and local community and media.

This exercise is a great example of the social influence of space projects. The involvement of the youth in these projects and competitions raises awareness and provides another option for academic possibilities. Particularly in CanSat, the youth is exposed to the demands of precision projects and teamwork. The whole competition familiarises slightly with what a future in space projects would look like. The CanSat competition also teaches about the enormous efforts needed for preparations and the pertinence of having backup plans for split-second decisions and adversities. A reminder of how “plans are useless, but planning is indispensable” – Dwight D. Eisenhower. Certainly true for aviation and aerospace. Not that plans are not needed, but fast and expensive airborne objects require a cold educated head. Furthermore, it is planning that allows us to know which resources we have available to us, even when a plan has been ruined. If, during the design and building, some creativity is welcome, execution is a completely different world. Execution requires thoroughness – and this, in this field, means a checklist.

The students must also concisely present their project in English in five minutes to be able to answer questions from a jury and even prepare all details of the launch.

It is generally agreed: space exploration has become an excellent platform of science and technology "divulgation", and a "multifaceted" means to "arouse scientific vocations".

The author Manuel Paiva explores the subject of the International Space Station, CERN, and Space shuttles. In this analysis, the author called attention to the enormous discordance related to the perception of the ratio between effort and benefit regarding the aforementioned concepts. He even exemplifies Serge Brunier's argument against manned space flights in his book *Impasse de l'Espace*. Many voices also question the usefulness of the ISS when compared to its costs and how CERN, costing only a tenth in construction, has provided so many contributions. The author contributes with his own vision: while it is understandable to search for numbers and contributions of each device, one immeasurable factor comes into play: Human affinity. He presents the case of cooperation aboard the ISS. While on the planet, geopolitics tends to place nations head-on in confrontation, the ISS has been the host of the beautiful phenomenon of international cooperation – namely between nations in conflict. Even though the concrete numerical price of these space endeavours was undoubtedly high, this cooperation beyond terrestrial conflict is extremely valuable and can never be numerically estimated. in the long term, all these space efforts and projects are worth it. Even if now, one might be tempted to think it is useless to go to Mars, the truth is that it will be imperative to go even beyond – for it is known that if Humanity survives long enough, we will not be able to live eternally on this Solar system. Looking way far ahead into the future, surely. However, if we make plans and toil, can we not plan with eternity in mind?

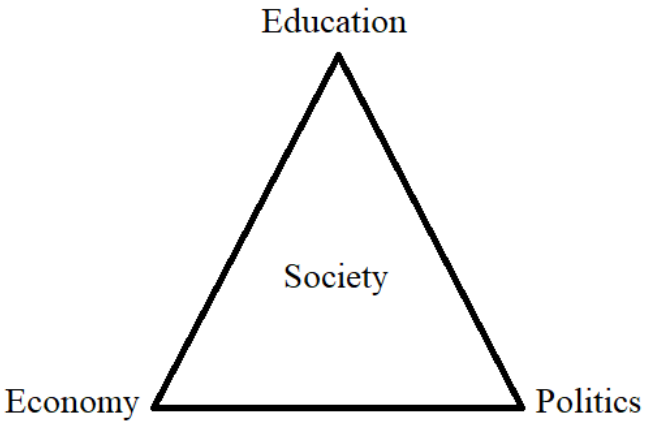
One can always consider that the effort to build and operate the ISS will always be worth it because it allowed studying weightlessness – an indispensable study in the space field. Therefore, international cooperation will always be worth it, for it brings humans together and usually brings about progress. Today it is known: The future belongs to societies of knowledge. Any civilisation that will invest in science and can turn those efforts into results will be leaping ahead of the remaining ones. The Human being is a technological one, no doubt about it. In the book *Portugal e o Espaço,* there is a testimony from Claudie Haigneré. She was a rheumatologist, scientific researcher in neuroscience, astronaut, and France's Minister of Education and Research. Within her testimony were

these sentences: “(…) To investigate is, above all, to prepare the future, it is to be curious, it is helping Humanity to build tomorrow”. Cooperation and proximity will always be two immensely important concepts. They will drive Humanity forward and help diminish cultural and geopolitical frictions – or so it is hoped.

So, if we compile the opinions of the referred authors and the many speakers at the Conference, one conclusion regarding the Portuguese higher education sector modus operandi can be made. Some changes need to be made for the Universities to be synchronised with the real needs of the space sector, and that waiting for Universities to self-regulate or change from within is unrealistic. Manuel Paiva goes further and reminds us that several suggestions for a census regarding Portuguese scientists and researchers have been made repeatedly to politicians to no avail. Since their quality is recognised, and it is agreed that Portugal needs their expertise, the author asks why this has not been done. I suspect it might have to do with the conclusions. It would give an objective conclusion that Portugal could be more appealing to those professionals, and that is probably not what a politician would want the public to conclude.

Conclusion

The main reference of analysis is the triangular relationship between economy, education, and politics, with the essence of a given society in the middle, deeply affecting the vertexes.



The composition of society, with the skill, and mentality of its members, will impose limitations on the reach of action of each vertex. Society itself will act on the balance of concepts such as openness to space endeavours, willingness to commit, and tolerance to novelty. These are highly susceptible to feelings of traditionalism, conservatism, and intellectualism.

The resistance to space efforts will limit the scope of action in each of the vertexes and will increase the political capital required to apply societal and economic changes to advance space progress.

Furthermore, being this dynamic so interdependent, a willing educated society with favourable politics will find its efforts hindered by an impotent economy. Similar failure will surface in the case of a rich, educated society applying unfavourable or lacking favourable space policies – may be due to a societal mindset closed to space efforts, in the case of a society that believes money should be spent solving “terrestrial” problems, for example. The remaining case seems less likely, albeit possible, and maybe the Azorean case to some degree. In the case where policies are put or are being put in place, there exists the willingness to invest, but there comes a lack of expertise and education in the space sector. This case might be easier to correct than the others presented if the society is receptive to space endeavours, which is not completely the Azorean case. Easier

to correct because if the economy is prosperous and favourable policies are in place, even if it takes years, part of the population will probably graduate in fields related to space. In the meantime, that same society might hire or import foreign expertise and skill – though this takes to another possible scenario of playing musical chairs with the limited space jobs later on.

Still, it is important to be aware that the Azorean economy is not exactly prosperous – far from it. So the odds at first are actually stacked against the region. Some sectors of the regional society are not receptive to space infrastructure, there is a pronounced shortage of skilled workforce in the region with low average levels of education, and the economy lacks prowess, with low wages and the lack of a surplus that could be comfortably applied to the space sector. So, realistically evaluating, the region only is being able to strengthen one of the vertexes, the political one.

This does not have to be discouraging. The Region and its people have been piercing reality for centuries. This reality has always been harsh to the inhabitants. From the isolation, the insular fragmentation, and the economy, to name a few persistent adversities. Yet, the quality of life has been steadily improving in the Region, and if one affirmation can be said of Azoreans is that they don't give up, keep on working, rather graciously accept their disadvantageous reality, and don't even complain much. They rather say "*é amanhar com isto*", which approximately translates to an expression "to make do with what one has".

This will probably be a weakness turned into a strength as the population, with their hardworking patience, will steadily, even if slowly, invest some effort in space education and will, in time, become able to apply for space industry jobs in the Region.

One word of caution might be the time it might take to change some of the rigid Azorean pragmatic mentality. It is not usually easy to convince some Azoreans to study more. Those living in more difficult situations tend not to give thought to sacrificing some time and money to pursue studies - which is not a situation anyone should dare to judge. Another characteristic of the local insular mentality is that most people tend to play safe, to prefer the traditional. It surely seems that the Azoreans prefer to see certain job openings appear steadily before committing to study in the field of said openings. As per contact with several Azoreans, many shared their resistance to studying a scientific field in which there are still no jobs in the Region, but expect preferential treatment when those

jobs become available, even if the timing of their eligibility is counterproductive to society. In their opinion, the delay that would occur between the job opportunities and their eventual graduation is something that "the government should put up with", and they would mostly consider these jobs being taken by foreigners as a setback.

Still, the younger Azorean generations have better and more abundant academic opportunities than the older generations, which is evident in the rising literacy and level of education.

It might be safe to assume that the private space industry settling in the Region will be asymmetric, with some agents already itching to come to the Region, as demonstrated in the Conference, and others needing a lot of convincing and incentive from the regional government.

As seen in the press, space is a hot topic in the Azores and evokes some passionate responses from certain groups. It also seems that the Region is having some trouble bringing the coveted projects to fruition, with deadlines being pierced and accusations of ineptitude, incompetence and incapability being thrown between governing and former governing entities. Some claim that those responsible for the space efforts in the Region lack the capability to bring projects to reality. In contrast, others claim all aspirations are within reach, but more time is needed.

A critical balance will need to be respected. Which is political interference in space project dynamics. While space projects depend heavily on favourable policies, they also easily incur some sort of political debt. Politicians tend to try to collect on this perceived debt – with some serious disasters such as the tragedy involving Space Shuttle Challenger in 1986. Some point fingers at political and budget demands made to NASA. To respect deadlines and keep their funding, some important operational and technical details were overlooked.

Another significant factor to consider in the regional space strategy is the differences of opinions on what path to take to make the most of space projects in the Region. Personal preferences, ideologies and agendas come into play as some advocate for a concentrated industry and cluster, and others prefer a more dispersed network of infrastructures. Some would rather see an island becoming the epicentre or one-stop-shop, while others refute this possibility. The scale of the projects also causes division. In the

Conference, there were those who wanted a decisive, all-in strategy, with zero hesitation, while the opposing side advised caution and starting small.

The political class will also need to operate with tact and intelligence. It will need to navigate the highly sensitive waters of public opinion and regulate the interests of technophiles, environmentalists, conservatives, intellectuals, capitalists, communists and even those who just want a quiet archipelago to live on.

As it stands, local expertise is not enough to bring the strategy to reality. National and international cooperation seems to be an absolute requirement to accomplish the coveted projects. This much-needed outside expertise will at least have some state-of-the-art built infrastructures to work with.

Unfortunately, there are more similarities between the Azores and French Guiana than the Region would desire. From economic disparity to a shortage of skills, there will likely be friction between the pragmatics and the protectionists. The rush for the best space industry jobs will not please many locals since they will be at a severe disadvantage. One can only hope that the further increment of the space industry and operations in the Region will encourage more Azoreans to study. Sceptics will probably claim the futility of space education in the Region as, initially, very few openings will be available, but the government wants the archipelago to specialise in space. If done right, the future can be bright and prosperous for the population. So many space applications are very pertinent in the Region, be it in agriculture, tourism, surveillance, planning, land use, maritime and emergency services.

The clock is ticking, and the Region is already blatantly late for what it proposed itself to do. Space endeavours are usually a race with many end users and clients forming a queue to materialise their projects. The Region has already lost many opportunities and possible clients to other spaceports worldwide.

Be it as it may, the potential of the Region has been discussed and debated, and important space agents place it high on their considerations. And if there is private willingness to carry out space operations in the Region, then all has been said.

The Azores have a great challenge ahead, but not an impossible one.

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Appendix

Vasco Cordeiro acusa ministro da Ciência de incompetência em projetos dos Açores

O antigo presidente do Governo dos Açores Vasco Cordeiro afirmou que "não houve derrapagem de prazo" no processo do porto espacial de Santa Maria e retribuiu as acusações de "incompetência" ao ministério da Ciência.

17 de Dez de 2021, 09:50

Concurso para Porto Espacial na ilha de Santa Maria em março

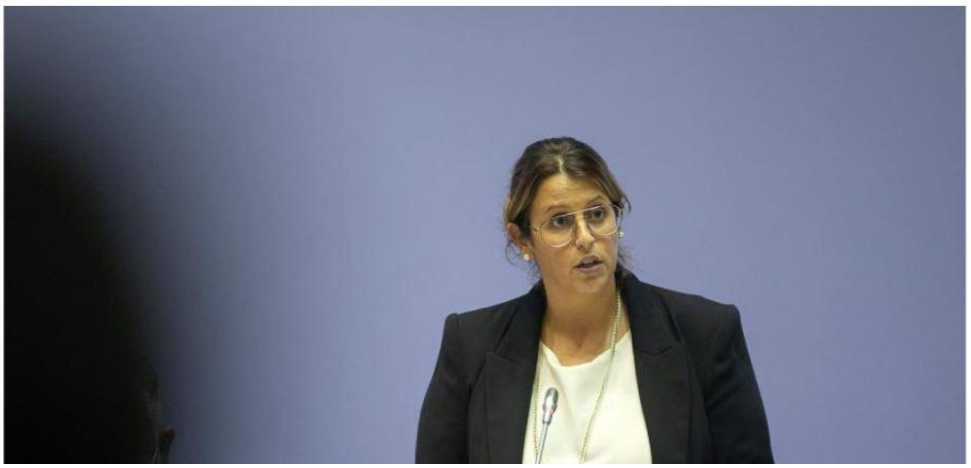
O novo concurso para a construção do Porto Espacial na ilha de Santa Maria, nos Açores, vai ser lançado em março, revelou a secretaria Regional da Cultura, da Ciência e Transição Digital.

15 de Fev de 2022, 15:24

PS/Açores preocupado com "mais um atraso" no Porto Espacial de Santa Maria

A deputada socialista Joana Pombo manifestou preocupação devido a "mais um atraso" no avanço no Porto Espacial na ilha de Santa Maria, devido à realização de "mais estudos e consultorias" por parte do Governo Regional.

15 de Fev de 2022, 17:14



Governo dos Açores abre concurso para reabilitar futura sede da Agência Espacial Portuguesa

O Governo dos Açores vai requalificar a antiga "Casa do Diretor "do Aeroporto de Santa Maria, nos Açores para instalação da sede da Agência Espacial Portuguesa, empreitada orçada em 1,1 milhões de euros.

15 de Fev de 2022, 17:58

Açores querem ser 'hub' transatlântico para atividades espaciais

O Governo dos Açores quer posicionar a Região como 'hub' transatlântico para atividades relacionadas com o Espaço e o aeroespacial, revela a anteproposta da estratégia para o setor, colocada em discussão pública.

27 de Fev de 2022, 11:38

Município de Vila do Porto reúne contributos para a Estratégia dos Açores para o Espaço

A Câmara Municipal de Vila do Porto, na ilha de Santa Maria, vai promover, no próximo sábado, uma sessão pública para reunir contributos para a Estratégia dos Açores para o Espaço.

7 de Mar de 2022, 15:03

PS/Açores acusa Governo Regional de destruir projeto do porto espacial de Santa Maria

O PS/Açores acusou o Governo Regional (PSD/CDS-PP/PPM) de "destruir" o projeto do porto espacial previsto para a ilha de Santa Maria, por “indecisões, inações e falta de visão”.

15 de Mar de 2022, 10:59

Governo dos Açores responsabiliza anterior executivo por atraso em porto espacial

A secretária regional da Cultura, Ciência e Transição Digital disse que o atual executivo só é responsável pelo atraso de quatro meses no projeto do porto especial de Santa Maria, imputando o restante tempo ao PS.

16 de Mar de 2022, 16:44

IL/Açores questiona Governo Regional sobre custos da Estrutura de Missão para o Espaço

O deputado da Iniciativa Liberal (IL) nos Açores, Nuno Barata, questionou o Governo Regional sobre os "custos associados ao funcionamento" da Estrutura de Missão dos Açores para o Espaço.

17 de Mar de 2022, 16:15

PS critica “silêncio ensurdecedor” de Bolieiro sobre porto espacial de Santa Maria

O deputado do PS/Açores João Vasco Costa criticou o “silêncio ensurdecedor” do presidente do Governo Regional (PSD/CDS-PP/PPM), José Manuel Bolieiro, que “hibernou” e “nada diz” sobre o projeto do porto espacial de Santa Maria.

18 de Mar de 2022, 10:20

Governo dos Açores tem procurado "rapidez" para instalar porto espacial

O presidente do Governo dos Açores disse que o executivo tem procurado agir com “rapidez” e “sentido muito estratégico” no processo de instalação do porto espacial de Santa Maria, lembrando o contencioso judicial que impediu avanços.

17 de Dez de 2021, 10:04

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