Aerospace Districts: Acceleration of the Strategic Transfer of Regional Advancements

Joint Action Plan

D3.1 – Joint Action Plan

Abstract:

The Joint Action Plan seeks to enhance collaboration and alignment in the aerospace sector using the Quadruple Helix model, involving government, academia, industry, and community. Over a 10-year period, it outlines short, medium, and long-term actions to create interconnected aerospace innovation ecosystems. In the short term (0-3 years), the plan focuses on education and talent development through cross-regional internships, STEM education promotion, interdisciplinary research, and Ph.D. exchange programs. It promotes industry-academia collaboration by developing specialized courses, training programs, and establishing internships and student exchanges. Industrial collaboration is encouraged through cross-regional partnerships among aerospace companies and other sectors, while networking is enhanced through regular events, matchmaking sessions, and collaborative tools. In the mid-term (3-5 years), the plan aims to improve the regulatory framework by working with policymakers to develop supportive regulations, streamline processes, address barriers, and align regional strategies with national and European priorities. It also emphasizes trans-regional collaborations and funding, monitoring global trends, adapting strategies, establishing joint research initiatives and innovation hubs, and creating funding initiatives for projects, startups, and research programs.
In the long term (5-10+ years), the plan focuses on market development for regional aerospace companies through international partnerships and trade agreements. It seeks to create online platforms for industry insights, establish international aerospace offices, and prioritize infrastructure development by funding projects and creating shared experimentation and test facilities to enhance capabilities, support growth, and foster collaboration and innovation.

Keywords:

Innovation, regions, aerospace, international cooperation, actions.

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Acronyms and Terminology

Term	Definition
ACARE	Advisory Council for Aviation Research and Innovation in Europe
AD-ASTRA	Aerospace Districts: Acceleration of the Strategic Transfer of Regional Advancements
eVTOL	electric vertical take-off and landing aircrafts
UAM	Urban Air Mobility
CCS	Carbon capture and storage
CEF	Connecting Europe Facility
ERDF	European Regional Development Fund
ESA	European Space Agency
ICT	Information and communication technology
KPI	Key performance indicators
OEM	Original equipment manufacturer
R&D	Research and development
RIS3	Research and Innovation Strategies for Smart Specialisation
RTO	Research technology organization
S3	Smart Specialisation Strategy
S3 CoP	S3 Community of Practice
S3P	Smart Specialisation Platform
SAFs	Sustainable aviation fuels
SWOT	Strengths, weaknesses, opportunities, and threats
STEM	Science, technology, engineering, and mathematics
TSSP	Thematic Smart Specialisation Platforms
UAM	Urban air mobility
WP	Work package

1. Introduction

The AD-ASTRA project represented a pivotal initiative aimed at advancing the aerospace sector across Europe by fostering an integrated network of innovative regions. The project's primary goal was to establish a cohesive European (EU) network of aerospace districts (Emilia-Romagna, Madrid, Apulia, Occitania, and South Holland) through collaborative action plans and strategic development. This ambitious undertaking involved a comprehensive approach to enhancing regional aerospace capabilities, leveraging the diverse strengths of participating partners, and addressing key challenges in the sector.

This deliverable focuses on the activities of Work Package 3 (WP3), specifically Task T3.1, titled *"Development of the Joint Action Plan"*. Through this deliverable, the consortium underscores the importance of strategic collaboration within the aerospace sector by outlining a series of comprehensive actions designed to align innovation agendas across various sectors and regions. The creation of this document, a product of the activities conducted in T3.1, followed a structured process:

- Analysis: conducted a thorough review of previously collected information, including best practices, skill assessments, strengths, weaknesses, opportunities, threats, synergies, and connections with other industrial sectors.
- Iterative process:
    - **initial basket of actions**: each region proposed a preliminary set of macro-actions based on input from local stakeholder groups.
    - **collective review**: project partners reviewed and refined these actions to identify the most viable and impactful ones.
    - **in-depth study**: selected actions were examined in detail, defining involved actors, timelines, impacts, budgets, funding sources, and inter-regional dimensions.
    - **final action plan**: compiled the selected actions into a comprehensive Joint Action Plan, incorporating a time-dependent perspective (short, medium, and long term), steps for implementation, and estimated benefits.

The Joint Action Plan's development aimed to foster an enabling innovation ecosystem across Europe. By promoting cooperation among regional entities and leveraging their diverse strengths, the project sought to transition from a linear to a networked collaboration framework. The five participating regions recognized the potential for significant European-wide benefits through effective transfer processes and decentralized cooperation in the aerospace sector.

The Joint Action Plan extended beyond economic benefits to consider societal and political impacts. Its goal was to create a dynamic, living community that promotes a systemic approach combining inclusivity and collaboration. The plan was designed to evaluate its practicality, with governance rules ensuring equal roles for all participating regions. Its effectiveness will be assessed based on actionable elements, practical implementation, and alignment with regional business and societal developments.

2. Context Analysis

2.1. Analysis of the Regional Ecosystems

The aerospace sector is a fundamental contributor to the industrial competitiveness and the strategic autonomy of the European Union, and overall, to the wealth and security of the region. The European aerospace industries, research centres, universities and institutions are globally recognized as worldwide leaders in their respective fields. Relevant aerospace stakeholders are present in most countries and many regions all along the European Union. In this context, the AD-ASTRA project brings together five of the most representative European regions from the point of view of their involvement in the aerospace sector: Emilia-Romagna, Madrid, Apulia, Occitania, and South Holland. These regions are characterised by diversified experiences and expertises in the aerospace sector and in other related sectors.

The first activities of the AD-ASTRA project focused on identifying existing innovation capabilities and networks, analysing previous successful connections, and evaluating future regional development megatrends. Relevant stakeholders - including public authorities, industry, research technology organisations (RTOs), universities, investors - were identified in each region along with their innovation and technical capabilities. Additionally, any existing innovation programs and policies were assessed. The project also mapped established inter- and intra-regional connections, as well as any pertinent international connections. To identify these capabilities and networks, a thorough review of existing databases and directories was conducted. As a result, an inventory was created (D1.1 and D1.2), documenting each region's relevant innovation and technical capabilities, established inter- and intra-regional connections, and any existing international connections.

The inventory highlights the richness and variety of the innovative ecosystem of the five regions participating in the AD-ASTRA project. All segments and sub segments of the aerospace sector are well represented, including leading universities, research centres, industry players (both original equipment manufacturers – OEMs, and their supply chains), and space agencies. Furthermore, multiple connections already exist among the five regions through industry associations, university networks, multinational companies, and even the European Space Agency (ESA), which has sites in three of the five regions. In terms of programs and policies, there are existing links that serve as a foundation for further connections between regional, national, and transnational programs. Finally, the inventory results demonstrate that the AD-ASTRA consortium is well-positioned to enhance and expand connections among the participating regions and potentially beyond. This will contribute to strengthening the leadership of the European aerospace industry. More in detail, in *D1.1 - "Innovation inventory"*, there were identified relevant stakeholders - including public authorities,

industry representatives, RTOs, universities, and investors. Their innovation and technical capabilities were assessed, along with existing innovation programmes and policies in each region. The already established inter- and intra-regional connections, and possibly any relevant international connection, were also identified. This monitoring activity was continuously updated along the development of the project, due to the dynamic asset of each ecosystem, changing and growing in any moment, and to the increasing knowledge that each partner was gathering on each ecosystem. In *D1.2 - "Former successful connections and case studies"*, the connections and networks were clearly singled out and detailed for each partner region. The common interregional connections were listed and specified and for each region also the specific connections that do not involve at present other regions of the partnership were identified and detailed. The latter were called case studies, in order to underline the fact that they may represent a reference for the whole partnership as best practice to take into account for the development of the Joint Action Plan.

After D1.1 proved the richness and variety of the innovative ecosystem of the five regions that participate in the project, D1.2 demonstrated that most of the partners belong to multiple networks. The list of already established inter- and intra-regional connections, and international connections was rich. This showed that the five regions were already well developed as aerospace hubs, even if all in a different way and with specific characteristics. Indeed, as all segments and sub segments of the aerospace sector are well represented in each of the ecosystems, the connections are multiple already, be they international connections implying several of the partners or simple case studies implying only one partner.

Commonalities and common orientations among the five ecosystems involved have been further analysed during the development of the project, being a valuable basis for the co-creation workshops performed. The results of D1.2 already showed that the five regions that are partners of the AD-ASTRA project are well aware of the need to collaborate by connecting to others. As was written earlier on, «diversity generates wealth». Thus, elaborating further on this concept: "collaboration also makes strength". Collaborating makes it more efficient, working together leads to better work, mutual choices bring about better alignment. In today's complex geopolitical context, it is all the more important to look in the same direction in order to make Europe a centre of excellence. Connecting is also a means to seek better funding, which in itself is essential to innovation.

Like for D1.1, the results of D1.2 proved that the AD-ASTRA consortium can provide valuable inputs to the extension of the connections and links among the five participant regions, and others to come. As all the strong players of the aerospace European ecosystem, such as European Space Agency (ESA) or multinational companies like Airbus or Thales Alenia Space are present in at least three of the five

regions, it seems coherent to connect all the systems, therefore contributing to consolidating the leadership of the European aerospace industry.

This inventory was the first step in the common understanding of the five ecosystems. Further improvement of these inventories was managed during the project, in particular during and after the co-creation events. In this way the five ecosystems have been even studied and known in more detail and they can be used as best practices to draw a Joint Action Plan that will help each of them to be improved and to grow up.

After describing the five regional aerospace clusters under D1.1 and identifying the European connections under D1.2, it was time in *D1.3 - "Future regional developments and megatrends"* to focus on the future of our aerospace regions and determining subjects for long-term cooperation. In the first segment, the concept of general megatrends was narrowed down to a more practical longlist of so-called "aerospace megatrends". The process of ranking them based on regional strengths has provided a practical and actionable framework. Each region was able to identify its strengths per megatrend, resulting in a clear ranking of topics most relevant to the five regions of the consortium. Based on that list it was possible to identify the top 10 most relevant megatrends for all five regions combined. The regions are active in four main categories such as Enabling Technologies for Aerospace (2 regions), Space (3 regions), Aeronautics & Aviation (2 regions) and Drones/AAM (3 regions).

What stands out is that all five regions generally score highly in the Enabling Technologies for Aerospace category, justifying that all our regions are indeed home to strong aerospace clusters. Toulouse-Métropole (TM) ranks highest in three categories (Space, Aviation and Drones), confirming that this region is home to the most developed aerospace cluster of the five regions. All regions score high in the space category; some score slightly higher than others in the aeronautics and aviation category, but it is clear that the drone/advanced air mobility clusters of the Emilia-Romagna and Madrid region are not as far developed as in other regions.

Based on the longlist and the subsequent discussions during the co-creation workshop of May 22nd, 2023 in Delft, it was also easier to determine common grounds for cooperation between two separate regions. An extensive list of 20 potential inter-regional projects was identified. It is noted that each of these inter-regional projects is also open to the participation of other regions if they are interested. And finally the rankings were utilized to establish the Unique Selling Points of each region. These five key regional development drivers serve as distinctive features that set one region apart from another. They represent specific areas where a region possesses a particular expertise or holds a competitive advantage, either currently or with the potential for future development. By identifying these key regional development drivers, it was possible to gain insights into the specific niches that differentiate each

region and can contribute to its success. Moreover, by understanding the unique strengths and advantages of each region, it was possible to determine the areas where cooperation and collaboration between regions can thrive.

In summary, this first WP has been instrumental in clarifying the future strategic priorities for each aerospace region. It has shed light on the specific areas of Aerospace Districts Europe expertise and competitive advantage that set them apart, allowing stakeholders to focus their efforts and resources accordingly. By identifying these key drivers and themes, it was possible to provide a roadmap for successful cooperation and collaboration, ensuring that regions can leverage their unique strengths to drive innovation, growth, and overall success in the aerospace industry.

2.2. Deep dive into the regional ecosystems

The AD-ASTRA project, through *WP2 – "Networks engagement"* and the organization of five in-person meetings and co-creation workshops, has made significant progress in fostering a connected and competitive interregional innovation ecosystem across the Emilia-Romagna, Madrid, Occitania, Apulia, and South Holland regions. These meetings have been instrumental in several ways: enhancing the consortium's shared knowledge and collaborative effectiveness, enabling each regional ecosystem to understand the strengths and weaknesses of other European ecosystems, and facilitating project partners' engagement with local organizations through site visits, thereby identifying key players in the aerospace sector within each involved region. In the following paragraphs, the five co-creation workshops are reported in a synthetic way (a detailed description is reported in D2.1 – "*Report on the interregional workshops and exchange activities*").

South Holland

The workshop concentrated on identifying megatrends pertinent to regions and their significant impact on the aerospace sector. Key inter-regional crossovers were identified based on the most relevant megatrends. Partners shared experiences, future regional trends and ambitions, and explored potential collaboration opportunities. The collective aim is to anticipate, contribute to, and benefit from these megatrends.

Emilia-Romagna

The workshop was conducted during the "Aerospace Innovative Ecosystem" event on the first day of the #R2B2023 fair. The co-workshop centred on employment skills, emphasizing the necessity for coordinated efforts to address skills gaps, improve training programs, attract investment, and engage the younger generation to ensure the long-term sustainability and growth of the aerospace sector across various regions.

Apulia

The workshop was held during the "Drone Beyond 2023" fair in Bari on October 24th-25th. The discussion centred on "European test beds for researching and experimenting with new forms of mobility, such as urban air mobility." The facilities considered are reported in Table 1:

Table 1 Test facilities described during the 3rd co-creation workshop in Apulia

Region	Test facilities
Emilia-Romagna	CICLoPE – Centre for International Cooperation in Long Pipe Experiments
	FLYTUN - FLYing TUNnel for UAM testing
Madrid	CEUS - Test Center for Unmanned Systems
Apulia	Grottaglie Airport Test Bed
Occitania	Francazal Airport
South Holland	Unmanned Valley
	DronePort Rotterdam

Occitania

The workshop was held at the B612 Building in Toulouse Métropole, focusing on the theme of "circular economy in aerospace". Consequently, one of the co-creation workshops and the second day's visits were dedicated to this topic. It became evident that while the circular economy is a thought-provoking and stimulating subject for the five regions, not all are actively engaged in its implementation. Some regions demonstrate a strong interest but lack concrete efforts in this area.

Madrid

The workshop "Role of Universities in the Regional Innovation Ecosystem," organized by Universidad Politécnica de Madrid, was held at the School of Aerospace Engineering. During the final discussion, it was emphasized that universities face significant challenges in retaining students for Ph.D. programs, post-doctoral positions, and academic careers. The attractive offers from private companies make it difficult for universities to respond proactively, given their limited flexibility in implementing actions. Departmental research lines are often inflexible, dictated by funding requirements that mandate specific topics. Allowing students more freedom to pursue their passions and interests could be a strategy to retain them, capitalizing on their enthusiasm.

2.3. The value of networks

The AD-ASTRA consortium partners served as intermediaries between various ecosystems, addressing the needs or wishes of stakeholders in one region by connecting them with counterparts in other regions. The aim was to establish connections with external networks to create partnerships and potential links with innovation ecosystems at the EU level. Partnerships can provide access to new ideas, resources, and expertise, enabling the partners to remain at the forefront of innovation and drive growth. Additionally, building partnerships with external networks can lead to potential collaborations and joint projects. Aligning goals and resources can result in the development of innovative solutions, products, or services that address common challenges or meet market demands. Such collaborations can enhance competitiveness and increase visibility in innovation.

The co-creation workshop and site-study visits conducted, facilitated the establishment of connections with external networks. During these collaborative workshops, participants identified potential opportunities and challenges and compared regional attitudes towards selected aerospace topics. The site-study visits enabled partners to observe and learn from existing regional aerospace ecosystems, providing AD-ASTRA partners with firsthand insights into the key elements contributing to success. This valuable knowledge can be applied to their projects.

After the co-creation workshops, identifying common themes and recurring keywords facilitates the discovery of insights and the drawing of meaningful conclusions. Notably, after five regional missions, the topic of space entrepreneurship based on research and development (R&D) emerged, highlighting the high regard for the space economy across all of AD-ASTRA's project regions.

2.4. SWOT and TOWS analyses on the five European regions

The SWOT (Strengths, Weaknesses, Opportunities, Threats) and TOWS (Threats, Opportunities, Weaknesses, Strengths) analyses are widely recognized as essential strategic tools used to evaluate the position of an organization, region, or sector, and to guide the development of strategic planning initiatives. These analyses provide a comprehensive assessment by examining internal factors—such as strengths and weaknesses—as well as external factors, including opportunities and threats. While SWOT is more commonly used to identify and leverage existing resources and conditions, TOWS offers a more action-oriented approach by focusing on how to counteract threats with opportunities and mitigate weaknesses with strengths. These tools are particularly valuable at the industrial level, where strategic foresight is crucial for maintaining competitiveness and fostering growth. In the context of the AD-ASTRA project, the following sections (extensively described in D2.2 – "*Initial*

report on the SWOT analysis, relevant networks, and innovation barriers mitigation" and D2.3 – "*Final report on the SWOT analysis, relevant networks, and innovation barriers mitigation*") highlight some of the most significant findings and results derived from these analyses.

Strengths

- **Emilia-Romagna**: strong innovator with a recognized industrial sector but a less developed aerospace district. Emilia-Romagna excels in education and research and development, thanks to the presence of high-level universities and research centers.
- **Madrid**: strong innovator with a solid aerospace district distinguished by its complete value chain in the aeronautical and space sectors, with a vast presence of component and manufacturing companies.
- **Apulia**: moderate innovator characterized by i) a well-structured aerospace district, ii) a comprehensive aerospace education system supported by leading universities and technical institutes, and iii) a well-established aerospace supply chain with Leonardo centers of excellence in Brindisi, Foggia, Grottaglie and Avio Aero Center of Excellence in Brindisi.
- **Occitania**: strong innovator with a consolidated aerospace district, and leader in the aeronautical sector thanks to the presence of large manufacturers like Airbus, an integrated supply chain, and renowned engineering schools.
- **South Holland**: leader in innovation boasting a solid research and development base across all aerospace sectors, with numerous research centers and a highly qualified workforce.

Weaknesses

- **Emilia-Romagna**: the aeronautic manufacturing is minimal, with limited R&D, business, and education in the drone sector, few aerospace events, weak regional policies, and a notable absence of European Space program actors and testing infrastructures.
- **Madrid**: lack of skills in AI and cybersecurity for aerospace, underdeveloped drone sector employment, no drone testing infrastructure, limited regulations, and insufficient hiring support hinder Madrid's aerospace sector, despite international opportunities for young talent.
- **Apulia**: employment in the region faces challenges due to insufficient strategic capabilities, difficulties in attracting specialized professionals, and a lack of proactive hiring measures by businesses and authorities, despite no major obstacles in recruiting suitable candidates.

- **Occitania**: despite progress in circular economy efforts, the space and drone sectors are regionally limited, aerospace funding lacks coordination, hiring remains challenging despite skilled labor, and Airbus R&D is absent from Occitania, affecting regional aerospace growth.
- **South Holland**: the aerospace sector struggles with talent retention, limited funding, inadequate regulatory support, fragmented downstream space businesses, underdeveloped testing infrastructure, and faces strong competition from the growing semicon, maritime technology, and medtech sectors.

Opportunities

- **Emilia-Romagna**: the inauguration of HPC - LEONARDO and the realization of the Tecnopolo Manifattura - Data Valley Hub.
- **Madrid**: the establishment of the Spanish Space Agency.
- **Apulia**: strategic geographical position in the central Mediterranean region.
- **Occitania**: the French "Loi Climat Résilience" promotes a greener industrial transformation.
- **South Holland**: leverage the growing need for a circular economy.

Threats

- **Emilia-Romagna**: the development of the aerospace sector could shift interest and funding from established sectors to new ones.
- **Madrid**: other regions/countries are moving faster in developing aeronautical, space, and drone capabilities.
- **Apulia**: competition from other markets makes it difficult to attract and retain specialized professionals.
- **Occitania**: Brexit has led to a decline in company capabilities with British companies.
- **South Holland**: manufacturing companies are moving to different (low-cost) regions or countries.

Building on the findings from the SWOT analysis, a TOWS analysis was conducted (D2.3) to identify how each region's internal strengths and weaknesses could be leveraged to address challenges and capitalize on external opportunities. This analysis was crucial in formulating strategic frameworks that can enable the regions to collectively exploit their strengths, navigate the complexities of the aerospace sector, capitalize on opportunities, and mitigate risks. The TOWS analysis served as the foundation for the Joint Action Plan reported in Chapter 4.1.

These analyses were instrumental in thoroughly examining each of the five ecosystems individually and in identifying synergies among them. This collaborative approach allowed the consortium to pinpoint common challenges and shared opportunities, which are essential in overcoming barriers to innovation. The insights gained from this process not only informed the strategic planning but also laid the groundwork for sustained growth and competitiveness in the global aerospace landscape. The barriers to innovation identified through this process are detailed in the following sections.

Barriers to Innovation

The main barriers to innovation in the aerospace sector are:

- **Lack of resources**: Financial, human, and technological constraints. Startups and SMEs often struggle to access the necessary funding to develop innovative technologies. This is a common issue in various regions.
- **Resistance to change**: Reluctance to adopt new ideas or technologies.
- **Regulatory and legal barriers**: Complex regulations that hinder new products or services. Complex and constantly evolving regulations can pose an obstacle to innovation, particularly in the drone sector. The lack of supportive regulatory frameworks can discourage investment and limit growth opportunities.
- **Market uncertainty**: Unpredictability of market demand and competition.
- **Lack of collaboration**: Insufficient cooperation that stifles creativity and diverse perspectives. Collaboration among different ecosystem actors, including universities, research centers, and companies, is crucial for fostering innovation. Lack of collaboration can lead to fragmented efforts and slow technological progress.

Various mitigation measures can be taken to address these barriers, including:

- Financially supporting innovation: governments and financial institutions can play a key role in providing funding for research and development, as well as supporting startups and SMEs through soft loans, grants, and tax incentives.
- Promoting interregional collaboration: regions can learn from best practices and each other's strengths to fill their gaps. For example, regions with a solid research and development base can collaborate with regions with strong production capacity to accelerate the commercialization of technologies.
- Simplifying regulatory frameworks: clear, stable, and innovation-friendly regulations are essential to encourage investment and growth. Regulatory authorities should collaborate with the industry to develop frameworks that promote innovation and ensure safety.

- Attracting and retaining talent: investing in specialized educational and training programs, as well as creating an attractive work environment, can help attract and retain top talent.

3. Objectives and Priorities of the Joint Action Plan

3.1. Towards a sustainable, innovative, and competitive aerospace sector in Europe

When formulating the objectives and priorities of a Joint Action Plan to enhance cooperation between the current five AD-ASTRA aerospace partner regions and potentially expanding collaboration with other aerospace regions in Europe, it is crucial to integrate the most relevant EU policies and strategies. This ensures alignment with broader European objectives and maximizes the potential for innovation, sustainability, and economic growth within the aerospace sector. Aligning with these policies also enhances the opportunity to secure additional programming and funding, thereby supporting interregional interaction and encouraging long-term innovative and economic development.

Most relevant EU policies to currently take into account are NextGenerationEU, Smart Specialisation Strategy (S3), and the Green Deal. They collectively promote a sustainable, innovative, and competitive aerospace sector in Europe. They also provide the necessary funding, regulatory framework, and collaborative environment to drive long-term advancements in aerospace technologies and practices. A more detailed description is reported in the following:

- **NextGenerationEU**, the European Commission's recovery plan, significantly impacts the aerospace sector in Europe by promoting green and digital transitions. It supports sustainable aviation fuels (SAFs) and eco-friendly technologies, aiding the industry's shift towards climate neutrality. The plan also enhances digital infrastructure and innovation in aerospace manufacturing through 5G, AI, and advanced analytics. Economic resilience is supported by funding for research and development, encouraging advancements in aerodynamics and propulsion technologies. Workforce development is also a focus, ensuring a skilled *labor* force for new aerospace technologies. Infrastructure modernization, including airports, and regional collaboration are key components, driving efficiency and sustainability in the aerospace industry.
- The **Smart Specialisation Strategy (S3)** by the European Commission focuses on developing economic growth and job creation through tailored regional innovation strategies. It is part of the EU's Cohesion Policy and emphasizes three main pillars: localization, prioritization, and participation. These strategies are designed to identify and develop unique competitive advantages within each region, aligning resources and strategies across different governance levels. The Smart Specialisation Platform (S3P) supports regions

in developing, implementing, and reviewing their Research and Innovation Strategies for Smart Specialisation (RIS3). The platform offers information, methodologies, and advice to policymakers, fostering innovation partnerships. Thematic Smart Specialisation Platforms (TSSPs) encourage interregional collaboration on shared priorities, enhancing economic cohesion through international innovation projects and co-investment initiatives. The S3 Community of Practice (S3 CoP) provides a central hub for networking, policy learning, and advancing smart specialisation practices, offering targeted support and facilitating stakeholder collaboration.

- The **European Green Deal** significantly impacts the aerospace industry, encompassing aviation, UAVs, drones, and space sectors. A major focus is on the development and adoption of sustainable aviation fuels (SAFs) to reduce carbon emissions from aircraft. This includes research into alternative fuels like hydrogen and electric propulsion systems. Advancements in electric and hybrid-electric propulsion systems for short and medium-haul flights are also essential, alongside the development of infrastructure to support electric aviation, such as charging stations at airports. Innovations in aerodynamics, lightweight materials, and engine efficiency are critical for reducing fuel consumption and emissions. Carbon capture and storage (CCS) technologies in manufacturing processes are also being explored. Urban air mobility (UAM) is another key area, with the development of electric vertical takeoff and landing (eVTOL) aircraft aimed at reducing congestion and emissions in cities. This requires regulatory frameworks and infrastructure planning for safe and sustainable operations. Green technologies and practices at airports are being implemented, including renewable energy sources, waste management, and water conservation. Sustainable ground handling and service equipment are also being developed. Drones and UAVs are increasingly used for environmental monitoring, data collection, and pollution control, necessitating eco-friendly UAV technologies and operations. In the space sector, green propulsion systems for rockets and space vehicles are being developed, along with sustainable practices for space exploration and satellite manufacturing. Compliance with stringent environmental regulations and standards set by the European Union is essential, as is participation in global initiatives to set industry-wide sustainability benchmarks. Increased investment in research and development for sustainable aerospace technologies is crucial, fostering collaboration between industry, academia, and government bodies. The adoption of circular economy principles, including recycling and reusing materials, is encouraged, along with the development of end-of-life strategies for aircraft and aerospace components. Initiatives to raise public awareness about the environmental impact of aviation and space activities are important, as are educational programs and training for the workforce to embrace sustainable practices.

Short Term Objectives

Taking the above policies into account and defining short term as a 1 to 3 year period from now, the following objectives can be identified:

- Increase Investment in SAFs and Green Technologies:
  - Secure funding and initiate research projects focused on the development and deployment of SAFs and hydrogen propulsion systems.
  - Promote the adoption of electric and hybrid-electric propulsion technologies in short-haul flights.

- Enhance Digital Infrastructure and Capabilities:
  - Implement digital transformation projects to improve air traffic management systems using AI and advanced analytics.
  - Develop and upgrade digital infrastructure in airports to support efficient and sustainable operations.

- Strengthen Regional Innovation Ecosystems:
  - Stimulate collaboration between aerospace clusters, research institutions, and SMEs through S3 initiatives.
  - Launch joint projects and programs to leverage regional strengths and drive technological advancements.

- Modernize Airport Facilities:
  - Invest in the modernization of airport facilities to incorporate renewable energy sources, sustainable practices and new ways of air traffic.
  - Enhance ground service equipment and logistics to reduce environmental impacts.

- Advance Space Sector Capabilities:
  - Invest in the development and deployment of next-generation satellite technologies and space exploration missions.
  - Promote the use of space data and services for various applications, including environmental monitoring, telecommunications, and navigation.

- Support Workforce Development:
  - Implement training programs and educational initiatives to equip the workforce with skills needed for new aerospace technologies and green practices.

Long Term Objectives

Taking the EU policies into account and defining long term as a 5 to 10 year period from now, the following objectives can be identified:

- Climate Neutrality in Aerospace:
  - Develop and commercialize zero-emission aircraft, including those powered by hydrogen and electric propulsion, in alignment with the Green Deal goals.
  - Achieve significant reductions in carbon emissions from aviation, UAVs, and space activities.

- Establish a Robust Innovation and Research Network:
  - Create a sustainable and collaborative network of research and innovation centres dedicated to aerospace technologies.
  - Maintain global leadership in aerospace innovation by continuously advancing cutting-edge technologies.

- Integrate Advanced Technologies in Aerospace Operations:
  - Fully integrate AI, IoT, and advanced data analytics in aerospace operations to enhance safety, efficiency, and environmental sustainability.
  - Develop smart aerospace systems and infrastructure that leverage digital advancements for better management and performance.

- Promote Sustainable Economic Growth:
  - Ensure the aerospace sector contributes to sustainable economic development by creating high-quality jobs and supporting regional economies.
  - Encourage the growth of SMEs within the aerospace industry by providing access to funding, resources, and collaborative opportunities.

- Expand and Strengthen Interregional Collaboration:
  - Set up long-term partnerships between different European regions to support continuous innovation and economic growth in the aerospace sector.
  - Implement interregional projects that contribute to the development of new aerospace technologies and solutions.

Regional Cooperation is Essential

Both the short-term and long-term objectives for the aerospace sector in Europe, as outlined in the context of NextGenerationEU, the Smart Specialisation Strategy (S3),

and the Green Deal, cannot be fully achieved without robust regional cooperation between aerospace regions.

This collaboration is essential for pooling resources, sharing expertise, and fostering innovation across various sub-sectors such as aviation, UAV/drones, and space. Interregional partnerships enable the alignment with EU policies, maximize funding opportunities, and support sustainable and economic development goals. Through coordinated efforts, regions can drive technological advancements, ensure sustainable practices, and maintain Europe's competitive edge in the global aerospace market.

Strategic Priorities for Aerospace Regions

When formulating strategic priorities for the AD ASTRA aerospace partner regions, it is essential to align short-term and long-term objectives with the relevant megatrends in aerospace, considering the enabling technologies and sector-specific developments in aviation, UAVs/drones, and space. Here are the strategic priorities for each category:

Enabling Technologies for Aerospace in General

1. **Increased Automation and Artificial Intelligence (AI):**
    a. **Short Term:** Invest in AI and automation projects, including the development of autonomous systems for aircraft, drones, and space applications. Encourage cross-sector collaboration to leverage AI advancements in automotive and industrial automation.
    b. **Long Term:** Establish centers of excellence for AI in aerospace, fostering continuous innovation and talent development. Create robust AI ecosystems that support technological spill-overs across different sectors.

2. **Advanced Materials and Manufacturing Processes:**
    a. **Short Term:** Promote R&D in advanced materials, including lightweight composites and bio-based materials. Support the adoption of advanced manufacturing processes such as additive manufacturing (3D printing) for aerospace components.
    b. **Long Term:** Develop infrastructure for large-scale production and testing of advanced materials. Foster collaboration between aerospace regions to share best practices and drive innovation in manufacturing technologies.

Space Sector

3. **Earth Observation, Weather Prediction, and Remote Sensing Technologies:**
    a. **Short Term:** Collaborate on developing and deploying advanced satellite systems for Earth observation and weather prediction. Enhance data collection and analysis techniques to improve accuracy and reliability.
    b. **Long Term:** Create an integrated network of Earth observation satellites to support global climate monitoring, disaster management, and resource planning. Promote the use of satellite data for policy-making and sustainable development.

4. **Advanced Sensors and Instruments for Scientific Exploration:**
    a. **Short Term:** Invest in R&D for advanced sensors and scientific instruments. Establish testing facilities and specialized infrastructure to support innovation in this field.
    b. **Long Term:** Foster international partnerships to enhance scientific exploration missions. Support the commercialization of advanced sensor technologies for various space applications.

5. **Small and Cube Satellite Technologies:**
    a. **Short Term:** Facilitate joint research projects and knowledge exchange on small and cube satellite technologies. Provide funding and infrastructure for testing and manufacturing small satellites.
    b. **Long Term:** Develop shared facilities for satellite assembly and launch. Encourage the growth of startups and SMEs in the small satellite market, enhancing the competitiveness and innovation capacity of aerospace regions.

Aeronautics and Aviation

6. **Electric and Hybrid Propulsion Systems:**
    a. **Short Term:** Support research into high-energy-density batteries and efficient power management systems. Foster collaboration with the automotive sector to leverage expertise in electric propulsion.
    b. **Long Term:** Develop comprehensive charging infrastructure and regulatory frameworks to support widespread adoption of electric and hybrid aircraft. Promote continuous innovation in propulsion technologies to improve performance and sustainability.

7. **Hydrogen Powered Aviation:**
    a. **Short Term:** Invest in hydrogen production facilities and refueling infrastructure. Encourage R&D projects focused on hydrogen propulsion systems and their integration into existing aircraft.
    b. **Long Term:** Establish partnerships to create a robust hydrogen aviation ecosystem. Promote international cooperation to standardize safety and certification processes for hydrogen-powered aircraft.

Drones/Advanced Air Mobility

8. **Urban Air Mobility (UAM) and eVTOL Aircraft:**
    a. **Short Term:** Develop regulatory frameworks and safety standards for UAM operations. Provide incentives for investment in UAM technologies and infrastructure.
    b. **Long Term:** Establish urban testbeds for UAM solutions, enabling real-world demonstrations and public acceptance. Promote cross-border collaboration to create a seamless UAM network across regions.

9. **Unmanned Aerial Systems (UAS) Air Traffic Management:**
    a. **Short Term:** Collaborate on developing communication and navigation systems for UAS. Address regulatory challenges and standardize detect-and-avoid technologies.
    b. **Long Term:** Create an integrated UAS air traffic management system that ensures safe and efficient operations. Support innovation in autonomous flight control systems to enhance UAS capabilities.

10. **Drone-based Inspection and Maintenance Services:**
    a. **Short Term:** Invest in advanced AI and automation technologies for drone inspections. Develop specialized payloads and sensors for various inspection and maintenance tasks.
    b. **Long Term:** Standardize and certify drone-based inspection services. Promote the widespread adoption of drones for infrastructure and industrial maintenance, enhancing efficiency and reducing costs.

By focusing on these strategic priorities, the AD ASTRA aerospace partner regions can leverage EU policies and megatrends to drive innovation, sustainability, and economic growth in the aerospace sector. This collaborative approach ensures that regions remain competitive and resilient in the evolving global aerospace landscape.

4. Operational plans and implementation

In the rapidly evolving aerospace sector, fostering collaboration and creating common knowledge assets among stakeholders from diverse ecosystems has become a priority. Over the last two years, the AD-ASTRA consortium has exemplified the importance of strategic collaboration and integration within the European innovation ecosystem of Emilia-Romagna, Madrid, Apulia, Occitania, and South Holland regions. With the conclusion of the project, and following the overall objectives and considering the impact of the megatrends, as depicted in details and thematically in the previous chapter, the consortium has highlighted the significance of strategic collaboration within the aerospace sector, by defining a series of comprehensive actions aimed at aligning innovation agendas across different sectors and regions. The actions, identified initially as puzzle pieces that fit neatly into the AD-ASTRA project activities, over time mature and become independent actions that nevertheless continue to have a solid foundation in past actions (Figure 1). All of them are designed to enhance synergies and complementarities among existing initiatives, encouraging the alignment of innovation agendas across various sectors and regions. These actions are systemic and might be applied at the regional policy level, trying to have vertical applications based on the global priorities, introduced in the previous paragraph in a short and long term perspective.

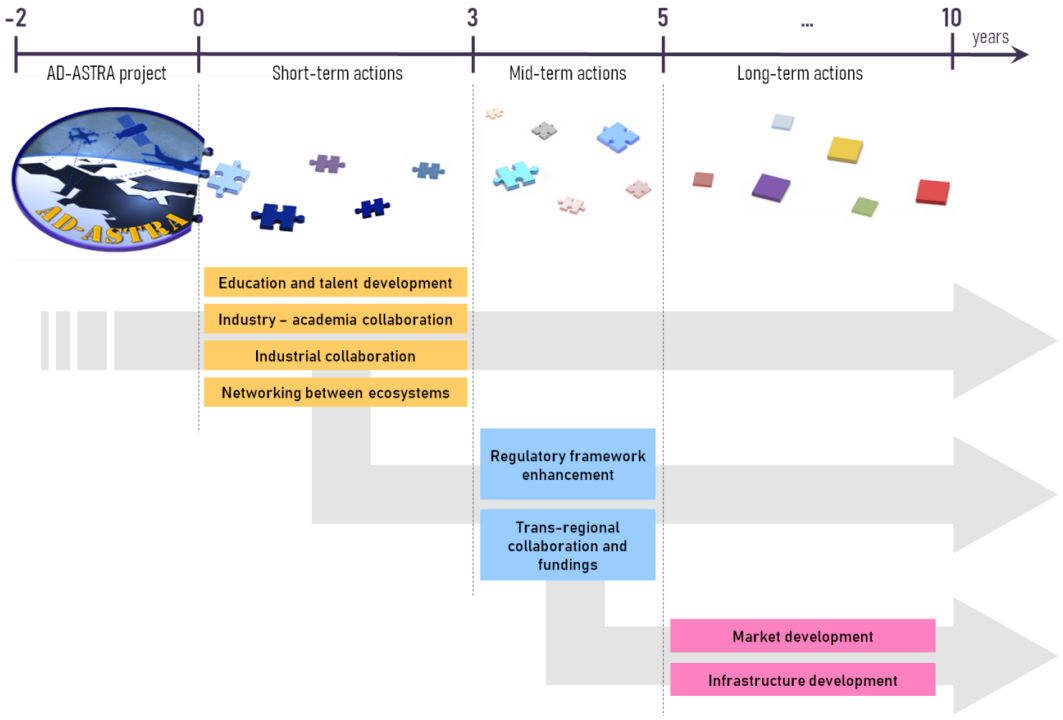

Figure 1 Schematic representation of the Action Plan, categorising activities based on their timelines.

The whole Action Plan applies the Quadruple Helix model, which recognizes four major actors in the innovation system: government, academia, industry, and

community. These actors collectively contribute to the innovation ecosystem, driving progress and ensuring that diverse perspectives and needs are addressed (Figure 2).

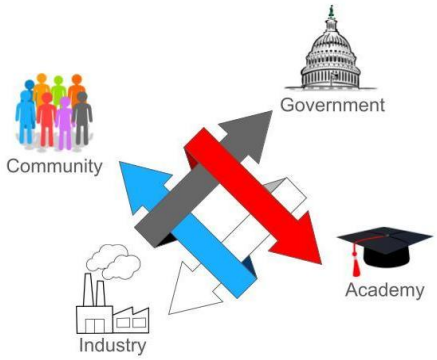

Figure 2 Schematic representation of the quadruple helix model.

The action plan outlines current and future connections among ecosystems, identifies key technologies transferable to and from the aerospace sector, highlights regional gaps, and proposes corrective activities to address these gaps. It also addresses operational modes to avoid competition barriers to knowledge and technology transfer. Furthermore, the plan evaluates the replicability of best practices across regions and proposes corrective actions to overcome specific territorial challenges. As illustrated in Figure 2, this information is presented with short, medium, and long-term perspectives, considering a 10-year timescale to foresee the development and growth of interconnected aerospace innovation ecosystems. The actions are reported in different tables and are grouped into different macro categories based on timeframes and specific themes which are detailed below:

- Short-term actions
  - Education and talent development
  - Industry-academia collaboration
  - Industrial collaboration
  - Networking between ecosystems

- Mid-term actions
  - Regulatory framework enhancement
  - Trans-regional collaborations and funding

- Long-term actions
  - Market development
  - Infrastructure development

Each group of actions is described in detail, with the rationale behind each action clearly outlined. To make these actions more concrete, the AD-ASTRA consortium has suggested specific implementation steps, some of which are already operative and

elaborated in documents D3.2 and D2.1. Additionally, the actors positively influenced by these actions are identified, along with cost and time estimates categorised as follows:

- €: Low resource use (cost < 500 k€, < 10 people)
- €€: Medium resource use (500 k€ < cost < 1 M€, < 50 people)
- €€€: High resource use (cost > 1 M€, > 50 people)

Each table that makes up the action plan highlights the benefits of these actions, emphasising how they can enhance collaboration among the five ecosystems. By fostering strategic collaboration and leveraging the strengths of various stakeholders, the AD-ASTRA consortium aims to create a resilient and interconnected innovation network that drives progress in the aerospace sector and beyond.

4.1. Action Plan

Short-Term Actions (0-3 years)

The short-term actions were identified based on the existing capabilities analysed in the first phase of the AD-ASTRA project. These activities are closely linked with the members of the consortium and are tightly integrated with the initiatives undertaken during the project's development. All short-term actions are built on the work completed within WP1 and WP2, which focused on analysing the five regional ecosystems, identifying successful connections and examining megatrends, SWOT, and TOWS analysis. Moreover, the primary beneficiaries of these activities are the local stakeholders who are in direct contact with the AD-ASTRA consortium.

EDUCATION AND TALENT DEVELOPMENT	
Actions	ACTION 1. Establish cross-regional internship and training programs for students in aerospace sectors. ACTION 2. Promote science, technology, engineering, and mathematics (STEM) education and career awareness programs to attract young talent to the aerospace sector. ACTION 3. Encourage interdisciplinary education and research involving aerospace and other related fields such as robotics, automotive, automation, materials science, etc… ACTION 4. Develop exchange programs for Ph.D. students and researchers. ACTION 5. Encourage education and career awareness programs at academia level, to generate the teachers of the future.

Description What needs to be done?	To support education and talent development within the aerospace sector, it is necessary to promote interdisciplinary programs such as Pegasus and Erasmus+ that represent success stories of collaboration among the five regions of AD-ASTRA project.
Rationale Why is it being proposed?	The academic collaboration among Emilia-Romagna, Madrid, Apulia, Occitania, and South Holland is of significant added value due to a wide range of academic courses offered across various disciplines. All the regions, particularly Madrid and Occitania, excel in valuable aeronautics and space programs. Beyond aerospace, E-R offers strong programs in automotive engineering and automation. Apulia is notable for its aerospace and ICT sector *(sectors in which the region is one of the most active in the country and which has shown considerable growth in the last decade)* and agricultural sciences, while South Holland leads in sustainable energy and water management studies. This diversity enables a multidisciplinary approach to education, fostering innovation and providing comprehensive learning opportunities. On the other side, there are commonalities among the 5 regions, that highlight the need for coordinated efforts in addressing skills gaps, enhancing training programs, attracting investment, and engaging the younger generation to ensure the long-term sustainability and growth of the aerospace sector. These reflect in the 4 actions suggested and in the following steps for implementation.
Suggested steps for implementation	➔ Determine the skills and knowledge gaps in the aerospace sector through the use of tools such as the skills Intelligence Emilia-Romagna (https://emiliaromagnainnodata.art-er.it/skills-intelligence-emilia-romagna/) or using direct surveys for in-depth analysis, that can be easily distributed through online platforms (*e.g.*, Google Form, Jotform[1]) to reach a more widespread audience. ➔ Define the goals of the internship and training programs (*e.g.*, skills development, job placement rates). ➔ Leverage existing alliances between universities and formalise collaborations through agreements (MoU) detailing roles responsalìbilities, and expectations. ➔ Organise workshops and seminars to promote interdisciplinary collaboration among universities and students. ➔ Promote the programs through various channels (*e.g.*, LinkedIn, Twitter, Instagram, Facebook, etc…) to attract students from different regions. ➔ Promote career awareness programs not only for industry-based careers, but also for careers at R&D/academia level. ➔ Promote Summer Schools organised from specific Universities in abroad regions/countries. ➔ Implement a fair and transparent selection process to identify qualified candidates and ease the recruiting process. ➔ Highlight success stories and breakthroughs from interdisciplinary programs to attract more students and collaborators. ➔ Involve the wider community through public lectures, open days,

	and media coverage to raise awareness of the importance of interdisciplinary approaches and eventually reduce the competition for talents.
Stakeholders positively affected	  
Impact measures	Interdisciplinarity, improvement of students' knowledge, and internationality.
Estimated cost/ time	€
Estimated benefits	➔ Encourage innovative thinking and problem-solving skills among interns, contributing to advancements in aerospace technologies. ➔ Equip the aerospace sector with a workforce that has the latest skills and knowledge, maintaining the industry's competitive edge. ➔ Create versatile professionals capable of addressing complex, multi-faceted challenges. ➔ Foster innovation through collaborative education and research that brings together diverse perspectives and expertise. ➔ Accelerate technological advancements by leveraging interdisciplinary approaches to research and development. ➔ Ensure a continuous supply of skilled professionals to meet the long-term needs of the aerospace sector. ➔ Contribute to economic development by creating high-level skills and driving technological advancements. ➔ Improve the reputation of academic institutions by offering cutting-edge, interdisciplinary programs.

INDUSTRY - ACADEMIA COLLABORATION	
Actions	ACTION 6. Develop specialised courses, training and internship programs, and student exchange initiatives, tailored to industry needs in collaboration with universities and vocational institutions, to bridge the gap between academia and industry. ACTION 7. Develop entrepreneurial competences among academics (students, Ph.D.s and researchers) by offering workshops, mentoring programs, hands-on projects, integrating entrepreneurship into the *curriculum*, and establishing partnerships with industry experts to provide real-world experience.
Description What needs to be done?	Leverage the collaborations between industry and academia not only at a regional level but on an international one to foster the industry academia collaboration and thus the scientific progress in industries, and also the development of an entrepreneurial spirit within the academic people.
Rationale Why is it being proposed?	Aerospace is a highly technical field that requires a workforce with specialised knowledge and skills. Academic institutions provide the training and education necessary to develop engineers, scientists, and technicians who can drive innovation and maintain industry standards. Academic institutions often lead in cutting-edge research, exploring new materials, propulsion systems, avionics, and other critical technologies. This research is fundamental to advancing the aerospace industrial sector.
Suggested steps for implementation	➔ Collaborate with industry experts and educators to design internship and training curricula that address current and future industry needs. ➔ Participate in specific call for projects that offer a great opportunity of collaboration among different types of institutions (*e.g.*, European project - Interconnected InnovationEcosystems, HORIZON-EIE-2024-CONNECT-02, Expanding Academia - Enterprise Collaborations)
Stakeholders positively affected	   
Impact measures	Skilled workforce, job creation and sustainable development.
Estimated cost/ time	€€
Estimated benefits	➔ Academia often collaborates with industry to solve practical problems, leading to mutual benefits. These partnerships can result in joint research projects, internships, and cooperation programs that provide students with hands-on experience. ➔ Academic institutions act as a bridge for knowledge transfer between theoretical research and practical applications, ensuring that the latest scientific discoveries are quickly implemented in the industry.

	➔ By investing in academia, regions can create high-quality jobs in both the educational and aerospace sectors. This not only benefits the local economy but also attracts additional investment and talent to the area. ➔ Academic research, trained with entrepreneurial competencies, can lead to the creation of startups and spin-off companies that commercialise new technologies, further contributing to economic growth and innovation in the aerospace sector. ➔ The aerospace sector faces significant challenges related to sustainability and environmental impact. Academic research is essential for developing greener technologies and practices that can help the industry reduce its carbon footprint and comply with global environmental regulations. ➔ The aerospace industry must constantly adapt to changing technologies and market demands. Academia plays a crucial role in anticipating these changes and preparing the industry to respond effectively. ➔ Academic and industrial research provides the data and insights needed to inform policymakers about the best practices and necessary regulations for the aerospace sector. ➔ Academy contributes to the development of industry standards and safety protocols, ensuring that the aerospace sector operates efficiently and safely. ➔ Collaboration at European level can give technology transfer a wider scope, provide a more efficient use of cutting edge R&D and a more integrated European Research Area, thus enhancing the competitiveness of European industries.

INDUSTRIAL COLLABORATION	
Actions	ACTION 8. Establish cross-regional collaboration among companies primarily active within the aerospace sector. ACTION 9. Establish cross-regional collaboration among companies dealing with aerospace and other innovative sectors.
Description What needs to be done?	Foster the collaboration established among consortium members during the AD-ASTRA project to facilitate engagement with aerospace sector stakeholders across the Emilia-Romagna, Madrid, Apulia, Occitania, and South Holland regions. Collaborations can take various forms, including direct one-to-one partnerships, participation in joint projects, and more.
Rationale Why is it being proposed?	The industrial scenarios of Emilia-Romagna, Madrid, Apulia, Occitania, and South Holland exhibit unique characteristics. These regions, all with well-established aerospace districts at varying levels of maturity, offer numerous benefits to their respective ecosystems. Facilitating networking and partnerships among aerospace companies within and across these regions can create cohesive business ecosystems, enhancing global competitiveness and attracting investments. Furthermore, such collaboration can also yield benefits through interaction with other strong sectors like automotive engineering and motorsports, automation, biotechnology, marine technology, agricultural sciences, sustainable energy, and water management within these regions.
Suggested steps for implementation	➔ Contact the AD-ASTRA consortium (info@aerospacedistricts.eu) to get in contact with the representatives of the aerospace sector in Emilia-Romagna, Madrid, Apulia, Occitania and South Holland. ➔ Leverage the AD-ASTRA tool (developed within the AD-ASTRA project) to get in contact with some of the companies working in the aerospace sector and not only. ➔ Participation in networking events. ➔ Leverage on the connection capabilities of the NEREUS network, where all the 5 regions involved in the project participate. ➔ Participate in specific call for projects that offer a great opportunity of support to promising innovative start-ups and SMEs, eg: HORIZON-EYE-2024-CONNECT-02-02 Mutual learning and support scheme for national and regional innovation programmes
Stakeholders positively affected	 
Impact measures	Cross-sector innovation, sustainable development, and economic growth.
Estimated cost/ time	€€
Estimated benefits	➔ Leverage the diversity of the five ecosystems can bring to more innovative solutions and advancements.

	➔ Collaborative projects can distribute the financial burden across multiple partners, reducing individual costs and risks. Moreover, it can speed up the innovation process by combining the strengths and capabilities of different partners. ➔ The collaboration at an industrial level can enhance the European and global competitiveness of the five regions. ➔ Collaboration can help companies enter new markets more easily, leveraging local partners' knowledge and networks. ➔ Enable the sharing of high-cost resources such as research facilities, testing equipment, and specialised labour. This optimises the use of resources and minimises duplications. ➔ Collaborations can strengthen lobbying efforts to influence favourable regulations and standards in different regions. ➔ Exposure to different cultures and business practices can lead to more culturally sensitive and adaptable business strategies. ➔ Collaborative efforts can address global challenges such as climate change by developing and implementing sustainable technologies and practices. ➔ Working together allows companies to contribute to global initiatives and create a more significant impact on society issues.

NETWORKING BETWEEN ECOSYSTEMS	
Actions	ACTION 10. Organise regular networking events such as workshops, seminars, webinars, or conferences where it is possible to meet, share insights, and build relationships. ACTION 11. Implement collaborative tools such as shared document repositories to facilitate collaboration and document sharing. ACTION 12. Organise matchmaking sessions or networking events specifically designed to connect partners with complementary skills and resources.
Description What needs to be done?	Leverage the events organised or where the partners of AD-ASTRA are involved to strengthen the collaboration among the five ecosystems started during the AD-ASTRA project.
Rationale Why is it being proposed?	Regular networking events provide numerous opportunities, such as building personal connections, enhancing trust and fostering collaboration. Workshops, seminars, and webinars allow partners to share insights, expertise, and best practices. By bringing partners together in a collaborative environment, networking events encourage discussions and idea generation, laying the foundation for future collaborations and joint initiatives.
Steps for implementation	➔ Identify and promote relevant events (*e.g.*, IAC, Paris/Farnborough Air Show, R2B, Aeromart Toulouse, etc….) where stakeholders from the five regions can convene, interact, and explore potential collaborations. ➔ Establish clear guidelines for communication frequency, channels, and protocols to facilitate interactions. ➔ Evaluate and implement collaborative tools to enhance communication and collaboration among partners across the five ecosystems.
Stakeholders positively affected	  
Impact measures	Foster long term collaborations, and knowledge sharing.
Estimated cost/ time	€€
Estimated benefits	➔ Partners can exchange insights, expertise, and best practices during networking events, leading to improved decision-making and problem-solving. ➔ Networking events provide opportunities to identify new collaboration opportunities, potential partners, and innovative solutions to project challenges. ➔ Partners who participate in networking events are likely to feel more engaged and invested in the project, leading to higher motivation and commitment to project success. ➔ Connecting partners with complementary skills and resources maximises the utilisation of available resources, leading to more

	efficient project implementation and delivery. ➔ Matchmaking sessions encourage the exchange of ideas and perspectives, leading to the development of innovative solutions and approaches to project challenges.

Mid-Term Actions (3 - 5 year)

The mid-term actions were designed on the basis of short-term actions. These activities are not so closely linked with the members of the AD-ASTRA consortium even if they are a consequence of the work done previously. In this case, all of the actions rest essentially on strong pillars consisting in the close cooperation among five ecosystems at academic and industrial level.

REGULATORY FRAMEWORK ENHANCEMENT	
Actions	ACTION 1. Engage with regional policymakers and regulatory bodies to develop supportive regulations for aerospace (*e.g.*, drones, space activities, etc…). ACTION 2. Advocate for reforms to streamline regulatory processes and promote innovation while ensuring safety and compliance. ACTION 3. Collaborate with industry experts and policymakers to address regulatory barriers and create a proactive environment for aerospace growth. ACTION 4. Work towards aligning regional aerospace strategies and policies with national and European priorities to ensure long-term compatibility and competitiveness.
Description What needs to be done?	To concretize the previous actions, organising roundtables and workshops with regional policymakers and regulatory bodies is essential for developing supportive aerospace regulations. Additionally, aligning regional aerospace strategies with national and European priorities through coordinated strategic plans and active participation in policy forums is a priority. These steps will create a supportive regulatory environment, streamline processes, and foster innovation and growth in the aerospace sector.
Rationale Why is it being proposed?	The rationale behind these actions is to establish a robust and supportive regulatory framework that drives innovation and growth in the aerospace sector. By developing such a framework, regions can leverage broader policy initiatives, secure funding, and seize collaborative opportunities, maintaining global competitiveness. These actions aim to foster an environment that supports innovation, lowers barriers to market entry, and aligns regional strategies with broader strategic goals.
Steps for implementation	➔ Map out all relevant stakeholders, including regional policymakers, regulatory bodies, industry leaders, academic experts, and advocacy groups. ➔ Organise workshops and roundtables to discuss with stakeholders with the aim to gather and build consensus on regulatory needs (participants from aerospace companies, academia, and legal experts to focus on regulation issues). ➔ Prepare detailed policy briefs and reports summarising the proposed regulation and their expected impact to present to policymakers. ➔ Draft legislative proposals or regulatory amendments based on

	the collaborative input and present them to legislative bodies or regulatory authorities for consideration. ➔ Provide training and resources to regulatory bodies to ensure they have the expertise and capacity to implement and enforce the new regulation.
Stakeholders positively affected	   
Impact measures	Enhanced innovation and growth, global competitiveness, economic benefits, collaboration and knowledge sharing, safety and compliance, sustainable development
Estimated cost/ time	€€
Estimated benefits	➔ Supportive regulations and streamlined processes can lead to faster development and adoption of cutting-edge aerospace technologies. ➔ By staying aligned with international standards and priorities, regions can position themselves as leaders in the global aerospace market. ➔ Competitive aerospace products and services can lead to increased exports, further strengthening the economic position of the regions. ➔ Improved collaboration between policymakers, industry experts, and academia can lead to stronger professional networks and more effective partnerships. ➔ Facilitating the exchange of knowledge and expertise can enhance the overall capability and innovation potential of the aerospace sector. ➔ Consistent adherence to safety and compliance standards can lead to safer aerospace operations and increased public trust. ➔ Clear and supportive regulations can reduce ambiguities, making it easier for companies to comply and innovate. ➔ Aligning with national and European priorities ensures that regional aerospace developments are sustainable and forward-looking. ➔ Innovations in aerospace can lead to more environmentally friendly technologies and practices, contributing to global sustainability goals. ➔ Growth in the aerospace sector can spur the development of educational programs and initiatives, enhancing the skills and knowledge base of the workforce (also in the public administration). ➔ Economic and technological advancements can lead to improved infrastructure and community development, enhancing the quality of life in the regions.

TRANS-REGIONAL COLLABORATION AND FUNDINGS	
Actions	ACTION 5. Monitor global aerospace trends and adapt regional and trans-regional strategies to diversify specialisations and mitigate industry shifts. ACTION 6. Establish joint research initiatives and thematic innovation hubs (eventually with incubation purposes) to facilitate cross-industry collaboration and knowledge exchange. ACTION 7. Creation of trans-regional funding initiatives (*i.e.*, Vinnovate programme, cascade fundings from I3 o RIV programmes, etc…) to support projects, startups, scale-ups and research programs in aerospace and cross-thematic technologies such as AI, cybersecurity, and drones.
Description What needs to be done?	Based on the global aerospace trends, collaboration should be enhanced through concrete actions and dedicated spaces such as innovation hubs (conceived also for nurturing the growth of spin-offs/startups), as well as through trans-regional funding initiatives. These measures are able to ensure regions remain aligned with global industry trends, foster innovation through cooperative efforts, and provide financial support for advanced research and development projects.
Rationale Why is it being proposed?	The rationale behind the above mentioned actions is to monitor aerospace trends, establish research initiatives, and create funding programs. The goal is to enhance competitiveness, foster innovation, and ensure sustainable growth in the aerospace sector across regions driving technological advancements and innovation.
Steps for implementation	➔ Form a team dedicated to tracking global aerospace trends and technologies (*i.e.*, permanent observatories). ➔ Produce regular reports and organise workshops to share insights. ➔ Hold strategy sessions to adapt regional plans based on trend analyses. ➔ Set up physical and virtual innovation hubs for cross-industry collaboration and, eventually, cross-industry and cross-regional spin-off/startup initiatives. ➔ Leverage joint research initiatives between universities and companies defined in past years and based on short-term actions. ➔ Organise conferences and seminars to encourage knowledge sharing. ➔ Establish trans-regional funding initiatives targeting startups, scale-ups, and research programs. ➔ Apply for fundings from regional, national, and EU sources. ➔ Establish regular issue of calls for project proposals focusing on aerospace and related technologies.
Stakeholders positively affected	   

Impact measures	Enhanced competitiveness, risk mitigation, diversification, increased innovation, cross-industry synergy, knowledge sharing, talent attraction and retention, financial support, stimulated growth, sustainable development, economic boost, global leadership, technological advancement, and investment attraction.
Estimated cost/ time	€€€
Estimated benefits	➔ Regions can better adapt to industry changes and mitigate risks. ➔ Maintain a competitive position in the global aerospace market. ➔ Reduce reliance on specific sectors, enhancing economic resilience. ➔ Fasten the development of new technologies through collaborative research. ➔ Attract and retain top talent and facilitate knowledge exchange. ➔ Boost economic growth and employment through targeted funding initiatives. ➔ Promote sustainable development in emerging technologies. ➔ Create an attractive environment for investments, driving further economic growth.

Long-Term Actions (5 - 10+ years)

The long-term actions were developed based on the previous initiatives, which aimed to create a robust interconnected ecosystem among the five regions. Consequently, these actions are primarily directed at policymakers and regulatory bodies, followed by industry and academia. The objective is to foster the growth of these interconnected ecosystems on a global scale, ensuring they comply with international standards and eventually involving other ecosystems outside of the boundaries of the AD-ASTRA partnership.

MARKET DEVELOPMENT	
Actions	ACTION 1. Facilitate market access for regional aerospace companies by leveraging international partnerships and trade agreements. ACTION 2. Develop online platforms for sharing industry insights, market trends, and research advancements globally. ACTION 3. Promote the establishment of international aerospace offices or representation to support regional businesses in the global market.
Description What needs to be done?	To facilitate these actions, actively leverage international partnerships and trade agreements to open new markets for regional aerospace companies. Develop centralised online platforms for sharing industry insights, market trends, and research advancements, enhancing global knowledge exchange (*i.e.*, the AD-ASTRA tool may represent a first step in this direction). Promote the establishment of international aerospace offices or representation to support regional businesses in navigating and accessing the global market.
Rationale Why is it being proposed?	The rationale behind these actions is to enhance the global competitiveness and growth of regional aerospace companies, considering how this sector is changing and will change in the next years, becoming more commercial and industrialised, significantly increasing the actual market and opening up brand new markets as well. By leveraging international partnerships and trade agreements, regions can open new markets and create opportunities for business expansion. Developing centralised knowledge platforms ensures that industry insights, market trends, and research advancements are readily accessible, fostering innovation and informed decision-making. Promoting the establishment of international aerospace offices provides regional businesses with the necessary support and representation to navigate complex global markets effectively. These actions collectively aim to create a robust framework that supports regional aerospace companies in expanding their reach, fostering collaboration, and staying competitive in the global aerospace industry.
Steps for implementation	➔ Identify key international markets with high potential for aerospace industry growth. ➔ Collaborate with trade organisations, government bodies, and

	international trade missions to facilitate introductions and negotiations. ➔ Participate in international aerospace trade shows and exhibitions to build relationships and promote regional capabilities. ➔ Develop programs to help regional aerospace companies navigate the complexities of international markets, including compliance with regulations and standards. ➔ Offer financial incentives, grants, or subsidies for companies expanding into new markets. ➔ Develop online platforms for sharing industry insights, market trends, and research advancements globally. ➔ Promote the establishment of international aerospace offices or representation to support regional businesses in the global market. ➔ Continuously monitor the performance of international offices and representatives.
Stakeholders positively affected	   
Impact measures	Expanded market access, enhanced collaboration and Innovation, economic growth, competitive advantage, and sustainable growth.
Estimated cost/ time	€€€
Estimated benefits	➔ Access to new markets and international trade agreements significantly boost sales and revenue for regional aerospace companies. ➔ Expansion into global markets generates new employment opportunities within the aerospace sector and its supply chain. ➔ Centralised knowledge platforms facilitate the sharing of cutting-edge research, market trends, and industry insights, driving technological advancements. ➔ Improved global collaboration leads to the development of innovative solutions and products through shared expertise and resources. ➔ Entering international markets reduces dependency on local markets and spreads risk, making companies more resilient. ➔ Companies gain a competitive advantage by staying constantly aware of global trends and standards, improving their offerings. ➔ International aerospace offices provide essential support for regional businesses, helping them navigate regulatory environments and cultural differences. ➔ Representation abroad facilitates the formation of strategic alliances and partnerships, enhancing global business opportunities. ➔ A strong international presence attracts foreign investments, contributing to regional economic growth and infrastructure development. ➔ Continuous access to new markets and collaborative opportunities ensures long-term sustainability and growth for the aerospace sector.

INFRASTRUCTURE DEVELOPMENT	
Actions	ACTION 4. Allocate funding for infrastructure projects to improve aerospace capabilities and support industry growth. ACTION 5. Create shared experimentation and test infrastructures to enhance collaboration and innovation, and to attract companies and research institutions.
Description What needs to be done?	To implement the actions, it is necessary a comprehensive approach that can assess infrastructure needs, identify diverse funding sources, and execute construction and upgrades with robust monitoring systems. Engaging stakeholders, including aerospace companies, research institutions, and universities, is essential for designing shared infrastructures equipped with cutting-edge technology.
Rationale Why is it being proposed?	By improving both facilities and capabilities, the regions can stay competitive, meet industry standards, and support the growth of aerospace companies within each aerospace ecosystem. Enhanced infrastructure also attracts investment, facilitates advanced research, and drives technological advancements that are critical for maintaining a cutting-edge aerospace sector. Creating spaces where companies, research institutions, and universities can experiment and test new technologies promotes the exchange of ideas and expertise. This collaborative environment can accelerate the development of innovative solutions and reduce costs by sharing resources.
Steps for implementation	➔ Realise a comprehensive assessment of current infrastructure and identify areas requiring improvement. ➔ Establish working groups to oversee the planning and development of shared infrastructures. ➔ Assess the specific needs for experimentation and test infrastructures. ➔ Gather input from key stakeholders, including aerospace companies, research institutions, and government agencies on existing resources that can be used or upgraded. ➔ Develop a funding strategy that identifies potential sources, including government grants, private investments, and public-private partnerships. ➔ Prepare detailed project proposals and plans (containing detailed project plans, including timelines, budgets, and resource allocation) that outline the scope, objectives, and benefits of the infrastructure projects. ➔ Apply for grants, seek investment, and establish public-private partnerships to secure the necessary funds. ➔ Implement robust monitoring systems to track the progress and impact of the infrastructure projects. ➔ Allocate resources for the construction and maintenance of the infrastructures. ➔ Ensure compliance with industry standards and best practices. ➔ Establish guidelines for the use and management of the shared infrastructures. ➔ Actively promote the shared infrastructures to attract companies and

	research institutions. ➔ Highlight the benefits of collaboration and innovation fostered by these shared resources. ➔ Monitor the usage and impact of the shared infrastructures. ➔ Gather feedback from users and make continuous improvements to enhance their effectiveness.
Stakeholders positively affected	
Impact measures	Enhanced aerospace capabilities, industry growth, job creation, technological advancements, global competitiveness, increased collaboration, cost efficiency, innovation acceleration, attraction of talent and investment, enhanced research and development, community and ecosystem building.
Estimated cost/ time	€€€
Estimated benefits	➔ Improved infrastructure allows for the development and deployment of advanced aerospace technologies. ➔ Regions can maintain competitive advantages by meeting and exceeding industry standards. ➔ Financial support for infrastructure projects stimulates the growth of aerospace companies, attracting new businesses and fostering existing ones. ➔ Improved infrastructure creates a favourable environment for investment and economic development in the aerospace sector. ➔ Infrastructure projects generate new jobs in construction, engineering, and related fields. ➔ Long-term, enhanced capabilities lead to more employment opportunities in the aerospace industry. ➔ Upgraded infrastructure supports cutting-edge research and development, leading to breakthroughs in aerospace technology. ➔ Improved facilities enable faster and more efficient testing and deployment of new technologies. ➔ Regions with advanced aerospace infrastructure can compete more effectively on a global scale. ➔ Enhanced capabilities attract international partnerships and collaborations. ➔ Shared infrastructures foster collaboration among companies, research institutions, and universities. ➔ Cooperative efforts lead to the exchange of ideas, knowledge, and expertise, accelerating innovation. ➔ Shared resources reduce the financial burden on individual entities, allowing them to access state-of-the-art facilities without incurring the full costs. ➔ Collaborative projects spread costs and risks among multiple stakeholders. ➔ Shared test infrastructures provide a platform for rapid prototyping, testing, and iteration of new technologies. ➔ Accelerated innovation cycles lead to faster commercialization of advanced aerospace solutions.

	➔ High-quality shared infrastructures attract top talent from around the world, enhancing the region's reputation as a hub of aerospace innovation. ➔ Investors are more likely to fund projects that have access to cutting-edge facilities and collaborative environments. ➔ Shared experimentation facilities support a diverse range of R&D activities, leading to a broader scope of technological advancements. ➔ Collaboration among different entities enhances the quality and impact of research outcomes. ➔ The creation of shared infrastructures builds a strong aerospace community and ecosystem. ➔ Networking opportunities and joint ventures emerge, further strengthening the industry's foundation and growth potential.

5. Sustainability and Future Prospects

5.1. Long term impact assessment

The long-term impact of the action plan for collaboration and an active European innovation ecosystem in aerospace can be profound, influencing technological advancements, economic growth, geopolitical stability, and environmental sustainability. These impacts can be seen at regional level but also at a more global European level.

Technological Advancements and environmental sustainability

Collaborative efforts can lead to accelerated innovation: sharing resources, expertise, and technology accelerates the pace of innovation. Joint research initiatives and shared facilities can foster breakthroughs in aerospace technology. Collaboration can also drive the development of common standards and protocols, which can optimise manufacturing processes and improve compatibility across different aerospace systems and components.

When collaborative efforts focus on the development of sustainable aerospace technologies, such as more efficient engines, lighter materials, and alternative fuels, it helps reduce the environmental footprint of the aerospace industry. Thus, by advancing sustainable aerospace solutions, Europe can make significant contributions to global climate goals, reducing greenhouse gas emissions and promoting cleaner air travel.

Economic Growth and workforce development

A robust innovation ecosystem necessarily stimulates the growth of the aerospace industry, leading to the creation of high-tech jobs and supporting industries. This can contribute significantly to the economies of the regions involved in the collaboration and other European countries.

European aerospace companies, by working together, can better compete on the global stage, leveraging collective expertise and resources to create superior products and services.

Continuous investment in R&D can keep the regions and more generally Europe at the forefront of aerospace technology, attracting talent from around the world and fostering a culture of innovation. An active innovation ecosystem can foster the development of a highly skilled workforce. Educational institutions and industry partnerships to create specialized training programs will ensure a steady supply of qualified professionals.

Societal Benefits and geopolitical stability

Advances in aerospace technology will maintain and improve connectivity across Europe and beyond, enhancing trade, tourism, and cultural exchange. It should also improve Europe's ability to respond to natural disasters and humanitarian crises, providing timely aid and support. As far as Strategic Autonomy is concerned, enhanced collaboration in aerospace will reduce Europe's dependence on external powers for critical technologies and capabilities, thereby increasing security.

Last but not least, a strong and unified interregional European aerospace sector can enhance the EU's influence in global aerospace standards, policies, and regulations, increasing the EU's soft power.

5.1. Economic, environmental and social sustainability

Creating a sustainable action plan for European inter-regional collaboration in aerospace involves integrating economic, environmental, and social considerations to ensure long-term viability and success.

Economic sustainability can be attained through diversified funding sources and regional specialization. EU funding programs such as Horizon Europe, Connecting Europe Facility (CEF), and the European Regional Development Fund (ERDF) can be a relevant source of funding. Public-private partnerships should be encouraged, as well as alternative financing options like VC or crowd funding to support SMEs or startups. Regional specialization will enhance competitiveness and reduce duplication of efforts. Emerging markets and technologies, such as space tourism, UAVs, and sustainable aviation fuels, should also be taken into consideration.

Environmental sustainability can be attained by giving priority to green technologies and stringent environmental standards. Funding for research and development of environmentally friendly technologies, such as electric propulsion, SAF, and lightweight materials, implementing sustainable manufacturing practices, including the use of recycled materials and energy-efficient processes should be considered. As far as regulatory and policy support are concerned, stringent environmental standards and regulations to minimize the aerospace sector's environmental footprint should be developed and enforced, as well as financial incentives, such as tax breaks and grants, for companies that adopt sustainable practices.

Social sustainability can be attained through education and workforce development and community engagement. As was said before, specialized training programs should be developed to equip the workforce with skills needed for emerging aerospace technologies, as well as the promotion of STEM education at all levels to ensure a steady pipeline of talent for the aerospace sector. Public awareness campaigns will raise awareness about the benefits of the aerospace sector and its

role in regional development. To finish, local communities should be involved in decision-making processes and it should be ensured that the benefits of aerospace projects, such as job creation and infrastructure development, are shared locally.

To achieve this sustainability, key performance indicators (KPIs) related to economic, environmental, and social sustainability should be developed and tracked, regular audits and assessments to ensure compliance with sustainability goals and to identify areas for improvement could be conducted. To ensure continuous improvement, feedback mechanisms could be established to gather input from stakeholders and continuously improve the action plan. And the sharing of best practices and lessons learned among regions should be promoted to enhance the overall effectiveness of the collaboration.

6. Recommendations for policy makers

Based on the actions reported in the previous Joint Action Plan, in the following paragraphs are reported some recommendations for policymakers to support the aerospace sector across short-term, mid-term, and long-term timelines:

Short-Term Recommendations (0 - 3 years)

- Establish and fund cross-regional internship and training programs for students in aerospace sectors.
- Encourage interdisciplinary education and research, integrating aerospace with fields like robotics, materials science, automotive, and automation.
- Promote STEM education and career awareness programs to attract young talent to the aerospace sector.
- Develop exchange programs for Ph.D. students and researchers.
- Facilitate the creation of specialised courses and training programs tailored to industry needs in collaboration with universities and vocational institutions.
- Implement internship programs and student exchange initiatives to bridge the gap between academia and industry.
- Promote cross-regional collaboration among aerospace companies and other innovative sectors.
- Organise regular networking events such as workshops, seminars, webinars, and conferences to facilitate relationship-building and knowledge sharing.
- Implement collaborative tools such as shared document repositories to facilitate collaboration and document sharing.
- Arrange matchmaking sessions or networking events to connect partners with complementary skills and resources.

Mid-Term Recommendations (3 - 5 years)

- Monitor global aerospace trends and adjust regional strategies to diversify specializations and mitigate industry shifts.
- Establish joint research initiatives and innovation hubs to facilitate cross-industry collaboration and knowledge exchange.
- Create trans-regional funding initiatives to support projects, startups, scale-ups, and research programs in aerospace and related technologies such as AI, cyber security, and drones.
- Allocate funding for infrastructure projects to enhance aerospace capabilities and support industry growth.
- Develop shared experimentation and test infrastructures to boost collaboration and attract companies and research institutions.

Long-Term Recommendations (5 – 10+ years)

- Engage with regional policymakers and regulatory bodies to develop supportive regulations for drones and space activities.
- Advocate for reforms to streamline regulatory processes, promoting innovation while ensuring safety and compliance.
- Collaborate with industry experts and policymakers to address regulatory barriers and create an environment conducive to aerospace growth.
- Work towards aligning regional aerospace strategies and policies with national and European priorities to ensure long-term compatibility and competitiveness.
- Facilitate market access for regional aerospace companies by leveraging international partnerships and trade agreements.
- Promote the establishment of international aerospace offices or representation to support regional businesses in the global market.
- Develop online platforms for sharing industry insights, market trends, and research advancements globally.

General Recommendations

- **Continuous engagement**: maintain ongoing dialogue with industry stakeholders, academia, and other regions to stay updated on emerging needs and opportunities.
- **Policy alignment**: ensure that all initiatives align with broader national and European aerospace strategies and priorities to maximise impact and coherence.
- **Funding and support**: provide consistent funding and support for the outlined initiatives to ensure their successful implementation and sustainability.
- **Innovation promotion**: encourage a culture of innovation through various incentives, support programs, and regulatory frameworks that facilitate technological advancements and industry growth.

7. Conclusions

The Joint Action Plan offers suggestions to foster cooperation, growth, and improved collaboration among the five aerospace ecosystems collaborating to the AD-ASTRA project, potentially leading to transformative impacts on technological advancements, economic growth, geopolitical stability, and environmental sustainability. By sharing resources, expertise, and technology, joint research initiatives and shared facilities could foster breakthroughs in aerospace technology, with common standards, optimizing manufacturing processes and improving compatibility across aerospace systems. Focusing on sustainable technologies like efficient engines, lightweight materials, and alternative fuels could reduce the aerospace industry's environmental footprint, contributing to global climate goals by reducing greenhouse gas emissions and promoting cleaner air travel.

A robust innovation ecosystem could stimulate the aerospace industry's growth, creating high-tech jobs and supporting ancillary industries, thereby significantly boosting the economies of participating regions. Collaborative efforts could enable aerospace companies in these regions to better compete globally, leveraging collective expertise and resources to produce innovative products and services. Continuous investment in R&D would keep the consortium at the forefront of aerospace technology, attracting global talent and fostering innovation, with specialized training programs ensuring a steady supply of qualified professionals. Advances in aerospace technology would improve connectivity, enhancing trade, tourism, and cultural exchange, and bolstering the regions' ability to respond effectively to natural disasters and humanitarian crises. Enhanced collaboration would reduce dependence on external powers for critical technologies, increasing security and strategic autonomy, while a strong, unified interregional aerospace sector would enhance the consortium's influence in global aerospace standards, policies, and regulations.

Economic sustainability would be ensured through diversified funding sources and regional specialization, with environmental sustainability achieved by prioritizing green technologies and enforcing stringent standards. Social sustainability would be supported through education, workforce development initiatives, public awareness campaigns, and community engagement, ensuring local benefits from aerospace projects.

Policymakers should consider short-term actions like cross-regional internships and STEM promotion, mid-term actions like monitoring trends and joint research, and long-term actions like regulatory alignment and market access facilitation. Continuous engagement, policy alignment, consistent funding, and innovation

promotion would be essential for the successful implementation and sustainability of these initiatives.

In conclusion, the Joint Action Plan sets a comprehensive roadmap for enhancing collaboration, fostering innovation, and ensuring the long-term viability of the aerospace sector within the AD-ASTRA consortium and beyond, integrating economic, environmental, and social sustainability to create a resilient and competitive aerospace ecosystem that contributes positively to global challenges.