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STUDY OF NEW COMPLEX MODELS OF INTERNATIONAL INDUSTRIAL COLLABORATION, STAKEHOLDERS, AND SELECTION MECHANISMS WITHIN INNOVATIVE EUROPEAN DEFENSE PROGRAMS: EPW CASE STUDY

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ABSTRACT

This thesis investigates new models of international industrial collaboration, stakeholder engagement, and selection mechanisms within innovative European defense programs, primarily focusing on the European Protected Waveform project funded by the European Defence Fund. The study opens by tracing the historical evolution of European defense policies and institutional frameworks, detailing the formation of NATO, the Western European Union, and the eventual establishment of the Common Security and Defence Policy. Emphasis is placed on contemporary collaborative defense initiatives such as Permanent Structured Cooperation, the European Defence Agency, and the EDF, exploring their roles in advancing technological capabilities, operational efficiency, and fostering cross-border partnerships within the European Union. The EPW project is then examined as a case study to illustrate its strategic and technological objectives within the EDF framework. This analysis contextualizes the EPW initiative considering advancements in satellite communications and the broader goal of strengthening European defense autonomy. The study also delves into the project's structure, detailing its development phases, funding mechanisms, and success criteria. The final section of the thesis explores technological trends and challenges in European defense R&D, particularly in satellite communications. It highlights the roles of major industry players like Thales Alenia Space in supporting the EU's strategic independence. Conducted at Thales Alenia Space following an internship, this research benefits from a direct, hands-on understanding of the sector’s intricacies. Overall, this thesis offers a comprehensive

overview of the European defense sector, identifying key drivers for resilience, innovation, and cooperation across EU member states in defense communications technology.

List of Acronyms

North Atlantic Treaty Organization (NATO)

European Defence Community (EDC)

Western Union (WU)

Western European Union (WEU).

Common Foreign and Security Policy (CFSP)

Common Security and Defence Policy (CSDP)

The Political and Security Committee (PSC)

The European Defence Agency (EDA)

Hub for Defence Innovation (HEDI)

The European Union Institute for Security Studies (EUISS)

The European Security and Defence College (ESDC)

The European Union Military Staff (EUMS)

Permanent Structured Cooperation (PESCO)

European Defence Fund (EDF)

European Union (EU)

EADS (European Aeronautic Defence and Space Company)

European Commission (EC)

Common Procurement Act (EDIRPA)

Connecting Europe Facility (CEF)

Coordinated Annual Review on Defence (CARD)

Capability Development Plan (CDP)

CBRN (chemical, biological, radiological, and nuclear)

Small and Medium-Sized Enterprises (SMEs)

C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance)

Work Package (WP)

European Defence Technological and Industrial Base (EDTIB)

Technology Readiness Level (TRL)

Security Aspects Letter (SAL)

Direct-to-Home (DTH)

European Protected Waveform (EPW)

Low Earth Orbit (LEO)

Medium Earth Orbit (MEO)

Geostationary Equatorial Orbit (GEO)

High Throughput Satellites (HTS)

Italian Space Agency (ASI)

Space Situational Awareness (SSA)

Public-Private Partnerships (PPP)

Thales Alenia Space Italia (TASI)

Participant Identification Code (PIC)

Commercial Off-The-Shelf (COTS)

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CHAPTER 1: NEW MODELS OF INTERNATIONAL INDUSTRIAL COLLABORATION

1.1 INTRODUCTION

In recent years, the European Union has faced a series of challenges locally and globally, putting its communities' founding values and principles under pressure. Economic difficulties intensified international competition, migratory waves, climate change, and environmental issues have been further exacerbated by the COVID-19 pandemic. This situation has highlighted the urgent need to develop a more resilient European Union better equipped to handle systemic crises, emphasizing the crucial importance of enhancing strategic autonomy and cohesion within the Union.

The Russian aggression against Ukraine in 2022 and the Israeli-Palestinian instability in the Middle East have further drawn attention to the importance of European defense and security. These events have compelled the Union to strengthen its defense policies by adopting a more cohesive and decisive foreign policy through initiatives such as Permanent Structured Cooperation (PESCO) and the European Defence Fund (EDF), examples of efforts aimed at increasing Europe's strategic autonomy by intensifying cooperation among member states.

At the heart of this complex landscape lies the defense industry, which plays a crucial role in production, innovation, and capacity development. The treaties and agreements on which the political framework of the European Union is based, regarding its member states, third parties, and NATO, still represent a very intricate and challenging legal foundation for smoother and more effective cooperation.

Exploring new collaboration models between the European Union's member states becomes essential in this context. Analyzing these models allows a better understanding of how European nations can collectively respond to these challenges and provides insights into enhancing resilience through joint and coordinated defense.

1.2 History Of European Defence

1.2.1 The Formation Of NATO And The PLEVEN Plan

The history of European defense from the post-World War II period to the present has been marked by several vital phases that reflect the evolving political dynamics and security challenges. The social, political, economic, and financial crisis that afflicted Europe at the end of the Second World War made it impossible to create new national armies capable of participating in potential active conflicts.

The power vacuums forming in Europe, along with the growing threat of Soviet expansion on the continent, led to the founding of the **North Atlantic Treaty Organization** (NATO) in 1949 with the signing of the Washington Treaty. NATO was established by twelve nations: the United States, Canada, the United Kingdom, France, Italy, Belgium, the Netherlands, Luxembourg, Norway, Denmark, Iceland, and Portugal. The organization's primary mission was to address the need for collective defense in response to the Soviet threat, a principle reinforced in Article 5 of the treaty, which stipulates that an attack against one ally is considered an attack against all. This commits the member nations to respond with joint military actions if necessary.

However, the issue of reintegrating West Germany into the post-war European context remained a critical concern. In October 1950, French

Prime Minister René Pleven proposed a plan to create European divisions that would include German troops, but without allowing the reconstruction of an independent German army.[1] Despite initial approval, the **Pleven Plan** encountered various political obstacles and did not lead to the formation of a European army. Nevertheless, this initiative had a lasting impact on discussions about European defense. It was a precursor to the **European Defence Community** (EDC), which, although not ratified, represented another attempt at European military integration.

1.2.2 THE WESTERN EUROPEAN UNION

The **Western Union** (**WU**), was founded in 1948 through the Treaty of Brussels, signed by Belgium, France, Luxembourg, the Netherlands, and the United Kingdom. Its goal was to synchronize military defense among the member countries by establishing shared command structures, particularly for air defense and military planning. However, in 1950, to avoid overlap with the emerging NATO, the WU decided not to pursue an independent military structure and instead opted to rely on NATO.

The failed European Defence Community project in the early 1950s revived interest in the Brussels Treaty. In 1954, the treaty was amended to remove anti-German clauses and to include Italy and West Germany as new members, transforming the WU into the **Western European Union** (**WEU**). This evolution introduced a renewed organizational structure with a headquarters in London, a decision-making Council, and a Secretary General coordinating the international staff[2].

The WEU played a central role in European defense until the early 1970s, when its influence began to wane, as many of its functions were absorbed

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[1] *Journal officiel de la République française. Débats Parlementaires. Assemblée nationale*

[2] *Cvce*

by other international organizations, such as the Council of Europe. The 1984 Rome Declaration represented an attempt to revive the WEU, promoting a more substantial European strategic presence, closer ties with the United States, and, above all, aiming to establish a distinct European security identity within the Atlantic Alliance.

However, the WEU's importance continued to decline until 2011, when its functions were integrated into the structures of the European Union. This marked the end of its existence as an independent entity and represented a further step towards a more unified European defense approach under the EU's leadership.

1.2.3 From the 1990s to the Present: CFSP and CSDP

During the 1990s, the conflict in the former Yugoslavia prompted European leaders to formulate the so-called Petersberg Tasks, adopted during the Western European Union Ministerial Council in June 1992 and later integrated into the 1997 Amsterdam Treaty[3]. On that occasion, the EU member states committed to providing military units from the full spectrum of their conventional armed forces to support the missions of the WEU, NATO, and the EU itself. These tasks included peacebuilding, peace enforcement and peacekeeping operations, humanitarian and rescue missions, conflict prevention, deployment of combat forces for crisis management, and military advisory and assistance activities.

In light of the geopolitical changes in the early 1990s, such as the reunification of Germany, the collapse of the Soviet Union, and the end of the Warsaw Pact, as well as the nationalist tensions in the Balkans leading to the disintegration of Yugoslavia, member states decided to establish the **Common Foreign and Security Policy** (**CFSP**). Initially formalized in 1970

[3] *Ecsa sixth biennal international Conference*

and institutionalized by the 1987 Single European Act, it gained a more defined structure with the entry into force of the Maastricht Treaty in 1993.

The CFSP anticipated more intense collaboration than in the past, which is essential for allowing the EU to take on a global role proportional to its importance. Its objectives included protecting the EU's values, interests, security, and integrity while promoting developing countries' sustainable economic, social, and environmental development, thus facilitating their integration into the global economy. Furthermore, the CFSP aimed to foster an international system based on strengthened multilateral cooperation and good global governance. Its role remains central in European security and defense, with a budget of over €2 billion for 2021-2027[4].

The **Common Security and Defence Policy** (**CSDP**) was defined in 2003 through the Lisbon Treaty as an integral part of the CFSP and became a key pillar of European security. The CSDP covers areas such as maritime security, counterterrorism, space, cybersecurity, disarmament, non-proliferation, arms export control, conflict prevention, peacebuilding, mediation, and crisis management.

The CSDP structure includes permanent political, military, and civilian bodies such as:

- **The Political and Security Committee (PSC)**
- **The European Defence Agency (EDA)**
- **The European Union Institute for Security Studies (EUISS)**
- **The European Security and Defence College (ESDC)**
- **The European Union Military Staff (EUMS)**
- **Permanent Structured Cooperation (PESCO)**

[4] *Foreign policy: aims, instruments and achievements*

- **European Defence Fund (EDF)**

As has become evident, European defense and security play a crucial and ongoing role. A retrospective examination of its historical evolution allows a better understanding of the current situation.

In the next section of the thesis, an in-depth investigation will be carried out into the previously mentioned political, military, and civilian bodies. The analysis will focus on exploring the stakeholders involved and their impact on industrial collaboration models within the scope of European security and defense, as well as discussing the criteria and selection mechanisms employed for participation in such initiatives. This study aims to outline the internal dynamics and interactions between the various actors, providing a detailed and critical overview of the structures governing the European Union's defense and security policy.

1.3 Analysis of the New Industrial Collaboration Models

As previously mentioned, the new models of industrial collaboration in European defense are designed to enhance integration and cooperation among European Union member states and defense sector industries. The primary objectives are to develop advanced technological capabilities, increase operational efficiency, and reduce costs through joint projects and resource sharing.

Key initiatives include Permanent Structured Cooperation, the European Defence Fund, and the European Defence Agency. **PESCO** encourages collaboration between member states on specific defense and security programs, promoting joint projects that strengthen collective capabilities. The **EDF** provides significant funding for research and development of new

technologies and defensive capacities, fostering industrial innovation through transnational partnerships. The **EDA** plays a crucial role in coordinating and supporting these efforts, ensuring that defense strategies are aligned with the common goals of the European Union.

1.3.1 THE EUROPEAN COMMISSION

The **European Commission** serves as the executive body of the European Union and plays a central role in managing and operating the Union itself. Its primary responsibilities include drafting legislative proposals, overseeing the implementation of EU laws, and managing the EU budget. As the initiator of the legislative process, the Commission formulates new legal proposals, which are then discussed and approved by the European Parliament and the Council of the European Union, promoting regulatory harmonization aligned with EU priorities[5].

Another critical function of the Commission is to **monitor the implementation** of EU laws and policies. The Commission ensures that Member States adhere to the regulations adopted at the EU level, working alongside the European Court of Justice when intervention is required to maintain compliance. On the international stage, the Commission negotiates agreements with third countries and represents the EU in global organizations, ensuring a unified approach that reflects the interests of the entire Union.

Regarding strategic planning, the Commission collaborates with other principal EU institutions such as the European Parliament, the European Council, and the Council of the European Union, to shape the EU's political strategy. Every five years, the European Council sets the EU's main goals

[5] *Role of the European Commission*

and direction through the **Strategic Agenda**. Concurrently, at the start of each mandate, the President of the Commission defines political priorities for the upcoming five-year term, which are then reviewed annually in the **State of the Union address**. In this speech, the President discusses the achievements and challenges of the past year with the European Parliament and announces the main initiatives planned for the coming year. These priorities are also communicated to the President of the European Parliament and the rotating Council Presidency via a “letter of intent,” fostering strategic inter-institutional coordination.

The Commission's work program outlines the **annual operational planning**, which translates long-term priorities into concrete actions. This process is supported by **strategic foresight** tools that allow the Commission to anticipate and integrate future challenges into its plans, orienting policies from a long-term perspective.

In decision-making and regulation, the Commission develops policies and laws aimed at maximizing benefits for EU citizens, businesses, and other stakeholders, adhering to "better regulation" principles. Each significant legislative initiative includes an impact assessment to analyze potential economic, social, and environmental effects, ensuring that every decision is grounded in evidence and best practices.

The Commission is responsible for managing the **EU budget**, a crucial tool that enables the implementation of political priorities and the funding of large-scale projects, creating added value for the entire Union. Each year, all of the Commission’s activities and outcomes are compiled in annual reports as part of the strategic planning and programming cycle. These reports assess policy effectiveness and monitor performance against set objectives. Since 2016, these findings have been included in the **annual EU**

budget management and performance report, providing a comprehensive overview of the value generated by EU investments.

Lastly, the Commission engages in an ongoing process of **policy evaluation** to assess its policies' effectiveness, efficiency, coherence, and added value for European citizens and businesses. The results of these evaluations are made public through evaluation roadmaps, contributing to transparency and making data on achieving the Union's strategic objectives accessible to the public.

1.3.1.1 European Commission's Budget Allocation to the Defence Industry

In 2024, the European Commission's budget allocation for defense underscores the EU's commitment to strategic autonomy and resilience in the face of security challenges. A central component of this allocation is the European Defence Fund (EDF), which receives €638 million specifically aimed at advancing collaborative research and capability-building projects among EU member states. This fund supports joint technological advancements and strengthens the defense industry by promoting cooperation across borders and reducing dependency on non-EU suppliers[6].

Additionally, the European Defence Industry Reinforcement through Common Procurement Act (EDIRPA) is allocated €260 million to facilitate the coordinated acquisition of essential defense materials, ensuring member states can address pressing capability needs through a unified European approach[7]. The Commission also channels €241 million into the Military Mobility initiative, under the Connecting Europe Facility (CEF), to

[6] *EU budget 2024: Enabling Europe to address its priorities*

[7] *EC:Europa*

upgrade dual-use transport infrastructure, essential for rapid military deployment across EU territories. This allocation is part of a larger €1.74 billion commitment from the Multiannual Financial Framework (MFF) 2021-2027, which prioritizes both civilian and military utility in infrastructure investments[8].

These targeted investments, totaling over €8 billion under the MFF 2021-2027, reflect the EU's comprehensive approach to fostering a more integrated defense ecosystem that emphasizes industry competitiveness, innovative research, and enhanced operational readiness in an evolving security landscape.

1.3.2 The Permanent Structured Cooperation (PESCO)

1.3.2.1 Political Significance of PESCO

In 2013, European Union leaders recognized the need for a more substantial commitment to European defense, leading to adopting an implementation plan for the CSDP in November 2016.

A year later, on November 13, 2017, 23 EU member states, excluding Denmark, Malta, Portugal, Ireland, and the United Kingdom, officially launched Permanent Structured Cooperation (PESCO). This political decision was primarily taken in response to the growing demand from EU citizens for enhanced European cooperation to tackle security issues such as terrorism and the increasing instability in the neighboring Middle East. Secondly, it aimed to consolidate the EU's role in crucial sectors like security and defense, boosting technological development ambitions and enhancing global visibility.

[8] *CINAEC:EC:Europa*

1.3.2.2 Role of EU Institutions

The launch of Permanent Structured Cooperation represents a significant political decision for European defense, establishing a legally binding framework that is deeply integrated into the EU's institutional system.

EU institutions play a fundamental role in PESCO. The High Representative for Foreign Affairs and Security Policy is responsible for overseeing the annual assessment of PESCO's results, while the European Defence Agency (EDA) provides crucial support in capacity development. Participating Member States (pMS) are committed to using the EDA as the European platform for joint capability development. Additionally, the EDA collaborates with the European External Action Service (EEAS) and the EU Military Committee to support the operational aspects of PESCO[9].

This robust legal and institutional framework serves both as a solid foundation and as a driving force for the initiative. The fact that the top EU institutions are legally bound to cooperate on PESCO with participating member states ensures that it remains a priority on the European agenda, even if national priorities shift. Moreover, the involvement of both civilian and military institutions acts as a catalyst for further initiatives and reviews, as has been observed in various EU policy areas, including defense, following the creation and implementation of the European Union Global Strategy (EUGS).

1.3.2.3 Links With Other EU Initiatives

PESCO is closely interconnected with other initiatives stemming from the EU's Global Strategy, such as the **Coordinated Annual Review on Defence** (**CARD**). CARD involves a periodic assessment of military planning at the

[9] *EEAS: A security and defence policy fit for the*

level of Defense Ministers, focusing on deepening defense cooperation, synchronizing defense planning, and addressing capability gaps through evaluations conducted by the European Defence Agency. With the launch of PESCO, participating member states have committed to fully supporting this review process, thereby enhancing PESCO itself.

This commitment has encouraged national governments to harmonize their military requirements and invest in the joint development of capabilities. Another EU initiative linked to PESCO is the European Defence Fund, which was launched by the European Commission in 2016. The EDF finances military research (€90 million for the 2017-2019 period) and co-finances the development and acquisition of capabilities (€1 billion after 2020), incentivizing member states to pursue cross-border cooperation[10].

PESCO members are highly motivated to access these funds, as they are bolstered by financial incentives worth millions of euros from the European Commission. The EDF will co-finance 20% of development and acquisition costs for projects outside PESCO and 30% for those within PESCO.

Overall, these initiatives, including the political and institutional framework established by PESCO, the ministerial evaluation carried out under CARD, and the initial EU funding for military research and procurement through the EDF, represent a significant and innovative path toward increased cooperation and integration in the defense sector.

Finally, once launched, any initiative requires sustained political support and commitment to ensure long-term progress. This is where NATO comes into play. Cooperation between Europeans and North Americans remains crucial for European security, particularly in light of current international tensions. A strengthened European defense through PESCO benefits NATO

[10] *PESCO: A force for postive integration in EU defence: Steven Blockmans & Dylan Crosson*

by addressing the fragmentation of European armies and responding to Washington's demands for greater burden-sharing.

1.3.2.4 PESCO PROJECTS AND THIRD-PARTY PARTICIPATION

All capabilities and resources developed within the framework of PESCO remain the property and under the control of the participating member states and are made available for NATO and UE operations. PESCO, however, does not grant the EU control over national armies.

In March 2018, a formal decision was made approving an initial list of 17 projects. Today, the number of projects has risen to 68, demonstrating consistent growth and an increasing commitment from the member states.

The programs developed under PESCO cover various domains, including:

- Training
- Land, maritime, and air operations
- Cyberspace
- Space

These projects aim to bring member states together to develop new capabilities, conduct joint training and exercises, and share expertise in specific sectors. The variety of these programs encourages collaboration with countries outside the EU.

Third-party participation is decided on a case-by-case basis by the members of individual PESCO projects, provided that the third party brings substantial added value. While PESCO membership is only open to EU member states, third countries may participate in specific projects under certain conditions. For example, the United States, Canada, and Norway are participating in the Military Mobility project; the United Kingdom has

been invited to join this project, and Canada has been involved in a second project concerning the Network of Logistic Hubs.

1.3.2.5 Future Prospects of PESCO

The Strategic Review of PESCO (2023-2025), launched in November 2023, represents a significant opportunity to shape PESCO's future development beyond 2025. With Denmark joining as the 26th participating member state in 2023, PESCO is likely to continue to grow in terms of the number of participating member states and the range of projects. This could involve inviting additional third countries to participate in specific projects, as seen in Canada and Norway.

PESCO will also continue to foster cooperation with transatlantic partners and NATO, enhancing interoperability and coordination on security and defense issues. As the geopolitical landscape evolves, PESCO will need to adapt to emerging challenges and threats. This may include a greater focus on resilience against hybrid threats, protecting critical infrastructure, and responding to emerging crises.

In summary, PESCO's future will be marked by strengthened cooperation and integration among EU member states and international partners, an expansion of project areas, and continuous adaptation to global geopolitical dynamics.

1.3.3 The European Defence Agency (EDA)

1.3.3.1 Formation

In December 2001, following the Laeken Declaration, the European Council established the European Convention, also known as the Convention on the Future of Europe. The purpose of this Convention was to engage key stakeholders in a broad exercise of strategic reflection on the future of the European Union, with the primary goal of drafting a constitution for the EU.

In this context, a renewed push emerged for the creation of a European Defence Agency[11].

Several major players in the European aerospace and defense industry began advocating for a strong armaments agency, capable of addressing the shortcomings of previous initiatives in the sector. Notably, Thales France joined forces with EADS (European Aeronautic Defence and Space Company), the parent company of today's Airbus, in its lobbying efforts toward EU representatives, particularly the emerging Convention, to promote the idea of a European Security and Defence Research Agency.

The lobbying efforts of the CEOs of Thales, BAE Systems, and EADS culminated in the Thessaloniki Council in June 2003, with the announcement of the imminent creation of the European Defence Agency (EDA). The Council tasked the relevant bodies with taking the necessary steps to establish an intergovernmental agency by 2004, focused on defense capabilities development, research, acquisition, and armaments[12].

The Agency Establishment Team (AET) was given the mandate to finalize the report by April 2004. This group, composed of about a dozen individuals, aimed to reconcile the divergent positions between the UK's preference for an agency focused on capability development and France's insistence on a dominant role for armaments.

The European Defence Agency was formally established on July 12, 2004, and Nick Witney was appointed as the Agency's first Chief Executive by Javier Solana, the EU's High Representative for the Common Foreign and Security Policy.

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[11] *Laeken Declaration on the future of the European Union*

[12] *Thessaloniki European Council 19 and 20 June 2003, Presidency conclusions*

1.3.3.2 Mission

The European Defence Agency's primary mission is to support the European Council and the member states in improving the Union's defense capabilities, particularly in crisis management, by reinforcing the Common Security and Defence Policy in its current form and future development.

The EDA pursues the following main objectives:

- **Development of Defense Capabilities**

The EDA supports the development of defense capabilities and military cooperation among EU member states. This includes promoting joint projects and harmonizing military requirements.

- **Research and Development of New Defense Technologies**

The agency stimulates research and the development of new technologies in the defense sector, strengthening the European defense industry. This involves encouraging joint research initiatives and developing cutting-edge, advanced defense technologies.

- **Military Interface for EU Policies**

The EDA acts as an interface between military and civilian policies within the European Union, facilitating the integration of military needs into EU policies.

- **EDA's Role as a Catalyst**

The agency aims to create a competitive market for European defense equipment. It aspires to become a leader in strategic technologies for future defense and security capabilities, enhancing its position in the global defense technology landscape.

1.3.3.3 EDA's Budget

In 2024, the European Defence Agency has been allocated a general budget of approximately €48.4 million, marking a continued increase to address the EU's expanding defense needs. Additionally, the EDA manages numerous collaborative projects through ad-hoc budgets that, combined, reach approximately €664 million[13]. This substantial funding supports over 90 projects and programs, from advanced military training to cybersecurity and aerospace developments. Notably, the EDA's Hub for Defence Innovation (HEDI) plays a key role, channeling resources into cutting-edge technology to equip the EU for emerging security threats. This broader financial strategy demonstrates a reinforced EU commitment to establishing a robust defense infrastructure, with the EDA at its center.

1.3.3.4 Operational Directorates

The European Defence Agency (EDA) 's structure consists of three operational directorates (ISE, CAP, RTI), supported by a fourth directorate, the CSD, that provides corporate services.

- **ISE**

Focuses on procurement, financing instruments, and the implications of EU legislation and policies for the defense sector.

- **CAP**

Ensures a coherent approach from setting priorities to achieving impact by identifying, planning, and proposing collaboration opportunities. This directorate develops the Capability Development Plan, provides the secretariat for the Coordinated Annual Review on Defence (CARD), and serves as the secretariat for PESCO, overseeing the evaluation of PESCO

[13] *EDA:Europa*

project proposals from a capabilities perspective and supporting project implementation.

- **RTI**

Ensures that activities are aligned with EU policies, promotes synergies between governments, industries, and research institutes, and ensures that European military capabilities are prepared for future challenges.

- **CSD**

Provides essential business services that support the agency's operations. These services include infrastructure, information technology, and other administrative functions *(fig1).*

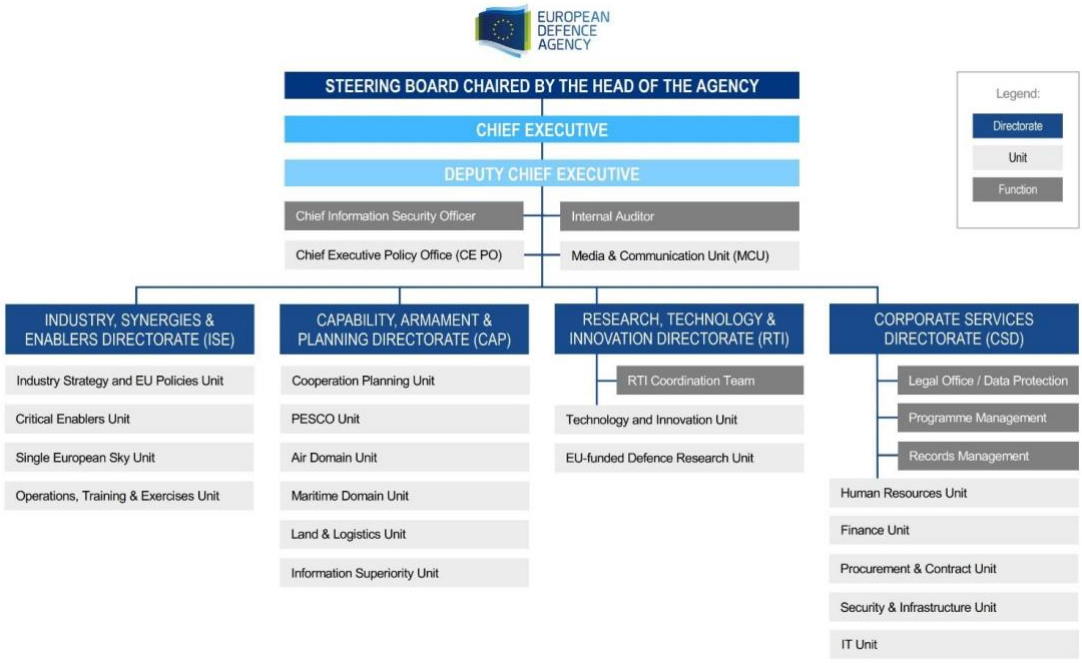

figure 1: Eda's structure

1.3.3.5 Future Prospects

The future of the European Defence Agency is closely tied to the growing importance of European cooperation in the defense sector. With the implementation of initiatives such as Permanent Structured Cooperation

and the European Defence Fund the EDA will play an increasingly central role in coordinating and supporting collaboration among member states. Its ability to manage a growing number of collaborative projects will be crucial, ensuring they align with the European Union's strategic priorities and make the best use of available resources.

Standardization and interoperability will continue to be critical objectives for the EDA. Promoting the standardization of military equipment and procedures among member states will improve interoperability and reduce costs. Strengthening standard certification processes will ensure the equipment and systems developed are safe and compliant with European standards.

The EDA's ability to ensure that member states are prepared to respond quickly and effectively to global crises will be critical. Improving the operational readiness and resilience of European armed forces and increasing cooperation with international partners and organizations like NATO will be essential for addressing global security challenges in a coordinated manner. Additionally, the EDA will need to promote sustainable technologies and practices within the armed forces, optimizing energy efficiency, which is crucial to reducing dependence on vulnerable energy sources and minimizing the environmental impact of military operations while protecting critical infrastructure.

Finally, supporting research and innovation will be fundamental to the EDA’s future. Promoting and financing research projects in the defense sector, in synergy with the EDF, will be essential for fostering technological innovation and developing new capabilities, enhancing the effectiveness of investments.

1.3.3.6 The Interaction Between Different European Defence Entities

Since 2008, the European Defence Agency (EDA) has produced a Capability Development Plan (CDP) to address long-term security and defense challenges. The CDP is updated regularly, and the EDA Steering Board approved the latest version in the Defence Ministers' formation in November 2023. The revised set of EU Capability Development Priorities acts as a cornerstone for EU defense planning, providing a basis for various current and future defense initiatives and tools, such as the Coordinated Annual Review on Defence (CARD), Permanent Structured Cooperation (PESCO), and the European Defence Fund (EDF), among others. Aligned with the political guidelines outlined in the Strategic Compass, it influences EU-level strategies and shapes national planning efforts[14].

CARD, PESCO, and EDF, while being three separate initiatives, are closely interconnected and significantly contribute to the development of the EU's capabilities: the EDF is a funding tool for both PESCO and non-PESCO projects. CARD provides a system for evaluating the defense capabilities of member states. PESCO defines operational and capability development objectives.

In this context, the EDA is responsible for guiding defense investments and capability development and submitting the annual evaluation report to the Council.

[14] *European Defence Agency, 2018 CDP revision – The EU Capability Development Priorities, Publications Office, 2019*

CHAPTER 2: THE EUROPEAN DEFENCE FUND (EDF)

2.1 INTRODUCTION AND POLITICAL CONTEXT

The European Defence Fund is a strategically significant initiative that fits within the broader framework of the European Union's security and defense policies previously mentioned. Created with the aim of enhancing and supporting the competitiveness of the European defense industry, the EDF represents a fundamental pillar for the development of advanced technological capabilities that can strengthen Europe's strategic autonomy. However, the term "fund" should not lead one to think of it merely as a financial tool; rather, it is a true driver of innovation, collaboration, and industrial integration in the defense sector.

With **Jean-Claude Juncker**'s 2015 declaration, at the time President of the European Commission, the urgency of overcoming dependency on external forces, such as NATO and the United States, and developing Europe's own defense capabilities was highlighted[15].

In parallel, the Ukrainian crisis, Russia's occupation of Crimea, and instability in the EU's southern neighborhood further emphasized the need to strengthen European defensive capacities. In response to these challenges, the European Union decided to invest in a program that not only promoted research and development in the defense sector but also improved cross-border cooperation between member states. The EDF was established in 2017 with this dual function: to provide the necessary

[15] Speech by President Jean-Claude Juncker at the Defence and Security Conference Prague: In defence of Europe

funding for advanced technologies and to strengthen the integration of European defense capabilities.

2.2 Strategic Objectives and Life Cycle of the EDF

2.2.1 Main Objectives

The fund has allocated a total budget of **€7.3 billion** for the period 2021-2027, of which **€2.4 billion is dedicated to research and €4.9 billion to development** [16] . This allocation is aimed at supporting collaborative projects among member states that address critical gaps in strategic technological sectors, *(fig2)* such as:

- **Medical response, CBRN (chemical, biological, radiological, and nuclear)**
- **Air combat**
- **Air and missile defense**
- **Land combat**
- **Force protection and mobility**
- **Naval combat**
- **Submarine warfare**
- **Disruptive technologies**
- **Simulation and training**
- **Innovative defense technologies (SMEs)**
- **Information superiority**
- **Sensors**
- **Horizontal categories**

[16] *EU F&T Portal. EDF*

- **Cyber**
- **Digital transformation**
- **Energy resilience and environmental transition**
- **Materials and components**
- **Space**

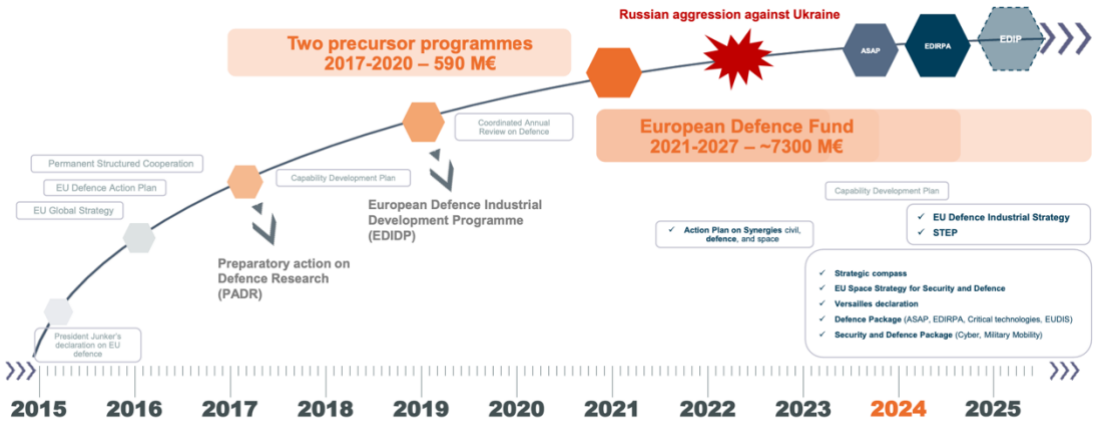

figure 2: EDF during the last 10 years

One of the main objectives is to r**educe the technological and industrial fragmentation** that currently characterizes the European defense landscape. Many member states develop defense capabilities independently, leading to duplicated efforts and significant inefficiencies. The EDF aims to create a single European defense market by promoting joint projects that optimize available resources and enhance the competitiveness of the European defense industry.

A central objective of the fund is also to **encourage innovation**, particularly by supporting small and medium-sized enterprises (SMEs) and non-traditional defense actors. The involvement of SMEs is crucial for introducing new ideas and technologies that can break away from the past and accelerate the adoption of innovative solutions in the defense sector.

Additionally, the EDF has been designed to **maximize the European Union's strategic autonomy** by reducing dependence on external suppliers, particularly those located outside the EU. This objective is

especially important in a context where increasing global competition among powers such as the United States, China, and Russia can jeopardize access to critical technologies. The EDF aims to develop European industrial capabilities that can ensure the security of supply chains and the resilience of defense infrastructures.

2.2.2 Lifecycle of the Fund

The lifecycle of the European Defence Fund includes several key phases, ranging from the preparation of the annual work program to the signing of grant agreements. These phases are outlined as follows:

- **Preparation of the work program**

This occurs the year before the lifecycle begins, including the calls for proposals.

- **Publication of calls for proposals**

This takes place in the year's first quarter.

- **Preparation and submission of proposals**

Interested entities submit their proposals according to the criteria outlined in the calls.

- **Evaluation**

Experts evaluate the proposals received.

- **Project selection**

Selected projects are approved and move towards the grant agreement preparation phase.

- **Signing of grant agreements**

The agreements must be signed by the end of the following year *(fig3)*.

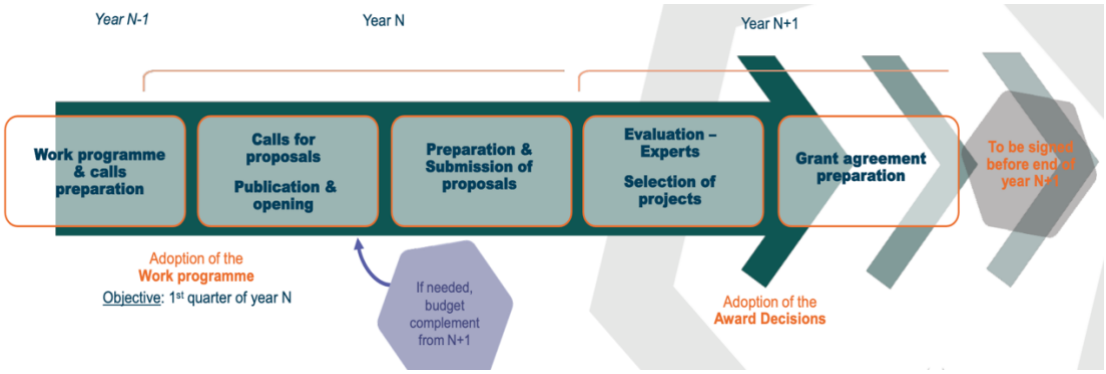

figure 3: Life Cycle EDF

The EDF also follows a structured lifecycle that comprises three main phases: **research**, **development**, and **acquisition**.

This cycle begins with fundamental and applied research aimed at generating new knowledge and technologies for defense. The research phase is 100% covered by the fund and focuses on innovative technologies and disruptive solutions.

Once the research phase is completed, the development phase begins, where technologies are refined and tested in simulated operational environments. This phase includes the design and realization of prototypes, their testing, certification, system prototyping, and improving operational efficiency. The fund co-finances this phase, usually in collaboration with member states, ensuring that new technologies can be developed to meet the operational needs of European armed forces.

Finally, the acquisition phase is when the developed products are produced on a larger scale and distributed among member states' armed forces. This phase is funded by the states themselves and aims to implement and deploy the tested and certified technologies in real operational scenarios.

It is also important to highlight that the EDF promotes projects fostering synergy between civilian and military sectors, allowing for the adoption of dual-use technologies, which can be applied to both **civilian** and **military** purposes. This approach not only maximizes the return on investment in innovation but also allows for a broader application of technologies across different industrial sectors.

The more projects can positively impact multiple sectors through the involvement of both civilian and military actors, the better they are evaluated in the funding **selection processes** *(fig4)*.

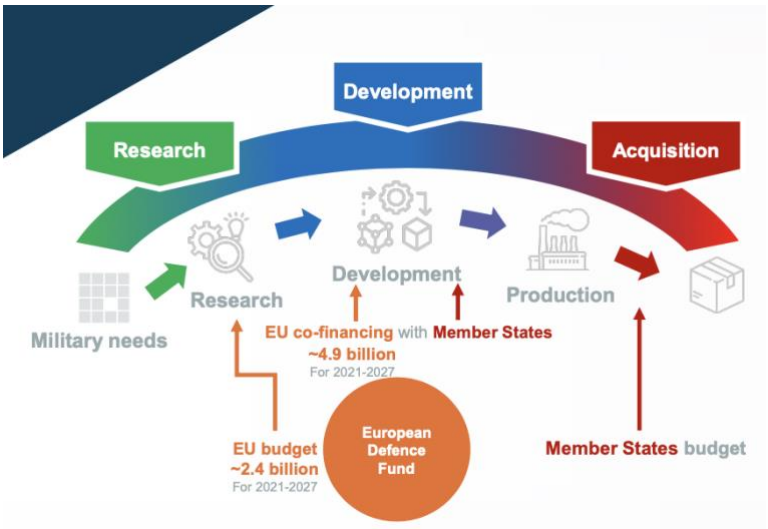

figure 4: research, development, acquisition

2.3 Call Of Proposals

2.3.1 General Overview of Tenders

Calls for Proposals (tenders) are the mechanism through which funds are allocated to different categories of research and development in the defense sector. They are formal invitations published by the EDF, allowing public and private entities, universities, research institutes, small and

medium-sized enterprises, and industrial consortia to submit project proposals in specific technological priority areas. These tenders, published annually, precisely define the areas of intervention, eligibility requirements, and participation conditions, thus establishing the framework for the allocation of European funds[17].

The calls are designed to be competitive and transparent, with the goal of identifying the most innovative and promising projects. Each call contains a detailed description of the topics it focuses on, indicating the technologies or specific sectors that will be prioritized for funding.

Each proposed project must meet a set of technical criteria, including:

- **Innovation**

Projects must present a high degree of technological innovation or propose disruptive solutions that enhance the EU's defense capabilities.

- **Technical excellence**

Proposals must demonstrate a solid scientific and technical foundation, with clear plans for design, prototyping, and implementation.

- **Strategic impact**

Projects must directly contribute to the EU's strategic objectives in terms of defense autonomy and resilience.

- **Economic efficiency**

Proposals must show efficient resource management, with a co-financing plan involving both the EU and member states.

- **Transnational cooperation**

[17] *EU F&T Portal. EDF*

Proposals must be submitted by consortia including at least three legal entities from three different member states or associated countries. This criterion is essential for promoting synergy between the industrial and technological capabilities of different member states, ensuring that the developed projects are interoperable and usable in a common defense context.

Proposals are then subjected to a competitive and rigorous evaluation process, involving independent experts who assess, in addition to the criteria mentioned above, the expected impact, the management capacity of the proposing consortium, and the relevance to the call's objectives. Only projects that receive the highest scores are selected for funding.

Furthermore, calls may differ in the type of funding provided. **Grants** can take various forms, including:

- **Non-repayable grants**
- **Soft loans**
- **Lump-sum contributions**

In all cases, the funding is generally aimed at supporting the development of projects that would otherwise lack sufficient resources.

Finally, each call includes a monitoring and evaluation system to ensure that the allocated funds are used efficiently and that the projects have a tangible impact on improving European defense capabilities. Selected projects must periodically report on their technical, financial, and operational progress and are evaluated based on predetermined criteria.

2.3.2 Main Call for Proposals 2024

The EDF work programme 2024 has allocated €**1.10 billion** for over 30 main topics, divided into 8 calls. Below, we will analyze them one by one[18].

2.3.2.1 EDF-2024-DA

This call primarily focuses on **Development Actions** and aims to fund advanced defense technologies. It is, in fact, the most important call both in terms of the number of projects and the total budget, which amounts to €579 million. It includes various topics such as systems for C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance), cyber defense, space, and energy.

This call also includes the **EDF-2024-DA-SPACE-EPW-STEP** project, which will be the focus of the third chapter of this thesis. This project aims to develop secure waveforms for satellite communications. The main objective is to design, prototype, and test satellite communication systems, including core equipment, satellite transponders, and related auxiliary systems. The goal is to ensure the security and resilience of communication capabilities, especially in military operations, providing a secure and robust solution for uninterrupted communications even in contested operational environments.

2.3.2.2 EDF-2024-DA-EUCI

This call focuses on highly classified projects, categorized at the **EU Secret** level. Proposals must ensure high levels of security and will be evaluated outside of standard assessment channels. Specifically, the focus is on the development of countermeasures against these new technologies, detailing their signature and behavior. This call stands out due to its

[18] *European Commision: European Defence Fund Info Days 2024*

requirement for high classification and the need for secure and controlled partnerships, with an allocated budget of €78 million[19].

2.3.2.3 EDF-2024-RA

The **Research Actions** call aims at innovative research projects, such as the study of advanced sensors to enhance surveillance capabilities. This call focuses on feasibility studies, design, and prototype construction, with a total budget of €199 million.

2.3.2.4 EDF-2024-RA-SI

This call is dedicated to **Spin-In Research Actions**, which involve the transfer of civilian technologies developed in previous EU research and development programs into military applications. One of the main objectives is to develop electronic components specifically for military applications, ensuring that the supply chain is entirely European and independent.

2.3.2.5 EDF-2024-LS-RA-CHALLENGE

This call promotes the development of technologies through **Technological Challenges**. Participants compete on topics such as:

- Autonomous drone navigation in hostile environments
- Analysis of multi-source satellite imagery

The proposed solutions are tested and evaluated in simulated environments to ensure their effectiveness. The budget allocated for this call amounts to €52 million, with lump-sum grants for participants.

2.3.2.6 EDF-2024-LS-RA-DIS

[19] *European Commision: European Defence Fund Info Days 2024*

This call is dedicated to the development of **disruptive technologies** that could radically change military operations. Selected projects must propose innovative solutions that could replace or render existing technologies obsolete. Coaching and support are also provided for participating SMEs, with grants of up to €4 million for each proposal.

2.3.2.7 EDF-2024-LS-RA-SMERO

This call is designed for SMEs and research organizations. Up to 40% of the funds can be allocated to research organizations. Each proposal can receive a maximum funding of €4 million, with a total budget of €34 million[20].

2.3.2.8 EDF-2024-LS-DA-SME

This call is exclusively aimed at SMEs for the development of non-**thematic technologies**, with a total budget of €33 million.

2.3.3 Structure of the Proposal

The structure of the proposal is one of the most important elements in participating in a call for proposals, as its clarity, coherence, and organization directly influence the evaluation by experts. A well-structured proposal allows evaluators to fully understand the objectives, activities, expected outcomes, and methods by which the projects will be implemented. Below is a detailed outline of the typical composition of a proposal, including the main sections that must be carefully developed to ensure a positive outcome.

2.3.3.1 Executive Summary

This section provides a concise overview of the project and must be able to immediately capture the evaluators' attention. In just a few pages, it outlines the critical aspects of the project: the context, the problem it aims

[20] *European Commision: European Defence Fund Info Days 2024*

to address, the main objectives, expected outcomes, involved partners, and the added value of the project. Although it is an introductory section, it holds strategic importance, as it is often the first part of the proposal that evaluators read, influencing their overall understanding of the project.

2.3.3.2 Project Goals

This part of the proposal provides a detailed description of the specific objectives the project aims to achieve. The objectives must be:

- **Clear and specific**

Defined in a way that they are easily understandable and measurable.

- **Realistic and achievable**

The proposal must demonstrate that the project has the capacity and resources to achieve the objectives.

- **Measurable**

The objectives should be linked to clear indicators that allow progress to be monitored.

- **Aligned with the priorities of the call**

The project's objectives must directly address the themes and goals outlined in the call[21].

2.3.3.3 Background and Rationale

In this section, a detailed analysis of the context in which the project is set is provided. It includes an overview of existing knowledge (**know-how**) and solutions already proposed or implemented in the relevant sector[22].

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[21] *European Commision: European Defence Fund Info Days 2024*

[22] *European Commision: European Defence Fund Info Days 2024*

It is important to demonstrate:

- **The relevance of the problem** the project aims to address.
- **The state of the art** in the field, highlighting any existing solutions and explaining why they are insufficient to solve the problem.
- **The technological or scientific gap** that the project intends to fill, showing how the proposal can bring significant innovations compared to what currently exists.

2.3.3.4 Work Plan And Work Packages

This is one of the most technical sections of the proposal, detailing all the operational activities that will be carried out to achieve the project's objectives. The description is usually divided into work packages (WPs), each representing a coherent set of activities. Each WP must follow a specific structure:

- **WP Title**

Each work package must have a title that summarizes its content.

- **WP Description**

A detailed description of the main activities to be carried out within the WP.

- **WP Objectives**

Specify what the WP aims to achieve and how it contributes to the overall project objectives.

- **Tasks and Sub-tasks**

Break down the activities into smaller tasks, each of which must be described in terms of activities, required resources, and timelines.

- **Responsibilities**

Each task must have a responsible partner to ensure clarity on who is leading that part of the project.

- **Timeline**

The implementation timeline must be clearly defined, often represented in a Gantt chart, illustrating the temporal relationships between various activities and milestones.

- **Expected Deliverables**

Concrete and tangible outputs must be defined for each WP (e.g., reports, prototypes, publications).

- **Success Indicators**

Criteria that will be used to assess the successful completion of activities.

2.3.3.5 Project Management

This section describes how the project will be managed throughout its duration[23]. It is crucial to include:

- **Management structure**

Clearly define the decision-making hierarchy, with well-identified roles and responsibilities for the various consortium members.

- **Internal communication mechanisms**

Explain how partners will coordinate and how communications between involved parties will be managed (e.g., regular meetings, collaborative management platforms, etc.).

- **Risk management**

[23] *European Commision: European Defence Fund Info Days 2024*

A key part of this section is the analysis of potential risks (technical, financial, operational) and the mitigation measures that will be adopted to manage them. This demonstrates that the consortium is aware of possible challenges and has plans in place to address them.

2.3.3.6 Innovation And Impact

Another crucial part of the proposal is the description of the level of innovation of the proposed solution and its potential impact [24]. This includes:

- **Innovativeness of the solution**

The project must propose new or improved approaches or technologies compared to existing ones. It is essential to explain how the project represents an innovation compared to

- **Impact on economic, social, or technological levels**

The proposal should highlight how the project's results will positively influence the relevant sector and possibly beyond. This impact can be measured in terms of new market opportunities, societal benefits, or improvements in security and efficiency.

2.3.3.7 Consortium and Partnership

The quality of the consortium is one of the key elements that evaluators consider. This section must describe:

- **Involved partners**

Each partner in the consortium should be presented, including their profile, expertise, and relevant experience for the project.

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[24] *European Commision: European Defence Fund Info Days 2024*

- **Role of each partner**

For every partner, clearly indicate their role in the project, specifying which activities they will be involved in and what their specific contribution will be.

- **Synergy between partners**

It is important to explain why the chosen partners work well together and how their skills and know-how complement each other to achieve the project's objectives.

2.3.3.8 BUDGET

The budget section must be detailed and transparent. Every cost must be justified in relation to the described activities[25]. Typically, the budget is divided into:

- **Personnel costs**

An estimate of the time each partner will dedicate to the project, along with related expenses.

- **Travel costs**

If meetings between partners or other mobility activities are planned.

- **Equipment costs (materials)**

If the project involves purchasing new tools or machinery.

- **Subcontracting costs**

[25] *European Commision: European Defence Fund Info Days 2024*

In specific cases, parts of the project can be outsourced to external subcontractors. It is important to justify why this is necessary and ensure that subcontracting does not exceed 30% of the total budget[26].

- **Other direct and indirect costs**

For example, administrative expenses, consumables, etc.

2.3.3.9 Exploitation and Dissemination Results

This section describes how the project results will be utilized and disseminated. Key aspects include:

- **Dissemination strategy**

How the project results will be communicated, both at the academic level (scientific publications) and at the industrial or commercial level (participation in conferences, events, etc.).

- **Exploitation plan**

If the project involves the development of new technologies or products, it is necessary to indicate how the results will be leveraged and commercialized.

- **Intellectual property**

This part specifies who holds the intellectual property rights over the project results and how they will be managed.

2.3.4 Required Documentation

Submitting a proposal within the framework of a call for proposals requires the completion and submission of several mandatory documents[27]. These

[26] *European Commision: European Defence Fund Info Days 2024*
[27] *European Commision: European Defence Fund Info Days 2024*

documents provide the detailed information specified in the previous paragraph. Below is a list of all the documents that typically must be completed and submitted along with the proposal:

2.3.4.1 Application Form - Part A

Part A of the application form contains administrative information, including:

- **Coordinator and partner details**

This section provides details on all organizations involved in the project (coordinator, affiliated entities, partners, SubCo), including legal name, address, PIC (Participant Identification Code), and contact information.

- **Project summary**

A brief description of the project is given, including the overall objectives, the total requested budget, and an overview of the consortium.

- **Summary budget**

A breakdown of the main cost categories is provided, divided by partner and by type of expense (e.g., personnel costs, equipment, subcontracts, etc.).

This part is usually completed directly online through the electronic portal provided by the funding body, such as the European Commission's Funding & Tenders Portal.

2.3.4.2 Application Form - Part B

Part B represents the technical section of the proposal, where all the operational and scientific components of the project are described in detail. Specifically, it includes:

- **Technical description of the project**

A thorough description of the project activities is provided, including the context, objectives, proposed methodology, work plan, and expected outcomes.

- **Work Plan and Work Packages**

Activities are detailed, divided into work packages, along with their respective timelines, deliverables, and milestones.

- **Roles and responsibilities**

The role of each partner within the consortium is explained, as well as their specific contribution to the various phases of the project.

Part B is usually completed using a template downloadable from the electronic portal, which must then be uploaded as a PDF file.

2.3.4.3 Detailed Budget Table

This document includes a detailed breakdown of the project's budget, where each partner must specify the anticipated expenses, such as personnel costs, indicating the number of hours to be worked and the hourly rate for each team member (FTE, full-time equivalent), travel and accommodation costs in case meetings between partners or other activities requiring travel are planned, and equipment costs with the estimated cost for purchasing or using specific equipment necessary for the project[28].

2.3.4.4 Participant Info

Each consortium partner must provide details about their organization, including relevant experience and expertise, with a summary of previous experience in similar or related projects, a list of previously managed or

[28] *European Commision: European Defence Fund Info Days 2024*

participated projects that are relevant to the current proposal, and organizational capacity. This includes the resources available for the project, such as personnel, equipment, and technical infrastructure, demonstrating the partners' skills and capacities necessary to successfully implement the project.

2.3.4.5 List of Infrastructure

This document provides a detailed list of the infrastructures, equipment, and resources that will be utilized for the project, such as the availability of laboratories and technical equipment necessary for the project's execution, as well as digital infrastructures like platforms or software essential for carrying out activities. This is particularly important when the project requires specialized equipment or the use of laboratories.

2.3.4.6 Ownership Control Declaration

The document related to ownership and control, known as the **Ownership Control Declaration**, is intended to declare the ownership structure of the organization and specify whether it is controlled or influenced by entities from non-associated third countries. This is particularly important in sensitive sectors such as defense to ensure there are no risks of external control that could compromise the project's security or objectives.

The document includes information about the organization’s identity, such as the legal name, address, and Participant Identification Code (PIC), along with details about the ownership structure, which describes the main shareholders or owners of the organization. It is also necessary to indicate whether the organization is subject to direct or indirect control by entities from non-eligible countries in the context of the call, such as non-associated third countries. If the organization is controlled by entities from non-associated countries, the document must provide information about

guarantees issued by the EU or associated member state to ensure the organization complies with the required security standards[29].

2.3.4.7 Co-Financing Information's

In cases where the requested funding does not cover the total project costs, the consortium must submit a co-financing declaration that indicates how the remaining costs will be covered (for example, through support from various defense ministries). The partners must declare whether and how they will contribute with their own resources or through other funding sources.

2.3.4.8 Actual Indirect Cost Methodology

If partners apply specific methods to calculate indirect costs (e.g., overhead costs related to project administration), they must submit a statement explaining these methods. This section is important to ensure that all costs are transparent and in accordance with the grantee's funding rules.

2.3.4.9 Ethics Issues Table

If the project involves ethically sensitive topics, such as the handling of personal data, experiments on human subjects, or research with animals, an Ethics Issues Table must be completed. This document should outline the procedures that will be followed to ensure compliance with ethical regulations and applicable laws. If required, ethical approvals from ethics committees must also be included.

2.3.4.10 Financial Capacity Certification

To demonstrate the financial stability of the partners, a Financial Capacity Certification may be required, such as annual financial statements, profit

[29] *European Commision: European Defence Fund Info Days 2024*

and loss reports, and audit reports. This is essential to ensure that the partners have the necessary financial resources to successfully complete the project.

2.3.4.11 Letters of Support or Letters of Intent

In some cases, it is useful to include letters of support or letters of intent from external organizations or stakeholders that express interest in the project. These letters are not always mandatory, but they can strengthen the proposal by demonstrating external support or potential future collaborations.

2.3.4.12 Other Attachments

Some specific calls may require additional documents or information, such as:

- **Detailed risk analysis.**
- **Intellectual property management plans.**
- **Proof of professional qualifications for team members.**

In **conclusion**, the preparation and submission of a proposal for a call for proposals require careful planning and accurate documentation. It is essential that every document is complete, clear, and aligned with the objectives and requirements of the call, as the quality of the documentation is one of the key factors in the evaluation of the proposal. Proper completion and organization of the documents not only facilitate the evaluation process but also increase the chances of securing the requested funding[30].

2.3.5 Success Criteria

Proposals submitted under the EDF are evaluated based on strict criteria, known as Award Criteria, which guide the selection process for the best

[30] *European Commision: European Defence Fund Info Days 2024*

initiatives to receive funding. These criteria are divided into eight main points, each carrying a specific weight in the overall evaluation, and are applied to both research actions and development actions *(fig5)*.

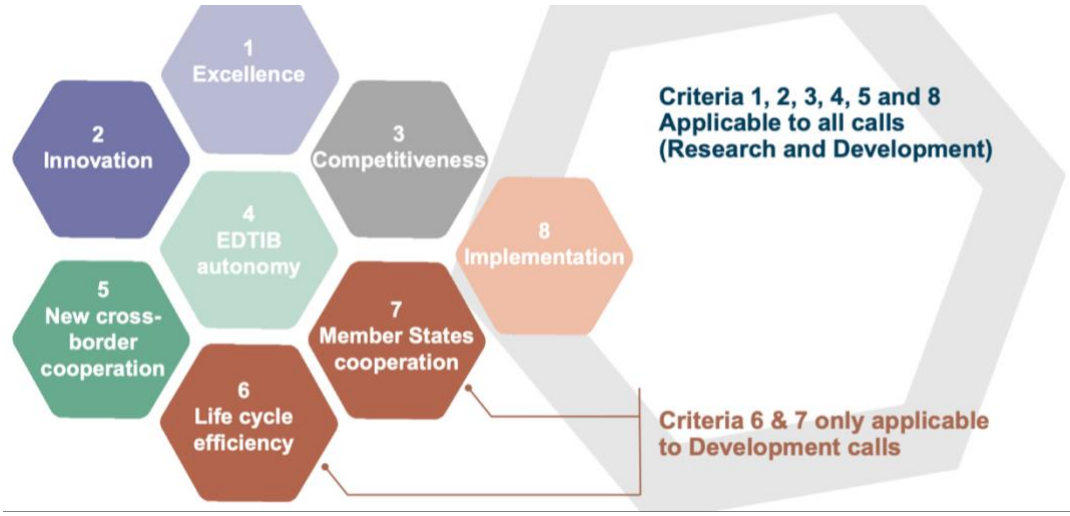


figure 5: Award Criteria

The first criterion is **excellence**, which measures the quality of the overall concept and the appropriateness of the proposed approach in relation to the objectives of the call. The proposal is evaluated based on its ability to deliver innovative results that offer significant advantages over existing defense products or technologies, with particular attention to the potential for disruption and the originality of the proposed solutions[31].

The second criterion is **innovation**, assessing the project's contribution to the technological development of the European defense industry. Proposals must demonstrate how innovative technologies, or pioneering concepts can bring long-term technological improvements or introduce applications of technologies not yet used in the defense sector.

The third criterion, **competitiveness**, focuses on the project's ability to enhance the competitiveness of the European defense industry, creating

[31] *European Commision: European Defence Fund Info Days 2024*

new market opportunities both within and beyond the EU. Proposals must demonstrate a competitive advantage over existing solutions and include a robust strategy for intellectual property and commercial exploitation of results.

The fourth criterion is **autonomy of the European Defence Technological and Industrial Base** (**EDTIB**). This evaluates the proposal's contribution to the EU's strategic autonomy by reducing dependency on non-EU suppliers and strengthening supply chain security.

The fifth criterion, **cross-border cooperation**, rewards initiatives that create new collaborations between legal entities from different member states, with particular attention to SMEs and mid-caps.

For **development actions** the sixth criterion assesses **lifecycle efficiency**, which includes the project's capacity to improve efficiency throughout the product lifecycle, from production to maintenance and decommissioning. The goal is to ensure that the proposed solutions are not only innovative but also sustainable and efficient in the long term.

The seventh criterion, also applied to development actions, evaluates the **degree of cooperation among member states**. Projects that demonstrate a coordinated commitment among states for joint use, ownership, or maintenance of the developed product receive higher scores, as they promote greater integration of the European defense industry.

Lastly, the eighth criterion, **implementation**, measures the quality and efficiency of project execution, including the structure of the work plan, risk management, and the distribution of tasks among consortium partners.

These award criteria are scored on a predefined scale ranging from 0 to 5, with half points allowed. The score reflects how well the proposal meets the defined criteria:

- 0: The proposal fails to address the criterion or cannot be evaluated due to missing or incomplete information.

- 1 (**Poor**): The criterion is inadequately addressed and has serious inherent weaknesses.

- 2 (**Fair**): The proposal addresses the criterion, but significant weaknesses are present.

- 3 (**Good**): The proposal addresses the criterion well, but some shortcomings are present.

- 4 (**Very Good**): The criterion is addressed very well, with only minor shortcomings.

- 5 (**Excellent**): The proposal successfully addresses all relevant aspects of the criterion, with negligible or no shortcomings.

2.3.6 Financial Aspects

2.3.6.1 Type of Grants

The EDF 2024 includes two main types of grants: Actual Cost Grants and Lump Sum Grants.

Actual Cost Grants refer to the reimbursement of the actual costs incurred by the beneficiaries for the project, including salaries, equipment, and management expenses. In this case, beneficiaries must provide detailed evidence of expenses through documents such as payrolls, invoices, and purchase contracts. These grants require meticulous reporting and are subject to ex-post and ex-ante financial audits[32].

[32] *European Commision: European Defence Fund Info Days 2024*

On the other hand, **Lump Sum Grants** involve a fixed payment for each completed activity, without the need to justify the actual costs incurred. Beneficiaries receive the funding based on the completion of specific milestones or work packages, simplifying financial management and reducing the need for detailed cost audits. However, beneficiaries must demonstrate the achievement of results through technical documentation, such as project progress reports.

2.3.6.2 Payment Timeline

The EDF payment system is based on a multi-phase approach, ensuring a continuous flow of funding throughout the entire project lifecycle. The main payment phases are:

- **Pre-financing**

This phase represents the initial payment after the signing of the grant agreement and amounts to up to 55% of the maximum grant value. This amount allows beneficiaries to start the project without financial delays. Before disbursing the pre-financing, an assessment of the beneficiaries' financial capacity is conducted, and if one of the consortium members shows financial weakness, additional guarantees may be applied.

- **Interim Payments**

During the implementation of the project, beneficiaries must submit periodic technical and financial reports, usually every 12-18 months. After the reports are approved, an interim payment is made, which can cover up to 90% of the total grant amount. These interim payments are designed to keep the project running without interruptions.

- **Final Payment**

At the conclusion of the project, after the submission of final reports and verification of the achievement of objectives, the final payment is made. This balance represents the difference between the maximum grant amount and the payments already disbursed. However, if the project does not meet the established requirements, the EU may decide to recover part of the funds already paid.

2.3.6.3 PAYMENT SCHEME

The EDF adopts an activity-based approach, meaning that projects are funded according to the type of activity carried out, and the funding rates vary depending on the nature of the project and the development phase:

- **Research**

For research actions, the EU covers up to 100% of the eligible costs, including expenses for personnel, equipment, and other related costs. This applies to activities such as knowledge generation and integration, studies, and design.

- **Development**

Development actions, which include prototyping, testing, certification, and qualification, have lower funding rates. For example, funding for prototyping can range from 20% to 55%, while testing and certification can reach 70-80% of eligible costs. These percentages also vary depending on the project's technology readiness level (TRL)[33].

- **SME's and PESCO Bonuses**

To encourage the participation of SMEs (Small and Medium Enterprises) and PESCO (Permanent Structured Cooperation) initiatives, the EU offers

[33] *European Commision: European Defence Fund Info Days 2024*

higher funding rates. Projects that include SMEs or mid-caps may receive a 10% bonus, provided these organizations represent a significant share of eligible costs. Involvement of SMEs with cross-border activities can lead to an additional increase in the funding rate.

2.3.7 Post Evaluation

2.3.7.1 Grant Agreement Preparation

After the evaluation phase is completed and the proposals are selected, the next step is the preparation of the grant agreement. This process involves close collaboration between the beneficiaries and the European Commission to finalize the technical and financial details of the project. During this phase, the project's **objectives**, **milestones**, and **deliverables** are established, along with the reporting criteria and financial control mechanisms. It is crucial for beneficiaries to provide all necessary information and address any concerns raised during the evaluation so that the agreement can be signed, and the funds can be released promptly. Additionally, financial capacity checks may be required to ensure that the beneficiaries have the necessary resources to manage the funds appropriately.

2.3.7.2 Model Grant Agreements - MGA

The Model Grant Agreements (MGA) are standardized templates used by the EU to formalize grants. In the context of the EDF, there are two main types of MGAs: one based on actual costs, and another based on lump sum amounts. These models define the legal and financial conditions governing the project's implementation, including the responsibilities of the beneficiaries, payment methods, and rules for intellectual property management and security. The MGAs include a series of annexes covering aspects such as the **Description of Action** (**DoA**), the estimated budget, and specific provisions for monitoring and reporting. These documents are

published on the **Funding & Tender Portal** and serve as the legal basis for collaboration between the beneficiaries and the Commission[34].

2.3.7.3. SECURITY FRAMEWORK

The Security Framework is a crucial element for EDF projects, especially when sensitive or classified information is involved. This framework is established during the grant agreement preparation phase and becomes an integral part of the agreement through the **Security Aspects Letter** (SAL), an annex detailing the specific security measures to be adopted to protect classified information. The Security Instruction Program (PSI), which includes the requirements for managing sensitive information, ensures that all beneficiaries comply with the security standards set by the EU or individual Member States. Depending on the adopted model, security management can fall under the authority of the European Commission or Member States, and it may vary according to the level of classification of the information involved (e.g., **CONFIDENTIEL UE or SECRET UE**).

2.3.7.4. TRANSFER AUTHORIZATIONS

Transfer authorizations are regulated by Directive 2009/43/EC, which establishes a licensing system for the transfer of defense-related products between EU Member States. EDF projects involving the transfer of these products must obtain the appropriate licenses, which may include: **general transfer licenses**, valid for specific categories of products and not requiring authorization for each individual transfer; **global transfer licenses**, applicable to a particular exporter and covering multiple transfers to specified recipients; and **individual transfer licenses**, issued on a case-by-case basis for specific transfers. The directive promotes a more efficient flow of defense-related goods within the EU but imposes a

[34] *European Commision: European Defence Fund Info Days 2024*

strict system of controls to ensure that transfers comply with national security requirements and EU regulations.

In **conclusion**, this chapter has provided a detailed overview of the workings of the European Defence Fund and the procedures related to Call for Proposals and their evaluation, in order to establish a solid knowledge base that will allow us to better understand the EDF-EPW case study addressed in the next chapter. In that context, we will conduct an analysis of the technological roadmap in the satellite communications sector, with particular attention to the positioning of **Thales Alenia Space** in this highly competitive market.

CHAPTER 3: TECHNOLOGICAL AND FINANCIAL TRENDS AND ROADMAP OF EUROPEAN DEFENSE RESEARCH AND DEVELOPMENT IN SATELLITE COMMUNICATIONS

3.1 STUDY OF TECHNOLOGICAL TRENDS IN THE SATELLITE COMMUNICATIONS INDUSTRY

The analysis of the technological and financial roadmap takes place within a context of modernization and integration of space capabilities, which are essential for ensuring the security and strategic independence of the continent. The roadmap focuses on two key points: the technological development necessary to maintain European competitiveness and the financial strategies supporting innovation and the production of new solutions.

Before diving into the details of the roadmap, it is important to provide a brief historical overview of satellite communications, which is essential to better understand the significance of the current roadmap.

3.1.1 HISTORY OF SATELLITE COMMUNICATIONS

In **1945**, Arthur C. Clarke first imagined the use of geostationary satellites to provide global radio communication coverage. Clarke, known for his futuristic insights, proposed that a satellite could orbit the Earth at a height that would allow it to remain stationary relative to the planet, enabling the transmission of radio signals and, later, television signals. However, his vision remained theoretical for several years, as the technology necessary

to realize it was not yet mature. Only in the following decades, with the development of the first artificial satellites, would it become possible to launch the first communication satellites[35].

The first concrete step toward this revolution occurred in 1957 when the Soviet Union launched **Sputnik**, the first artificial satellite in history. This event marked the beginning of the space race, triggering a technological escalation that would lead to rapid advancements not only in space exploration but also in telecommunications. Sputnik was a simple satellite that transmitted a radio signal that could be received on Earth, but its symbolic and technological success paved the way for a new era.

The real leap forward in satellite communications occurred in 1962 when AT&T, with the support of NASA, launched Telstar. Although this satellite was not geostationary, it allowed for the first time the transmission of television and telephone signals across the Atlantic, connecting Europe and the United States and enabling **bidirectional communication** between two continents. This was a clear demonstration of the potential of satellite communications, paving the way for the commercialization of this technology.

Following these developments, the United States, as pioneers in the field, immediately recognized the commercial potential and it became evident that there was a need to create international organizations to manage and coordinate the use of satellite telecommunications. In 1964, Intelsat was established, an intergovernmental organization tasked with developing and operating a network of satellites for international communications. Intelsat, with its multilateral approach, brought together different nations into a single organization, facilitating resource sharing and coordination of

[35] *The 1945 Proposal by Arthur C. Clarke for Geostationary Satellite Communications*

satellite infrastructures. The first **INTELSAT** satellite, named Early Bird, launched in 1965, marked the beginning of commercial satellite communications, connecting Europe to the United States with a capacity of 240 telephone circuits and operating in the C band (4-6 GHz). In the following decades, INTELSAT expanded its network, covering the entire globe and increasing its capacity to thousands of telephone circuits and hundreds of television channels.

In 1977, Europe followed suit by creating Eutelsat, a new intergovernmental organization aimed at developing satellite infrastructures for telecommunications in Europe. Italy played a crucial role in the development of satellite communications since the 1970s, particularly in exploring high frequencies. Sirio I, launched in 1977, was designed to study the propagation of radio waves at high frequencies, particularly those between 12 and 18 GHz. The goal of this satellite was twofold: on one hand, to expand technical knowledge on the use of high frequencies, and on the other, to open new possibilities for satellite telephone and television communications. The success of Sirio I solidified Italy's role in the field of satellite telecommunications, making it the third country in the world, after the USA and the USSR, to achieve space autonomy.

Another significant moment for satellite communications was the launch of the Olympus satellite by ESA in 1989. This satellite marked the beginning of the satellite broadcasting boom, as it allowed for direct television transmission to homes, known as Direct-to-Home (DTH) broadcasting. Olympus utilized higher frequencies (18/12 GHz), which were anticipated by Italian experiments, enabling better transmission of television and radio signals at the domestic level[36]. Thanks to this technology, millions of people

[36] *ESA: The Telecommunications Programme*

could access satellite television programs with small parabolic antennas, a landmark change that revolutionized the telecommunications and broadcasting world.

In the 2000s, the landscape of space telecommunications began to change radically, influenced by two main factors: the development of terrestrial **fiber optic** networks and the emergence of non-geostationary satellite systems. While satellites had played a key role in global communications during the second half of the 20th century, the development of fiber optic technology and the launch of the first transatlantic fiber optic cable (TAT-8) in 1988, with a capacity of 40,000 telephone circuits, revolutionized the sector, gradually relegating satellite systems to more specific and less central roles than before.

Fiber optics proved particularly effective for point-to-point communications, such as the transmission of telephony and data between continents. The practically unlimited transmission capacity and relatively low maintenance costs made terrestrial networks preferable for many traditional telecommunications applications. This change prompted the space industry to focus on applications more suited for satellites, such as point-to-multipoint communications, where satellites, due to their ability to cover large geographical areas with a single repeater, became extremely competitive. A significant example is direct television transmission (Direct To Home, DTH), where satellites became the preferred option for reaching millions of users over vast areas.

Another fundamental change at the end of the 1990s and the beginning of the 2000s was the introduction of **low Earth orbit** (**LEO**) satellite constellations, such as Iridium and Globalstar. These systems were designed to provide global coverage for low-speed voice and data services. Unlike geostationary satellites, which remain stationary at about 36,000 km

from the Earth, LEO satellites orbit at around 700 km, allowing for lower latency and better communication quality with small portable terminals similar to mobile phones.

The Iridium system, launched in 1998, consisted of a network of 66 satellites in LEO orbit, with a complex network of inter-satellite links in Ka-band, allowing autonomous routing of traffic between the satellites. Globalstar, also launched in 1998, was a constellation of 48 satellites that used transparent repeaters and relied on ground stations for traffic routing.

In both cases, Italy played an important role in the industrial development of these systems, with **Alenia Spazio** as a partner for the development of the Globalstar payload and Telespazio involved in supporting Iridium. However, despite technical innovations, both systems faced initial financial and commercial difficulties due to competition with rapidly expanding terrestrial cellular networks. These satellite systems found a niche market, serving users in remote areas (sea, deserts, mountains) not covered by terrestrial cellular networks.

With the increasing demand for multimedia services and internet access, new broadband satellite projects operating in Ka-band emerged. These satellites, such as ITALSAT and the American ACTS, were designed to handle large data flows, with total transmission capacities on the order of 10 Gbit/s. **Multi-beam** antennas were used to cover limited geographical areas, and regenerative transponders could autonomously route traffic onboard the satellite[37].

At the end of the 1990s and the early 2000s, many commercial initiatives for Ka-band satellites emerged, such as Astrolink, SpaceWay, WildBlue,

[37] *EHF for Satellite Communications: The New Broadband Frontier*

and Teledesic. In Europe, Alenia Spazio also developed the Euroskyway project in collaboration with ESA and with the support of the Italian Space Agency (ASI). The goal of these systems was to provide high-speed internet access to users in areas not covered by terrestrial networks.

In the 2000s, there was also significant consolidation in the European space industry. Alenia Spazio, previously part of Finmeccanica (now Leonardo), merged with Thales, creating **Thales Alenia Space**, while Telespazio became a joint venture between Finmeccanica and the French group Thales. These mergers and acquisitions strengthened the European space industry's ability to compete on a global scale, particularly in the development and management of telecommunications satellites.

However, the evolution of space telecommunications did not stop with the introduction of broadband satellites. In recent years, the exponential increase in internet traffic has driven the development of even more capable and sophisticated satellite systems, with satellites capable of carrying information flows on the order of **100 Gbit/s**. These systems use multi-beam antennas to illuminate limited geographical areas and reusable frequency segments to increase the efficiency of the available radio spectrum. Regenerative transponders and onboard switching devices manage complex communication flows, while ground transit stations handle routing operations[38].

In recent years, a new trend in space telecommunications has emerged: the integration of **dual-use applications** (civil and military), allowing for cost-sharing between civil and defense projects. The Athena-Fidus project, developed in cooperation between Italy and France, is an emblematic example. This geostationary satellite provides telecommunications

[38] *EHF for Satellite Communications: The New Broadband Frontier*

services for both public administrations and the armed forces of both countries, operating in Ka-band.

This new vision, which prioritizes dual-use and institutional projects, has prompted the **Italian Space Agency** (**ASI**) to focus more on strategic initiatives of public interest, such as satellite telecommunications for national security, defense, and civil protection. A clear signal of this change was the announcement by ASI President Enrico Saggese in 2010, which indicated the development of satellite systems for institutional purposes as a priority for the future, emphasizing the need to develop independent systems capable of meeting both institutional and governmental strategic needs in Italy.

An area where Italy will continue to play a leading role is satellite navigation, with participation in the Galileo program promoted by the European Union. Galileo will be the first European satellite navigation system, independent of the American GPS, and the Italian industry, through Thales Alenia Space and Telespazio, will be directly involved in both the construction of the satellites and the realization of the ground segment.

The role of the Italian industry in satellite telecommunications is, in fact, set to grow significantly, also thanks to the support of European funds, such as the European Defence Fund, already analyzed in previous chapters. These financial resources provide a crucial boost to the development of advanced technologies that strengthen Italy's competitiveness in the global space landscape, as well as its ability to contribute to Europe's strategic autonomy. Italian companies, such as Thales Alenia Space, Leonardo, and Telespazio, which have a long tradition of excellence in the sector, will continue to be key players in the development of cutting-edge satellite systems for both civil purposes and security and defense needs, consolidating their technological **leadership**. In this context, Italy will not

only strengthen its weight in international collaborations but will also consolidate its role as a key player in building European technological sovereignty, promoting a future where satellite telecommunications will be at the center of the continent's security and innovation policies.

3.1.2 Technological Innovation, Strategic Objectives and Challenges of the European Financial- Technological Roadmap

Satellite communications (**SatCom**) play a fundamental role in European defense and security by providing secure, reliable, and global connectivity essential for military operations, crisis management, critical infrastructure protection, and border control. With their ability to deliver constant and stable access to information, even in remote or difficult-to-reach areas, satellite communications are a strategic tool for rapid and coordinated responses in emergencies or conflicts[39].

Moreover, satellite communications are crucial in **military operations**, particularly in complex environments and isolated areas, enabling the real-time transmission of data and strategic orders, even in the absence of terrestrial infrastructure. Additionally, they are essential in crisis management, facilitating continuous communication during natural disasters or armed conflicts and allowing real-time monitoring, rescue management, and protection of affected populations.

Satellite communications are also vital for monitoring European borders, integrating with both space and ground surveillance systems, which enable the tracking of movements and prevention of illicit activities along borders.

[39] *EUSPA: Secure Satcom*

Finally, SatCom ensures the coordination of multinational operations, such as those of NATO and the Common Security and Defense Policy, enhancing interoperability between the communication systems of member countries and increasing the effectiveness of joint missions in an increasingly complex geopolitical context.

3.1.2.1 Main Market Trends

The global satellite telecommunications market is expected to grow at an average rate of **9.2% per year from 2023 to 2028**, increasing from a revenue of $156 billion by next December to a projected $200 billion by the end of 2028. Key factors driving this growth include the rising demand for ultra-fast broadband, increasingly significant integration with 5G networks, and the expansion of IoT applications[40].

- **Growing Demand for Connectivity**

The increasing global digitization, coupled with rising data traffic, is leading to strong demand for high-speed communication services. This need is particularly felt in remote areas or regions poorly served by terrestrial infrastructure, where satellite communications provide an effective solution to bridge the connectivity gap.

- **Integration with 5G**

5G is set to revolutionize the communications sector, and the integration of satellite networks with this technology plays a crucial role in its rollout. The integration of 5G with satellites is gaining momentum, especially since satellites can support the extensive expansion of the 5G network, contributing to the creation of uniform global coverage. This is particularly important in areas like large-scale Internet of Things (IoT) connectivity and

[40] *Markets and Markets: Satcom Market size*

smart cities, where 5G is the key technology to ensure real-time communications.

- **Expansion of IoT Applications**

The number of devices connected through IoT is increasing exponentially, further driving the demand for satellite communication solutions. In sectors such as precision agriculture, natural resource management, and oil and gas, satellites enable real-time monitoring and management of infrastructure and resources. Satellite-based IoT also provides effective solutions for cargo tracking, fleet management, and natural resource management, contributing to improved operational efficiency across numerous industrial sectors.

3.1.2.2 Key Technological Components: Innovation and Integration

In a rapidly transforming context characterized by increasing adoption of advanced technologies and a growing integration of military and civilian components, the European-level technological-financial roadmap aims to promote the development of innovative solutions while simultaneously addressing strategic objectives and tackling challenges related to global competition and the security of space infrastructures. Innovation in the satellite communications sector is essential for maintaining Europe's competitiveness on the global stage and ensuring its strategic autonomy, with developing technologies increasingly focused on enhancing data transmission capabilities, operational efficiency, and communication security.

The following sections examine in detail the main technological developments currently underway.

- **Broadband and Large-Scale Satellites**

These next-generation satellites are designed to handle significantly larger amounts of data compared to previous technologies. They are capable of supporting complex operations that require high data transmission capacities, such as remote control of drones and other autonomous platforms, as well as advanced surveillance of extensive geographical areas. The ability to transmit critical information in real-time on a large scale is essential for military, security, and emergency management operations. Broadband satellites are also crucial for improving coverage in remote or hard-to-reach areas, providing stable, high-speed connectivity even under adverse operational conditions.

- **High Throughput Satellites (HTS)**

HTS represents one of the most significant evolutions in satellite communications. They utilize high-density frequency beams to transmit large volumes of data more efficiently. Compared to traditional satellites, HTS offers significantly higher transmission capacity, making them ideal for critical military missions and operations that require high redundancy and extremely secure connections. The features of HTS allow for the management of complex satellite networks, simultaneously supporting a wide range of applications, from high-resolution video transmission to sending sensitive intelligence data, ensuring that operations can continue even in the presence of interference or partial system failures[41].

- **Advanced Encryption and Security Technologies**

The rise in cyber threats has made the security of satellite communications a top priority. The technological roadmap includes the development of cutting-edge security protocols, including advanced encryption systems

[41] Evolution of High-Throughput Satellite Systems: A Vision of Programmable Regenerative Payload

that leverage quantum encryption. This represents a revolution in cybersecurity, as it uses the principles of quantum mechanics to secure communications, making it virtually impossible to intercept without altering the transmitted information.

- **Satellite Constellations**

Another significant development is the use of small satellite constellations, commonly known as mega-constellations. These systems consist of dozens or hundreds of small satellites that operate in synergy to ensure global and continuous coverage. The distribution across multiple orbits provides operational redundancy, enhancing the resilience of the overall system. In the event of a failure of one or more satellites, others can compensate for the loss of capacity without compromising service. Small satellite constellations also offer a more economical and flexible option compared to traditional satellites, reducing launch and maintenance costs, and facilitating adaptation to the dynamic needs of the operational context. They are particularly well-suited for surveillance applications, real-time monitoring, and global connectivity in areas difficult to cover with terrestrial infrastructures.

3.1.2.3 Roadmap's main Objectives

The European technological-financial roadmap for the satellite communications sector is designed to address a series of strategic objectives aimed at strengthening the strategic autonomy of the European Union and promoting the competitiveness of the European space industry.

The first objective is to develop independent satellite capabilities that reduce Europe's dependence on non-European suppliers, especially for critical military and government communications. Establishing secure,

high-performance satellite telecommunications systems is essential for ensuring technological sovereignty and the security of transmitted data.

A second key objective concerns the integration of civilian and military technologies. The **dual** nature of satellite technologies allows for optimized development costs and the creation of synergies across different sectors.

The roadmap also aims to promote international cooperation and interoperability among the various EU Member States. **Standardizing** technologies and creating a common infrastructure is crucial for facilitating cooperation in both military and civilian contexts. The long-term goal is to ensure that European satellite systems can be used in an integrated manner in multinational operations, enhancing the effectiveness and responsiveness of the EU.

3.1.2.4 Challenges and Risks in Implementing the Roadmap

Despite the potential offered by new satellite technologies, the realization of the European technological-financial roadmap is subject to various challenges and risks.

One of the main concerns is global competition, particularly with powers like the United States and China, which continue to invest significant resources in the space sector. Europe must face the challenge of maintaining its competitive position by developing cutting-edge technologies and ensuring the financial sustainability of projects.

Another risk relates to the security of space infrastructures. The increasing congestion in space, with the rise of space debris and the proliferation of satellites in orbit, poses a threat to the integrity of European satellite networks. To address these challenges, the EU is investing in **Space Situational Awareness** (SSA), a set of technologies and protocols aimed at

monitoring the space environment and preventing potential collisions or attacks.

Financial sustainability of projects is an equally relevant challenge. The high costs of developing, launching, and maintaining satellite infrastructures require close cooperation between public and private actors, along with a consistent commitment from Member States. The implementation of **public-private partnerships** (PPP) is seen as one of the solutions to ensure long-term funding for satellite technologies and to encourage the entry of new players into the space sector.

In this context, the implementation of PPPs emerges as a key solution. PPPs provide a platform for combining public sector resources with those of the private sector, facilitating the sharing of financial and technical risks. Public actors, such as the European Union and Member States, can provide initial funding, regulations, and incentives to stimulate innovation, while the private sector can contribute its innovation capacity, operational flexibility, and access to new markets, thereby accelerating the development and commercialization of satellite technologies.

Another fundamental aspect of PPPs is their ability to attract private investors to sectors that require substantial and long-term capital, such as space infrastructures. These partnerships can help reduce the return on investment time and ensure greater economic sustainability over time. Additionally, PPPs promote the entry of new players into the space sector, encouraging the development of start-ups and innovative companies that can bring new ideas and technologies.

In conclusion, the integration of advanced technologies, strategic objectives, and the challenges associated with the European technological-financial roadmap outline a complex but promising

framework for the future of satellite communications. Innovation and international cooperation represent the main levers upon which the European Union can base its growth in the sector, not only to address security and defense needs but also to ensure its strategic autonomy while playing an increasingly important role in the global market.

This thesis, developed at **Thales Alenia Space Italia** (**TASI**), one of the leading companies in the European space landscape, focuses on the case study of the **EPW** (**European Protected Waveform**) project, which is part of the EDF, where TASI acts as the Italian national coordinator. To fully understand the context and capabilities that make Thales Alenia Space a key player in strategically and technologically significant projects, such as those funded by the EDF, it is important to briefly outline the history and profile of the company.

3.2.1 THALES ALENIA SPACE

Thales Alenia Space is one of the leading companies in the European space sector, with a long history of leadership and innovation. The company was formed from a joint venture between **Thales Group**, which holds 67% of the shares, and the Italian holding company **Leonardo** (formerly Finmeccanica), which owns the remaining 33%[42] *(fig6)*.

figure 6: TASI's logo

[42] *ThalesAleniaSpace.com*

Thales Alenia Space [6] has a significant presence not only in Europe but also worldwide. In addition to its headquarters in France and Italy, the company operates in Germany, Belgium, Spain, Poland, the United Kingdom, Switzerland, among others, with a strong network of partners and collaborators contributing to the realization of its projects. In Italy alone, the company has offices in Rome, Turin, Gorgonzola, and L'Aquila, employing over 2,800 people.

The company operates across a wide range of sectors covering the entire spectrum of space applications, including aerospace, space, defense, telecommunications, and transportation. Thanks to its versatility and technological expertise, Thales Alenia Space is able to offer advanced solutions for various domains, supporting both scientific missions and space exploration, as well as terrestrial applications such as national security, global connectivity, and intelligent transport systems.

CHAPTER 4: THE EUROPEAN PROTECTED WAVEFORM (EPW)

4.1 EPW OBJECTIVES

Space is both a global commons and an emerging operational domain, providing critical capabilities increasingly indispensable for military purposes. As the reliance on satellite communications for military operations grows, so too do the threats and challenges associated with securing this domain. Ensuring access to space while protecting already deployed assets has become a strategic imperative. Military satellite communications are now inextricably linked to security, resilience, and information assurance, especially as operations become more complex and dispersed globally. The need for secure, resilient, and efficient satellite networks has never been greater, particularly in light of growing security threats, such as jamming, interception, and cyber-attacks by state and non-state actors.

The evolving nature of military operations, which often involve a mix of on-the-move, on-the-pause, and fixed platforms, highlights the necessity for advanced satellite communication systems. Modern military operations depend heavily on high-bandwidth services, including Intelligence, Surveillance, and Reconnaissance (ISR), situational awareness, and the increasing use of drones. However, this dependence introduces significant risks, mainly as hostile actors exploit vulnerabilities in satellite networks. The challenge lies in meeting the rising demand for data capacity while

ensuring the security and resilience of these communications against ill-intentioned acts such as jamming and cyber-attacks[43].

Developing a European Protected Waveform is essential to address these challenges. The EPW is envisioned as a robust, secure, and resilient satellite communication solution tailored to the complex demands of military operations. It must ensure seamless interoperability among EU Member States, provide autonomy from non-European technologies, and enhance joint operations within NATO, the EU, and other multinational contexts. By creating an entirely European solution, the EPW will help reduce dependency on foreign technologies while improving military satellite communications' overall security and efficiency.

4.1.1 Innovation and Autonomy in European Satellite Communications

The EPW must be an ambitious, innovative project that capitalizes on the strengths of different EU Member States and their respective industries. It cannot replicate existing solutions; instead, it must incorporate cutting-edge technologies that are flexible and scalable to meet future military communication needs. A primary goal of the EPW is to ensure European autonomy in satellite communications, reducing the reliance on non-European technologies while fostering cooperation among EU Member States for mission-critical operations. This will enable greater strategic independence while enhancing interoperability during multinational missions.

[43] *EDF: EPW-STEP Call2021*

4.1.2 Efficiency, Affordability, and Technological Flexibility

A key objective for the EPW is to provide an affordable and efficient satellite communication solution that reduces operational and capital expenditures. By leveraging innovative Commercial Off-The-Shelf (COTS) technologies, the EPW can offer high throughput with minimal satellite bandwidth, reducing costs while enhancing operational effectiveness. Furthermore, the system must be flexible, capable of operating across various satellite constellations (LEO, MEO, GEO), frequency bands (C-band, X-band, Ku-band, Ka-band), and network architectures, making it adaptable to different military environments and use cases.

The EPW should support multiple platforms, from fixed to on-the-move and on-the-pause, ensuring mobility and scalability in even the most challenging environments. This flexibility is crucial as military operations increasingly rely on mobile communication platforms in dispersed and remote areas, including regions with limited coverage, such as the Polar Regions[44].

4.1.3 Multi-layered Security and Resilience

Security and resilience are fundamental features of the EPW, which must be capable of defending against a wide array of threats, including jamming, signal interception, and cyber-attacks. The EPW will employ an integrated, multi-layered security approach to protect satellite communication networks from these increasingly sophisticated threats. This includes anti-jamming technologies, network redundancy, and cyber-hardening

[44] *EDF: EPW-STEP Call2021*

solutions designed to mitigate the risk of interference and ensure continuous, secure communications in contested environments.

The EPW will also incorporate advanced satellite link protection measures, ensuring that communication remains uninterrupted even in challenging conditions, such as during rain fade or in congested spectral environments. Furthermore, the waveform must be future-proof and adaptable to upcoming security technologies, such as quantum encryption and self-healing networks, while remaining interoperable with existing military communication systems.

4.1.4 Design and Development Phases

The development of the EPW will progress through several vital phases, beginning with feasibility studies and system specifications. This will be followed by a detailed design phase, which includes the creation of technological demonstrators to test the waveform and its associated security technologies. These demonstrators will simulate real-world operational scenarios, including potential threats such as jamming or interception, to ensure the EPW performs under various conditions. Significantly, military end-users will be involved throughout this process to provide feedback and ensure the EPW meets their operational requirements[45].

Ultimately, the goal is establishing the EPW as a standard comparable to other military communication waveforms. This standard will ensure that the EPW is interoperable across different systems and platforms, while providing robust protection against cyber threats and other security risks. The result will be a system that offers seamless, secure, and resilient

[45] *EDF: EPW-STEP Call2021*

satellite communications for EU Member States, supporting national and multinational military operations.

4.1.5 EXPECTED IMPACT

The successful development and deployment of the EPW will have far-reaching impacts on European defense capabilities. It will provide Member States with secure, scalable, and resilient satellite communication systems critical for modern military operations. By ensuring full interoperability across different systems and platforms, the EPW will enable joint operations within NATO, the EU, and other multinational contexts, ensuring that mission-critical information can be securely transmitted and shared[46].

Moreover, the EPW will significantly enhance European autonomy in satellite communications, reducing dependence on non-European technologies. This will strengthen Europe's defense capabilities and ensure the protection of sensitive information during military operations. The EPW will be a state-of-the-art solution that integrates the latest innovations in satellite communications, including 5G, IoT, and small satellite constellations, ensuring that Europe remains at the forefront of military communication technologies.

In conclusion, the EPW represents a critical enabler for European defense forces, providing a secure, resilient, and interoperable satellite communication system that meets the demands of modern military operations. By fostering innovation and enhancing cooperation between EU Member States, the EPW will contribute to greater European autonomy

[46] *EDF: EPW-STEP Call2021*

in space while ensuring that Europe's defense capabilities remain robust in the face of evolving threats.

4.2 EPW Documents

In this section we will look at some of the documents discussed in chapter 2, specific to the EPW case. it is important to note that some information will be masked for reasons of corporate secrecy.

4.2.1 Participant Info

In this specific document, Thales Alenia Space Italia must provide detailed information about their organization as a primary participant. The description should cover TASI's extensive experience, particularly in satellite telecommunications for defense applications, including their contributions to secure and resilient satellite communication systems *(fig7)*.

PARTICIPANT INFORMATION

(To be filled in by the participants (beneficiaries, affiliated entities, subcontractors involved in the action and associated partners) and uploaded as part of the application. To add information for more participants, copy the table as many times as necessary. This section is not bound by any page limit.

Subcontractors involved in the action — Subcontractors involved in the action means subcontractors with a direct contractual relationship to a beneficiary or affiliated entity, other subcontractors to which at least 10 % of the total eligible costs of the action are allocated, and subcontractors which may need access to classified information in order to carry out the project.

Only participants which are established in the EU or an EDF associated country and who have their executive management structure in one of these countries may participate in the project as beneficiaries, affiliated entities or subcontractors involved in the action. Associated partners who do not fulfil this condition may participate exceptionally, under certain conditions and if agreed by the granting authority.)

PROJECT	
Project name and acronym:	European Protected Waveform — EDF-2024-DA-SPACE-EPW-STEP

Participant 1 *(use same partner numbering as on Submission System screens; add subcontractor tables at the end).*	
Legal name (short name) — Role:	Thales Alenia Space Italia Spa (TASI) — BEN
PIC:	999488195
Legal registration number:	02101600480 fiscal code and registration number
Place of establishment: *(country of registration; full address)*	Viale Machiavelli, 29 – Florence (Italy)
Location of global headquarters/head office:	Via Saccomuro, 24 – Rome (Italy)
Location of executive management structure:	Via Saccomuro, 24 – Rome (Italy)

Description of participant

Provide a short description of the participant, with an explanation on how it matches its main role and tasks in the proposal.

Thales Alenia Space has more than 40 years of experience in the design, implementation, integration, testing, operation and commissioning of innovative space systems. In the frame of this project TASI has been involved for his background experience in Satellite Telecom systems with specific attention to Defence Systems, for which an enhanced level of security of the missions communication and control capabilities is mandatory.

TAS-I main contribution in the project will be in the frameworks of the Satellite reliable secure communication and command/control. TAS-I is positioned in the consortium as follows:

- Leading the Satellite Communications assessment in the overall SBMEW network;
- Leading the Satellite Links Threats analysis and countermeasures definition task;
- Contributing the specification of the overall Secure Communications & Network Architecture;
- Contributing to GEO and LEO Satellite Systems design for TRANSEC/COMSEC protection aspects, satellite-to-satellite and satellite-to-ground communication and TT&C links;
- Leading the definition and preliminary design of the ISL and Space↔Ground communication layer defining the on-board Transponders and Routing policy to be implemented for Low orbit constellation systems;

Leading the Pre-Development task for a preliminary demonstration of the defined communication techniques on suitable Breadboarding.

figure 7: Participant info part 1

Key staff *(only for beneficiaries, affiliated entities)*

Provide a short description of the profile of the persons who will be primarily responsible for carrying out the proposed activities.

Please provide sufficient detail to demonstrate your operational capacity (i.e. that you have the sufficient. know-how, qualifications and resources to successfully implement the project and contribute your share.

[Alessandro] [PISANO], [contract staff], [Head of Competence Centre System Engineering - Domain Telecom Italy]

Multi-year experience in managing TAS-I Telecommunication Engineering, resources and activities.

[Lorenzo], [SIMONE], [contract staff], [Head of Processing, Navigation & Power Product Lines]

Senior Expert in Integrated Communication and Radio Science.

[Andrea] [BARTOLAZZI], [contract staff], [Systems Bid & Project Manager]

Project manager for Defence programs and R&D projects from 2013; IPMA Level C certified.

[Miriam] [PETRONE], [contract staff], [Defence R&D and Strategic Opportunities coordination; Head of In-Orbit Mission Operations, Ground Systems and Labs Unit in CCSE Domain TLC Italy]

Large experience as Project Design Authority of Defence R&D projects and Military Defence programs from 2004.

[Guglielmo], [LULLI], [contract staff], [Senior System Architect]

Specialist in Digital TLC Solutions

[Raffaele], [CIRILLO], [contract staff], [System engineer]

TLC system engineering manager

[Dario], [GELFUSA], [contract staff], [Head of Digital Communication Products]

Expert in Digital Radio

[Marco], [SALVATI], [contract staff], [Head of Digital Payload Equipment and VLSI Processing Products]

Specialist in Digital HW Architecture

Projects or Activities *(only for beneficiaries, affiliated entities)*

List of up to 5 relevant previous projects or activities, connected to the tasks to be performed in the proposed project..

Design, development and delivery of:

- Secure TRANSEC TT&C Systems for Defence

- NATO Future SatCom support tools

- Secure FH/SS Communication transponder

- On board Hybrid processor for interactive network

- On Board Processor for UHF Tactical communications

figure 8: Participant info part 2

Additionally, TASI's key personnel, with expertise in fields like telecommunications engineering, digital communication products, and secure waveform design, are highlighted to demonstrate operational capacity *(fig8)*. Previous relevant projects are also summarized, such as the

development of secure TRANSSEC TT&C systems, NATO SatCom support tools, and hybrid processors for tactical communications. These details collectively showcase TASI's technical infrastructure, specialized personnel, and proven track record, substantiating their capability to effectively contribute to and execute the objectives of the EPW-STEP project.

4.2.2 List of Infrastructure

This document provides a comprehensive overview of the infrastructure, equipment, and resources to be used by Thales Alenia Space Italia (TASI) for the EPW-STEP project *(fig9)*.

LOCATION OF INFRASTRUCTURE, FACILITIES, ASSETS AND RESOURCES

(To be filled in and uploaded in the Portal Submission System as part of the application.)

LOCATION OF INFRASTRUCTURE, FACILITIES, ASSETS AND RESOURCES USED

Location of infrastructure, facilities, assets and resources used

List and give details on the location of the infrastructure, facilities, assets and resources that will be used for the action.
Include all infrastructure, facilities (e.g. offices, laboratories, production capabilities), assets and resources (e.g. the technical equipment, tools, software, patents at the disposal of the applicant, personnel's expertise and know-how in the field covered by the action).
Give their precise location (number, street, city, postal code and country). Use the following:
- *for cloud services: location of the servers + place of establishment of owner/operating entity*
- *for space assets or services: location of the ground stations+ place of establishment of owner/operating entity*

If a facility security clearance (FSC) is needed to handle classified information, indicate if you are already in possession of a valid FSC for the listed infrastructure and facilities.
In principle only infrastructure, facilities, assets and resources which are located in the eligible countries (see Call document) may be used.
Assets, infrastructure, facilities or resources located outside these countries, may exceptionally be authorised, if you can show:
- *that there are no competitive substitutes readily available*
- *why this does not contravene the EU and MS security and defence interests*
- *how it is consistent with the EDF objectives*
- *how you will ensure that the results will not be subject to control or restriction by a non-associated third country or by a non-associated third-country entity, directly, or indirectly through one or more intermediate legal entities.*

However, even if authorised, such infrastructure, facilities, assets or resources will NOT be eligible for reimbursement under the grant (only infrastructure, facilities, assets or resources located in the eligible countries are eligible for funding).

Short description of infrastructure, facilities, assets and resources	BEN/AE/ subcontractor to which it is linked	Owner (if different from BEN/AE/ subcontractor)	Location (number, street, city, postal code and country)	Justification (for infrastructure, facilities, assets and resources located **outside** the eligible countries: Why is there no competitive substitute readily available? How will you make sure that the use does not contravene the EU and MS security and defence interests? How is the use consistent with the EDF objectives? How will you ensure that the results will not be subject to control or restriction by a non-associated third country or by a non-associated third-country entity, directly, or indirectly through one or more intermediate legal entities?)	Facility security clearance (if needed, please indicate if you have one for the facility)

figure 9: List of infrastructure part 1

It includes detailed information about the available laboratories, secure facilities, and specialized technical equipment required for the project's execution. The resources listed encompass secure restricted areas, system engineering labs, and electronic prototype facilities, all located within TASI's premises. Additionally, it specifies digital infrastructures, such as processing boards and simulation software, which are essential for

tasks related to design, testing, and prototype development. This detailed listing ensures that all necessary infrastructure is accounted for, particularly where specialized or secure facilities are needed to support the project's objectives *(fig10)*.

Corporate offices structure	TAS-I		Via Saccomuro 21/24, Via Tiburtina 1232 00131 Rome (IT),	-	No
Secure Restricted Area	TAS-I		Via Saccomuro 24, Via Tiburtina 1232 00131 Rome (IT)	-	Yes
System Engineering Laboratory	TAS-I		Via Saccomuro 24, 00131 Rome RM (IT)	-	No
Electronic Prototype Laboratory	TAS-I		Via Saccomuro 24, 00131 Rome RM (IT)	-	No
Company production facility	TAS-I		Via Gian Domenico Cassini 6, 67100 L'Aquila AQ (IT)	-	Yes/No
Laboratory Instruments, computers, digital processing boards, digital channel emulators, software tools for design and simulation.	TAS-I		Via Saccomuro 21/24, 00131 Rome RM (IT)	-	N/A

figure 10: List of infrastructure part 2

4.2.3 OWNERSHIP CONTROL DECLARATION

The Ownership Control Declaration in this document specifies the ownership structure of Thales Alenia Space Italia (TASI) and confirms its compliance with European Union standards for control and influence, especially concerning entities from non-associated third countries. This declaration is critical in the defense sector to ensure there are no external influences that could pose risks to the security or objectives of the EPW-STEP project *(fig11)*.

OWNERSHIP CONTROL DECLARATION

To be filled in by the project participants as part of the application. All declarations must be assembled by the coordinator and uploaded in a single file in the Portal Submission System.

Beneficiaries and affiliated entities must always provide the form; associated partners and subcontractors must provide it only if required by the call conditions (for HE, associated partners always). Entities that are validated as public bodies by the Central Validation Service are exempted since they will automatically be considered as controlled by their country.

Supporting documents do not have to be provided at application stage, but will be requested later on. You will receive a task notification asking you to upload the documents to your PIC account in the Portal Participant Register.

The supporting documents should reflect the situation at the moment you sign this declaration. Please be aware that additional evidence may also be requested later on, in case there are open questions about your ownership/control status.

Please note that the information in this declaration may be reused in case you apply to other EU calls that have ownership/control restrictions.

Please also note that you must inform the granting authority in case of changes in your shareholding during the project implementation, if these could impact the ownership/control requirements.)

DECLARATION ON OWNERSHIP AND CONTROL	
Participant	
Legal name:	Thales Alenia Space Italia Spa
PIC:	999488195
Legal registration number:	02101600480
Place of establishment: *(country of registration; full address)*	Via Saccomuro, 24 – Rome (Italy)
Headquarters	
Location of global headquarters/head office: *(full address)*	Via Saccomuro, 24 – Rome (Italy)
Location of the executive management structure: *(if different from the location of global headquarters/head office; full address)* *'Executive management structure' means a body appointed in accordance with national law, and, where applicable, reporting to the chief executive officer, which is empowered to establish the strategy, objectives and overall direction, and who oversees and monitors management decision-making.*	Via Saccomuro, 24- Rome (Italy)
Listed, subsidiary or controlled *Supporting documents: report/minutes of the last three shareholders meetings, for each of the listed companies.*	
Are you listed on a stock exchange?	No
Are you a subsidiary of a listed company?	No
Are you controlled by a listed company?	Yes
If the reply is YES to any of these three questions, please provide:	
Which stock exchange?	Paris
Legal name of the listed company:	Thales S.A.

figure 11: Ownership Contol Declaration part 1

The document includes essential details about TASI's identity, such as its legal name, address, and Participant Identification Code (PIC). It provides a breakdown of TASI's ownership structure, listing the main shareholders and their respective shares. In this case, TASI is controlled by Thales S.A., with significant shares held by Leonardo S.p.A. and Thales S.A. subsidiaries *(fig12)*.

Share of the float in the total outstanding shares: *'Floating stock' is the result of subtracting closely-held shares from the total number of issued shares. It represents the portion available for unrestricted trade on a regulated stock market.*	45,59%

Ownership structure and specific rights

In the table below, detail any owners that:

- *detain, directly or indirectly, at least 5% in the capital or at least 5% of the voting rights, including through any content, understanding, relationship[1] or/and intermediary*
- *have one or more of the following specific rights in relation to their ownership:*
  - *right to veto a transfer of shares*
  - *pre-emption rights*
  - *right to purchase additional shares or investment subject to conditions*
  - *right to sell shares (only for owners that are not established in eligible countries (i.e. legal entity) or do not have the nationality of one of the eligible countries (i.e. individual) and holding more than 5% of the voting rights).*

Supporting documents:

- *commercial registry extracts, shareholders book or a declaration signed by the legal representative of the organisation and any other relevant document containing clear mention of the shareholders and their percentage of interest/voting rights.*
- *shareholders' agreement, memorandum of understanding among shareholders, statutes, articles of association or other relevant documents regarding the decision-making procedures within the legal entity, investment agreements between the shareholders, etc.*
- *If there are legal persons as shareholders [2], please provide also a graph describing the different ownership layers/chain of control until the ultimate owners.*

The supporting documents must show the complete ownership structure, for the entity and all its layers of ownership, up to the ultimate owners and should reflect the situation at the moment you sign this declaration.

[1] This includes voting agreements between shareholders that would together have more than 5% of the voting rights or 5% of the capital.

[2] Detaining at least 5% in the capital or at least 5% of the voting rights.

Owner name	Country of establishment/ or nationality	How is the ownership/ control held		Specific rights attached to shares
		by share [%]	by voting right [%]	
Thales Alenia Space S.A.S. (direct)	France	100,00	100,00	
LEONARDO S.p.A. (indirect)	Italy	33,00	33,00	
Thales S.A. (indirect)	France	67,00	67,00	

figure 12: Ownership Contol Declaration part 2

Corporate governance

Describe briefly:

- *the decision-making bodies, their composition as well as their nationality or place of establishment (where applicable);*
- *the rules regarding election, appointment, nomination or tenure of members of the decision-making bodies or other management positions;*
- *the decision-making procedures, including information regarding the required majority and/or quorum needed for decisions.*

Supporting documents: Documents establishing/describing the decision-making bodies, rules regarding election, appointment, nomination or tenure, decision-making procedures within the legal entity (e.g. articles of association bylaws, reports on corporate governance, etc).

You can refer to specific sections of your supporting documents.

The same documents and information should be provided for each intermediate legal entity holding directly or indirectly 5% or more of the capital or voting rights, up to the ultimate owners of all the layers involved.

Thales Alenia Space Italia S.p.A. is 100% controlled by Thales Alenia Space Sas, whose captal share is

owned by Thales S.A. at 67% and LEONARDO S.p.A. at 33%.

Thales S.A.: French State (T.S.A.) 26,06 % + Dassault Aviation 26,05% + Thales 2,30% + Employees 2,79% + Other shareholders 42,80%.
Thales S.A. is a public company listed on EURONEXT Paris with the ISIN Code FR0000121329

Leonardo S.p.A.: Institutional 50,3 % + MINISTRY OF ECONOMY AND FINANCE 30,2% + RETAIL 19% + INSTITUTIONAL UNIDENTIFIED 50,3 % + TREASURY SHARES 0,5%;
Leonardo S.p.A. is a public company listed on the Italian Stock Exchange Borsa Italiana S.p.A. with the ISIN Code IT0003856405

Control

Commercial links conferring control

List individuals or legal entities with whom you (or your owners, including intermediate layers until the ultimate owners) have a commercial relationship that (1) leads to a similar level of control on management and resources as the ownership of shares or assets and (2) is of very long duration (e.g. very important long-term supply agreements or credits provided by suppliers/ customers, coupled with structural links).

Supporting documents: cooperation agreements with the customer or supplier, etc.

Name	Country of establishment/ or nationality	Commercial link type *(Supplier, customer, etc...)*	Indicative amount
-	-	-	-
-	-	-	-
-	-	-	-

Financial links conferring control

List individuals or legal entities (including controlling shareholders/owners) from whom you (or your owners) are financially dependent in a way that could allow them to obtain concessions in strategic business areas.

Supporting documents: loan documents, by-laws, documents showing the link; etc.

Name	Country of establishment/ or nationality	Financial link type	Indicative amount
-	-	-	-
-	-	-	-
-	-	-	-

figure 13: Ownership Contol Declaration part 3

The declaration clarifies whether TASI is subject to direct or indirect control from entities in non-associated countries *(fig13)*. If such control exists, the

document would require the provision of guarantees approved by the EU or associated member states to ensure compliance with the security standards mandated by the project and EU regulations *(fig14)*.

Other sources of control

Indicate if there is any other mean, process or link ultimately conferring control to another country entity (similar level of control on management and resources as the ownership of shares or assets and of long duration).

Supporting documents: documents showing the control

Not applicable

DECLARATION (control)

We hereby confirm that:

1) our organisation is **subject to control** by an ineligible country or ineligible country entity
2) the present declaration is true and sincere
3) the information regarding ownership and control is accurate and reliable
4) if needed, we will provide guarantees to prove compliance with the requirements set out in the call conditions.

DECLARATION (no control)

We hereby confirm that:

1) our organisation is **NOT subject to control** by an ineligible country or ineligible country entity
2) the present declaration is true and sincere
3) the information regarding ownership and control is accurate and reliable
4) to the best of our knowledge, there are no other arrangements or coordination between shareholders from ineligible countries that would together exercise control
5) to the best of our knowledge, there are no other financial or commercial links with ineligible countries or ineligible county entities conferring control
6) we are aware that false declarations may lead to proposal rejection/grant termination and to administrative sanctions under Articles 135 to 145 of the EU Financial Regulation 2018/1046.

DECLARATION (no change)

figure 14: Ownership Contol Declaration part 4

This ownership and control assessment confirms that TASI meets the required conditions for participation in sensitive defense-related projects, assuring compliance with EU security standards to protect the integrity and objectives of the EPW-STEP project.

4.2.4 Actual Indirect Cost Methodology

In this specific document, partners are required to provide detailed explanations of the methods used to calculate indirect costs, including

categories such as overhead costs related to project administration. This transparency ensures that all costs align with the European Union funding regulations and are appropriately documented. The cost categories include direct labor, travel, and subcontracting costs, as well as various indirect costs like depreciation, administrative expenses, and material handling.

In cost calculation, there are two possible approaches: actual costs and flat-rate costs. The choice between actual and flat-rate cost calculation is significant, as it impacts how indirect costs are reported and reimbursed. In **actual cost calculation**, all expenses are meticulously tracked and recorded based on actual expenditures. This method provides high accuracy and specificity in cost reporting but can be more labor-intensive due to the need for detailed financial tracking and justification of each expense *(fig15)*.

In contrast, the **flat-rate cost calculation** uses a predefined percentage or formula to estimate indirect costs without requiring detailed records for each item. This approach is simpler and faster, as it does not require extensive documentation of individual expenses, but it may be less precise in capturing the true cost structure of a project.

Cost of the project for the applicant (summary of the usual accounting practices)	
	References in General chart of accounts
Direct Labour cost Hourly direct cost "COB" (Euro 39,83 per hours,00)	xxx.xxx.xxx,xx €
Subcontracting costs	
Materials	
Other Services Travels (cost of plane, train etc) Euro Subsistence - cost rate (diaria) Euro Number of days per meeting and number of meetings and diaria	xxx.xxx.xxx,xx €
= **Direct costs**	xxx.xxx.xxx,xx €
Indirect Costs linked to "Improduttivi" (Labour cost related to indirect activities, not included in Direct labour cost, but related to indirect organization of the company (general services, administration, financial management, human resources) Hourly indirect cost rate "improduttivi" (Euro 16,53 per hours,00)	xxx.xxx.xxx,xx €
Indirect Costs linked to "Ammortamenti" (Amortization/Depreciation for Material and Immaterial invesments necessary for the proper functioning of the business. Not included costs for write off or related to financial transactions) Hourly indirect cost rate "Ammortamenti" (Euro 4,85 per hours,00)	xxx.xxx.xxx,xx €
Indirect Costs linked to "Spese Funzionamento Aziendale" (Nature of costs necessary for the ordinary performance of the business: Maintenance, energy (electricity, gas &water), consumables (supplies &petty equipments),site rent, equipment rentals etc. Not included all extraordinary or financial costs) Hourly indirect cost rate "Spese Funzionamento Aziendale" (Euro 8,40 per hours,00)	xxx.xxx.xxx,xx €
Indirect Costs linked to General and Administrative expenses (G&A) (Nature of costs necessary for the ordinary performance of the company: Stationery, cafeteria, safety, cleaning, insurances, professional fees (legal, audit fees), telecommunication &postal fees. Not included all extraordinary costs, provision for future losses &debts, taxes, bank costs, debt charges, interests owed, financial income & losses) Hourly indirect cost rate "Spese Funzionamento Aziendale" (Euro 19,21 per hours,00)	xxx.xxx.xxx,xx €
Material Handling (Costs related to material management: procurement & supply chain, factory logistics (incoming & outcoming) Material cost (Euro ....) per recovery rate 6,89%	xxx.xxx.xxx,xx €
= **Indirect costs**	- €
Total Costs of the Project (TCP)	xxx.xxx.xxx,xx €

Ineligible costs for National Authorities	.../... .../...

For the national authorithy

As described above, the total Costs of the Project (TCP) has been calculated in accordance with the usual cost accounting practices of the applicant. These accounting practices are accepted by our services for comparable activities of the applicant in the defence domain

Name, title, function Date	Signature and stamp

figure 15: Actual Cost Methodology table

For this project, the chosen methodology ensures compliance with EU regulations on financial reporting. The methodology follows the European Commission's guidance for funding by categorizing eligible direct and

indirect costs as outlined in Annex 2, with **actual costs applied** to categories like personnel, travel, and subcontracting for accuracy in essential project activities.

Implementing this approach ensures that the project remains within budget parameters while meeting the administrative and financial transparency requirements set by the granting authority.

4.2.5 Detailed Budget Table

This document presents a structured budget outline for the project, detailing anticipated expenses across each project phase. Each partner is required to specify projected costs, which include:

- **Travel and Subsistence**

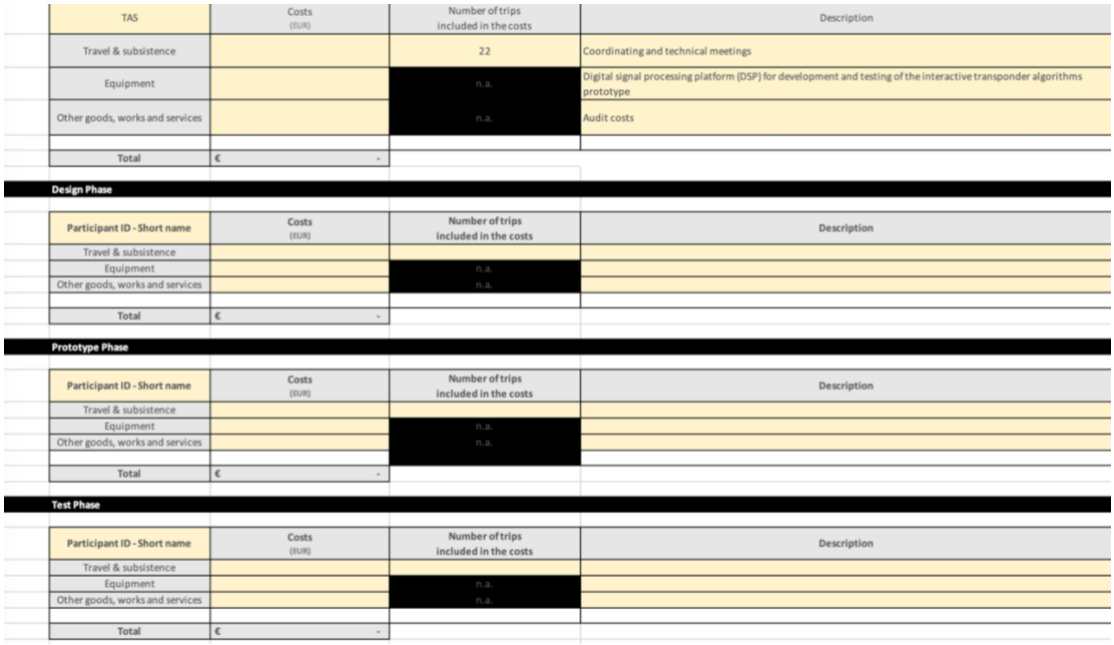
Covers expenses related to partner meetings or activities that necessitate travel, with details on the number of trips planned.

- **Equipment Costs**

Lists estimated costs for the purchase or use of specific equipment essential to the project, such as the digital signal processing platform (DSP) for developing and testing algorithms.

- **Other Goods, Works, and Services**

Includes additional costs such as audit fees and other necessary resources or services.



TAS	Costs (EUR)	Number of trips included in the costs	Description
Travel & subsistence		22	Coordinating and technical meetings
Equipment		n.a.	Digital signal processing platform (DSP) for development and testing of the interactive transponder algorithms prototype
Other goods, works and services		n.a.	Audit costs
Total	€ -		

Design Phase

Participant ID - Short name	Costs (EUR)	Number of trips included in the costs	Description
Travel & subsistence			
Equipment		n.a.	
Other goods, works and services		n.a.	
Total	€ -		

Prototype Phase

Participant ID - Short name	Costs (EUR)	Number of trips included in the costs	Description
Travel & subsistence			
Equipment		n.a.	
Other goods, works and services		n.a.	
Total	€ -		

Test Phase

Participant ID - Short name	Costs (EUR)	Number of trips included in the costs	Description
Travel & subsistence			
Equipment		n.a.	
Other goods, works and services		n.a.	
Total	€ -		

figure 16: DB Table

Each section *(fig16)*, representing different phases like Study, Design, Prototyping, and Testing, includes fields for identifying participants, specifying costs in euros, and providing descriptions of expenses.

CONCLUSIONS

The in-depth analysis of the thesis focused on the European Protected Waveform project reveals several key conclusions highlighting the importance of this initiative within the European defense landscape. The EPW represents a significant advancement in creating a secure, resilient, and interoperable satellite communication system to meet modern military needs. This thesis emphasizes the potential of this project to elevate Europe's strategic autonomy in space and reduce dependency on non-European technologies, thereby strengthening the EU's defensive position against evolving threats.

Central to the EPW project is its alignment with the European Union's innovation, cooperation, and independence goals. By promoting collaboration among EU Member States and integrating cutting-edge technologies, the EPW provides a model for European defense initiatives. Supported by the European Defense Fund, the EPW represents a joint effort to enhance the EU's capabilities in satellite communications, a crucial domain for modern military operations. The EDF finances and promotes these initiatives and establishes strategic guidelines and evaluation criteria to ensure that proposed projects, such as the EPW, meet stringent security requirements and contribute to European technological sovereignty.

The detailed roadmap outlined in the thesis reflects a comprehensive development approach, ranging from feasibility studies to design phases, including technology demonstrators. This structure ensures that the EPW meets current military requirements and is adaptable to future challenges, such as cyber threats and signal jamming.

Moreover, the EPW project provides significant operational and economic benefits. By leveraging Commercial Off-The-Shelf (COTS) technologies, the

EPW achieves high bandwidth with minimal satellite usage, balancing performance and cost-effectiveness. The project's flexibility, with capabilities extending across various satellite constellations and frequency bands, further strengthens its applicability in different military environments, supporting fixed and mobile operations.

In conclusion, this thesis not only underscores the importance of the European Protected Waveform as a technical solution for secure satellite communications but also emphasizes its role in advancing European defense's integration and strategic autonomy. The EPW project is a model for future EU defense initiatives, demonstrating how coordinated and technologically advanced projects can meet Europe's security needs while fostering innovation and cooperation among Member States. It represents a fundamental step towards a more secure and self-sufficient European Union in defense and space.

LIST OF TABLES AND FIGURES

SITOGRAPHY AND BIBLOGRAPHY

https://www.consilium.europa.eu/it/policies/defence-security/defence-security-timeline/?taxonomyId=271842c3-2535-4f5a-a049-bcdab2758865

https://www.cvce.eu/en/education/unit-content/-/unit/803b2430-7d1c-4e7b-9101-47415702fc8e/6d9db05c-1e8c-487a-a6bc-ff25cf1681e0/Resources#93ad0d9e-61f3-47eb-b895-e28e4c135751_en&overlay

http://aei.pitt.edu/2356/1/002919_1.PDF

https://www.europarl.europa.eu/factsheets/en/sheet/158/foreign-policy-aims-instruments-and-achievements

https://commission.europa.eu/about-european-commission/role-european-commission_en

http://www.jeanmonnet-pv.it/Jean_Monnet_Centre_of_Excellence/publications_files/SP_DIFESA_jm.pdf

https://eda.europa.eu/docs/default-source/edamagazine/edm24final.pdf

https://su.diva-portal.org/smash/get/diva2:1561816/FULLTEXT01.pdf

https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/754598/EPRS_BRI(2023)754598_EN.pdf

https://www.sipri.org/sites/default/files/202306/eunpdc_space_paper_no_83_0.pdf

https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/reference-documents;programCode=HORIZON?programmePeriod=2021-2027

https://static1.squarespace.com/static/604251cac817d1235cbfe98d/t/6496db32e62cf50d22d38a07/1687608115351/ENGAGE+Working+Paper+23_Assessing+Current+CFSP+Structures+and+Processes+and+Formulating+Recommendations.pdf

https://apre.it/wp-content/uploads/2021/04/guida-Horizon-Europe.pdf

https://www.consilium.europa.eu/it/policies/defence-security/defence-security-timeline/

https://www.esteri.it/en/politica-estera-e-cooperazione-allo-sviluppo/politica_europea/dimensione-esterna/sicurezza_comune/

https://www.pesco.europa.eu

https://ec.europa.eu/commission/presscorner/detail/en/doc_03_3

https://www.iai.it/sites/default/files/iaicom1726.pdf

https://researchbriefings.files.parliament.uk/documents/CBP-8149/CBP-8149.pdf

https://www.eeas.europa.eu/sites/default/files/documents/2024/2024-03-PESCO-Deepening-defence-cooperarion.pdf

https://cdn.ceps.eu/wp-content/uploads/2021/09/EFAR_26_SI06.pdf

https://defence-industry-space.ec.europa.eu/european-defence-fund-info-days-2024-2024-05-28_en

https://www.torrossa.com/en/resources/an/2472106

https://www.unipr.it/sites/default/files/allegatiparagrafo/13-10-2021/rdg_lectio_doctoralis_laurea_hc_parma_2021_v1.0_clean.pdf

https://www.iai.it/sites/default/files/iaiq_18.pdf

https://www.programmazioneeconomica.gov.it/it/il-dipe-in-tema-di-partenariato-pubblico-privato/partenariato-pubblico-privato/partenariato-pubblico-privato-e-finanza-di-progetto/

https://www.spaceconomy360.it/comunicazioni-satellitari/satcom-il-mercato-mondiale-crescera-del-92-allanno/#:~:text=Il%20mercato%20mondiale%20dei%20satelliti,previsti%20per%20la%20fine%202028.

Satellite Communication (Satcom) Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2023-2028

https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/edf-2021-space-d-epw

https://ec.europa.eu/commission/presscorner/api/files/document/print/es/speech_17_1581/SPEECH_17_1581_EN.pdf

https://www.esa.int/esapub/br/br114/br114tel.htm

https://www.researchgate.net/publication/220473340_EHF_for_Satellite_Communications_The_New_Broadband_Frontier

a mia madre forza vitale

a mio padre luce della mia notte