AERONAUTICS STRATEGIC RESEARCH AND INNOVATION AGENDA

2019 -2030

Executive Summary

PLATAFORMA TECNOLÓGICA AEROESPACIAL ESPAÑOLA


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INTRODUCTION

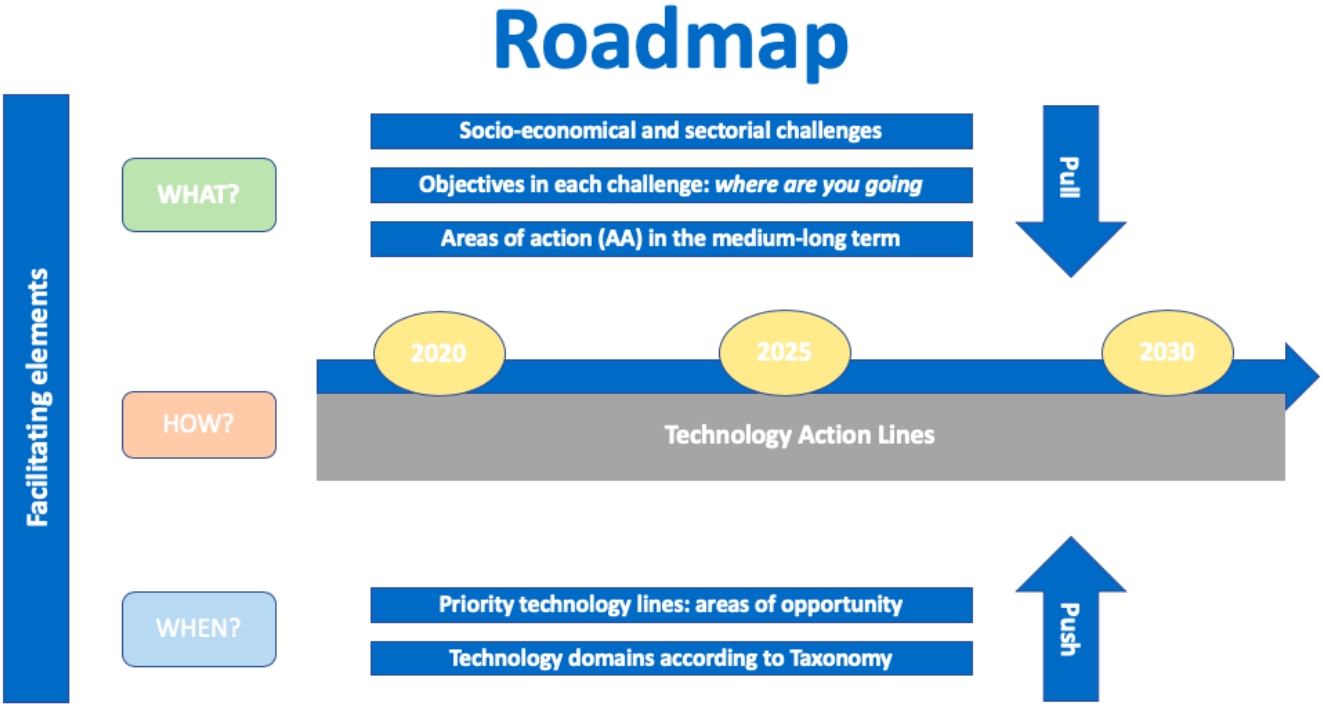
This Aeronautics Strategic Research and Innovation Agenda (A-SRIA) was created with the objective of serving as the reference for any research, development and innovation effort of the Spanish aeronautical sector.

Its recipients are:

- R&D&I agents in the sector
- General State Administration
- Regional Administrations
- Other interested organizations

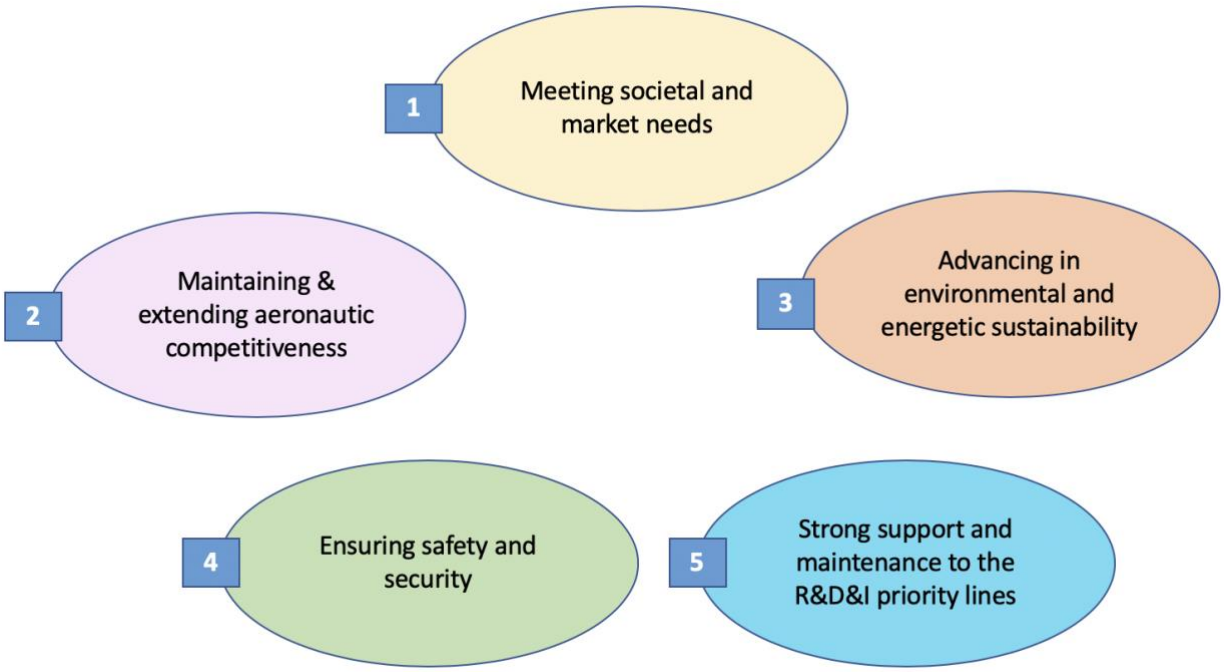
The A-SRIA has been developed as a collaborative process by industries, universities and technology centres.

The following figure summarizes that process:



CHALLENGES

Following the direction of the "*Strategic Research and Innovation Agenda*" defined by ACARE at European level, the following big challenges have been defined:



Each Challenge is divided into Areas of Action (AA) and each Area of Action is divided, in turn, into a series of Technology Action Lines (TAL). A total number of 126 TALs have been defined.

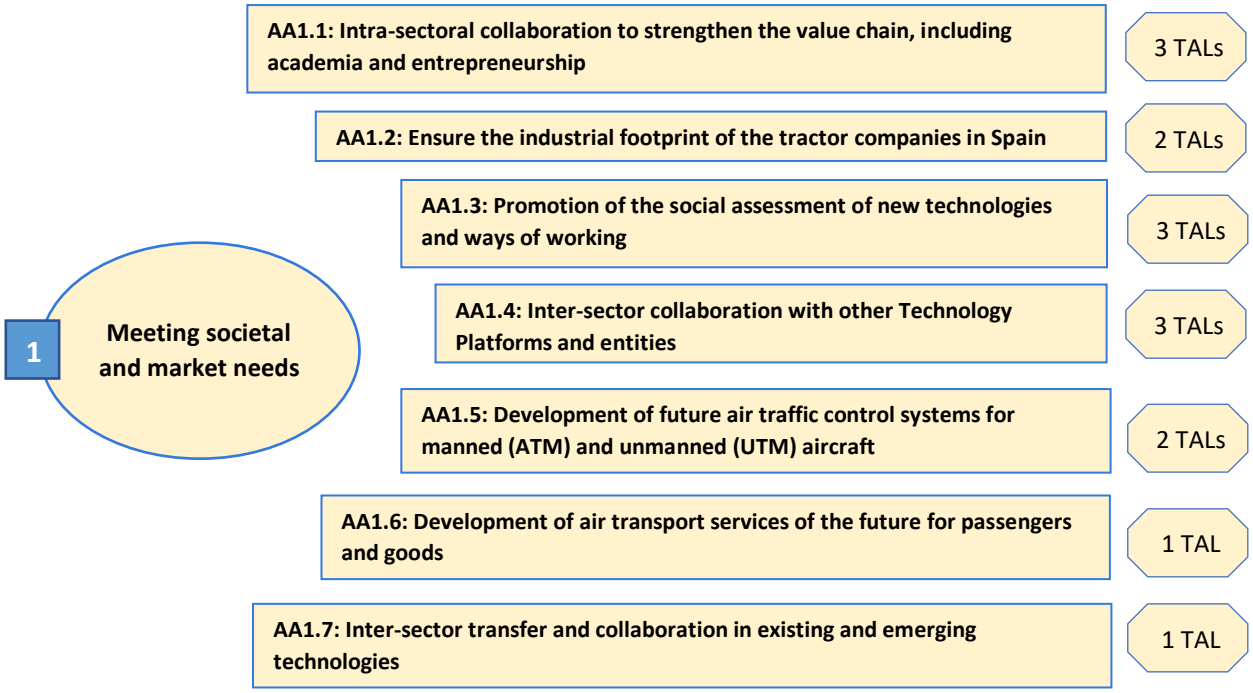
CHALLENGE 1: MEETING SOCIETAL AND MARKET NEEDS

The Spanish aeronautical sector is always responsive to the needs and expectations of users, customers throughout the value chain and society in general.

This implies putting the customer and the user ahead and organizing the developments always thinking about him. But it also means always paying attention to the social benefits of our activity.

The fluid and constant relationship with the public actors involved in our sector is a way of serving our customers and serving our society.

Challenge 1 includes 7 areas of action explicited in 15 technological lines of activity.

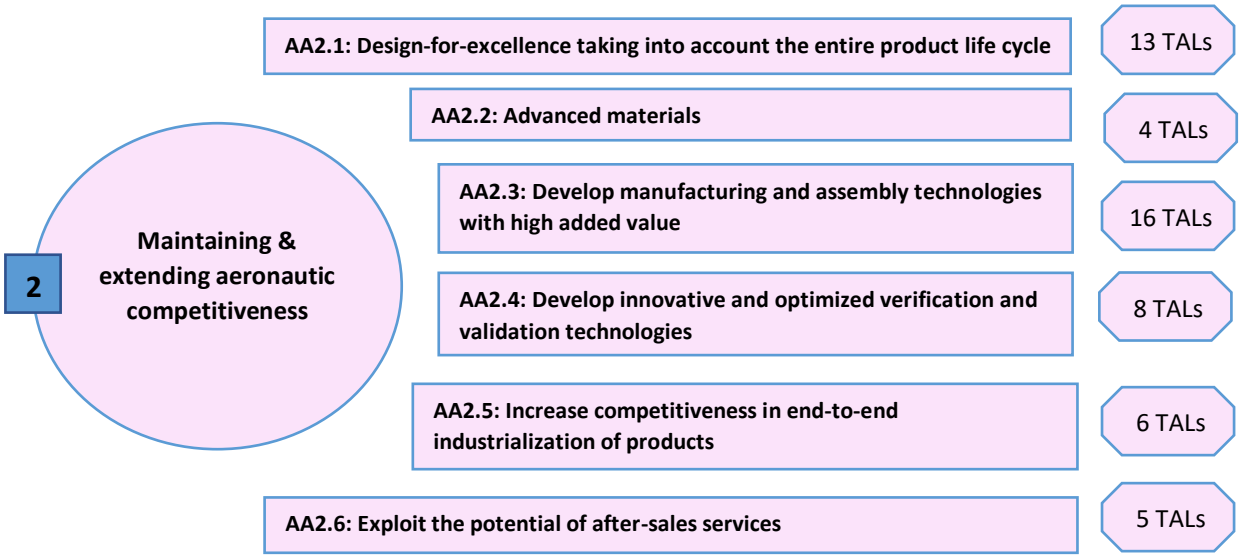


CHALLENGE 2: MAINTAINING AND EXTENDING AERONAUTIC COMPETITIVENESS

The industrial objectives that must be met to remain internationally competitive are known and can be summarized as follows:

1. Shorten the development times .
2. Have a flexible production capacity.
3. Reduce production times.
4. Dramatically reduce recurring costs.
5. Reduce the operating costs of the products.
6. Increase product performance (aerodynamics, range, fuel consumption, pax, etc ...)
7. Achieve full operability of the products.
8. Optimize validation and certification processes through new systems that combine online simulation, experimentation and monitoring technologies.

Research and Innovation have much to contribute to the achievement of each and every one of those ambitious objectives. To this end, 6 areas of action have been defined within this challenge. In this case a total number of 52 technological lines of activity detail an exhaustive program of research and innovation to be followed in all the product value chain.

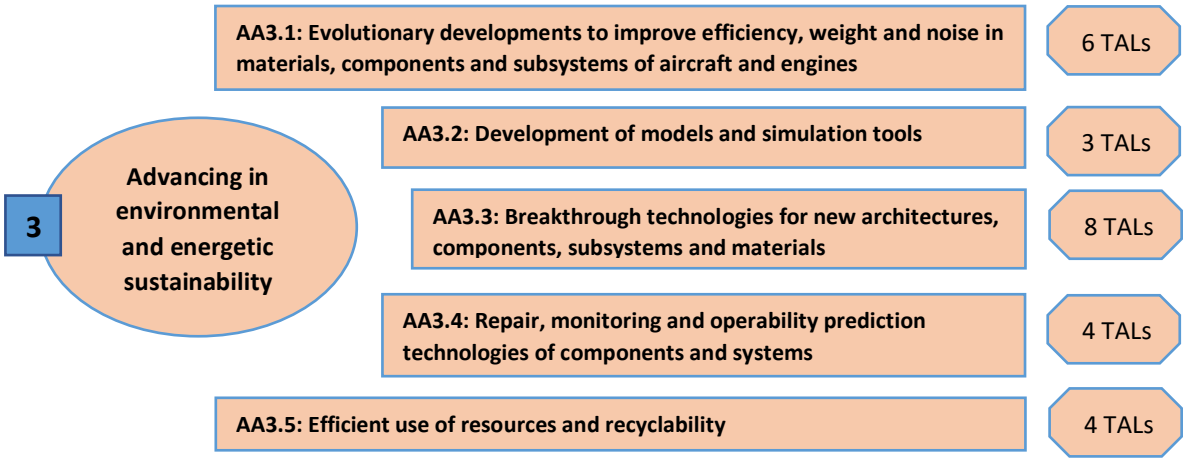


CHALLENGE 3: ADVANCING IN ENERGETIC AND ENVIRONMENTAL SUSTAINABILITY

The European aeronautical sector is firmly committed to the fight against climate change and the goal of keeping global warming below 2ºC (COP 21, Paris 2015). In this context, Research and innovation efforts at national level should be aimed at:

- Contribute to the reduction of global warming, through the objectives of the SRIA from ACARE.
- Consolidate and expand the client / product portfolio in a context of high demand by operators and OEMs of technologies to reduce the environmental impact.
- Develop the perception in society and stakeholders of environmentally friendly products as a differential feature of European aeronautical technology compared to other extra-community products, reinforcing communication about environmental efforts and achievements of the Spanish value chain.
- Allow social acceptance of the foreseeable increase in operations, particularly in airport and urban environments, through low emission and noise products.
- Anticipate new European regulatory frameworks with greater environmental requirements and encourage their implementation.

This challenge is divided in 6 areas of action that are deployed in 25 technological lines of activity.

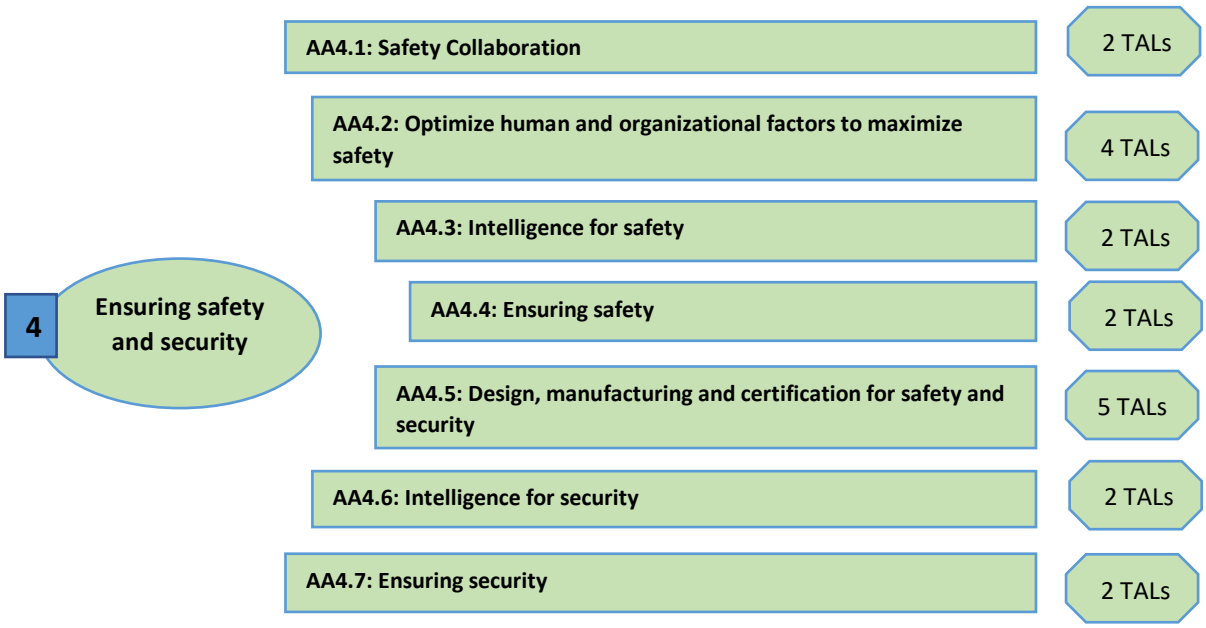


CHALLENGE 4: ENSURING SAFETY AND SECURITY

Aviation has as a distinctive point its continuing concern for both safety and security. In this context, Research and Innovation efforts at national level should be aimed at:

- Reduce the number of air accidents.
- Evaluate and mitigate the effects produced by climate and weather problems.
- Obtain an air transport system that allows manned and unmanned aerial vehicles to operate safely, in the same airspace.
- Efficient boarding and safety measures, which allow a minimum impact on passengers and cargo.
- To ensure that aerial vehicles are resistant in their design, to avoid the evolution of security threats, on board and on the ground, current and planned ones.
- Achieve an air transport system with a global and secure data network, resistant to cyberattacks.

This challenge is divided in 7 areas of action that are deployed in 19 technological lines of activity.

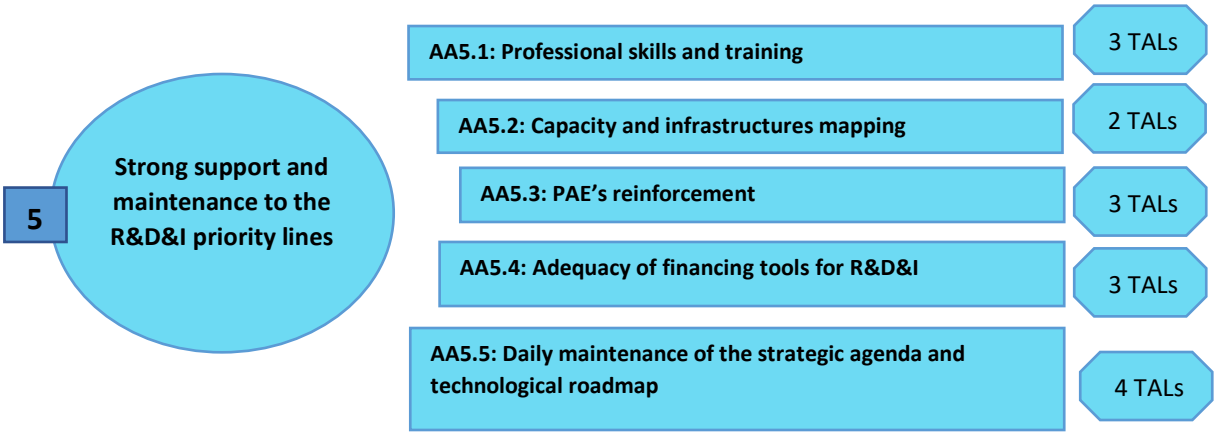


CHALLENGE 5: STRONG SUPPORT AND MAINTENANCE TO THE R&D&I PRIORITY LINES

The Spanish aeronautical sector must develop and maintain a determined support for the entire Spanish R&D ecosystem in a context of:

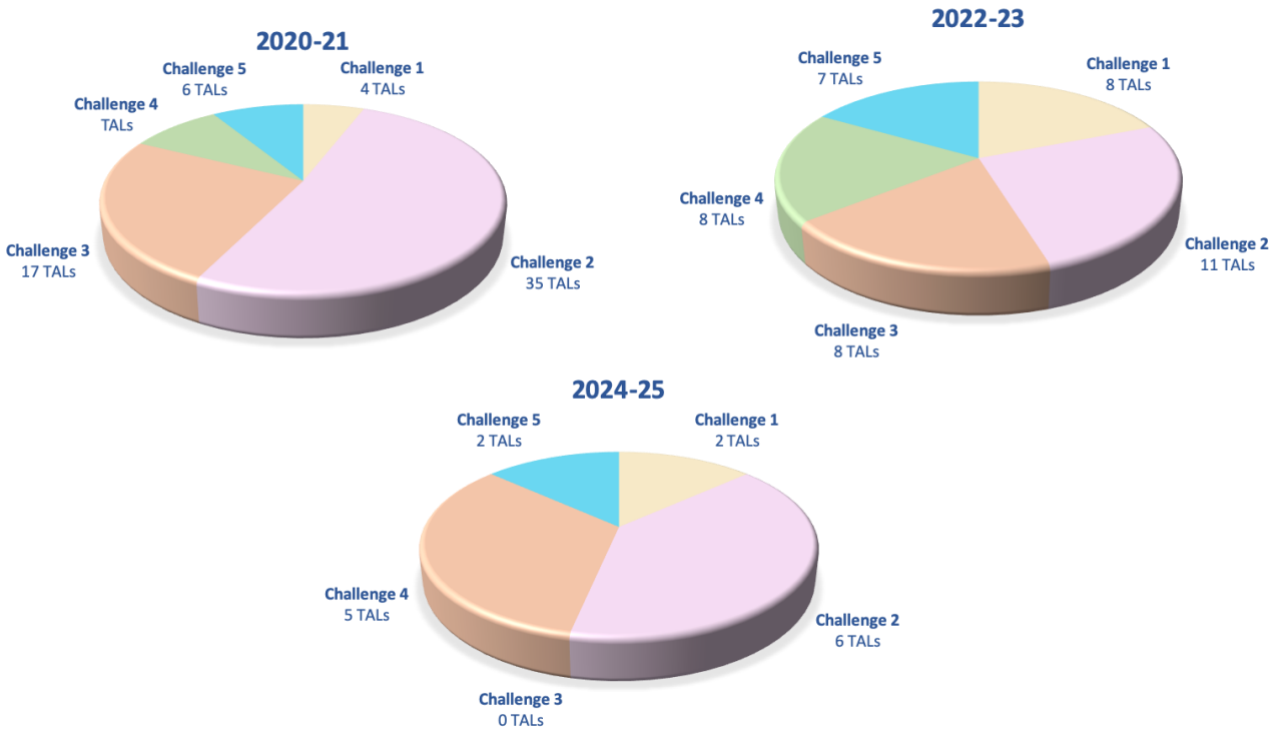
- Continuous improvement of professional skills and training for industrial competitiveness.
- Promotion of knowledge of the sector through the development and maintenance of applicable capacity and infrastructure maps.
- Strengthening of the PAE in continuous benchmarking and convergence with other national and international technology platforms.
- Recommendations for the adequacy of R&D financing instruments and infrastructure development.
- Commitment to continually update the Strategic Research and innovation Agenda and the Technology Roadmap.

This challenge is divided in 5 areas of action that are deployed in 15 technological lines of activity.



TECHNOLOGY ACTION LINES

Taking into account the priority and impact of each TAL, a Technology Roadmap has been defined including three periods in which each TAL must have begun to be developed.



KEY BUSINESS LINES

The TALs are oriented to a set of key business lines where the Spanish aeronautical sector should be developed and should concentrate its efforts, those lines would be the following ones:

- 100% electric or more electric aircraft
- Advanced manufacturing and design
- Advanced composite materials
- Advanced metallic materials
- Multifunctional structures
- Aerodynamic optimization
- Connected, intelligent, unmanned and autonomous vehicles
- More efficient, quiet and sustainable engines
- New forms of in-service support
- Development of future air traffic control systems
- Integral optimization of non propulsive energy

100% ELECTRIC OR MORE ELECTRIC AIRCRAFT

This includes all developments aimed at:

• The electrification of the mechanical, pneumatic and hydraulic systems of aircraft and engines.

• The new electric power systems for ground maneuvers.

• The study of the impact of the new concepts of hybrid and electric propulsion on the components of current engines and the development of new optimized design concepts.

ADVANCED MANUFACTURING AND DESIGN

Digitalization technologies and physical and process simulation technologies allow:

• Accelerate the speed of designs contributing to reduce development cycles.

• Treat the design in a holistic and concurrent way to achieve concepts optimized for its manufacture, assembly and commissioning.

• Develop new means of manufacturing and automation (factories of the future) compatible with people.

• Eliminate subsequent inspections to the maximum, deploying online monitoring and predictive analysis.

• Develop simulation, control and monitoring technologies for production processes.

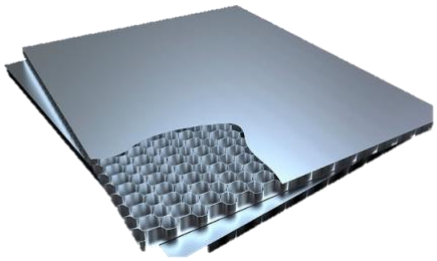
All previous advances must be made in a necessary circular economy context that contemplates the entire life cycle of aircraft and their components.

ADVANCED COMPOSITE MATERIALS

The drastic evolution of composite materials technologies is necessary to:

- Significantly lower costs and increase manufacturing rates up to what the market demands.
- Implement flexibility in production, being able to correct what is planned without significant non-recurring investments having a high initial maturity.
- Reduce or take advantage of waste materials.

And all this without affecting the final properties of the product, that is, maintaining and improving performance.



ADVANCED METALLIC MATERIALS

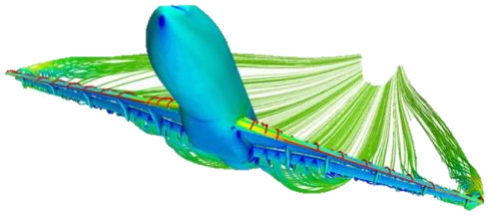
This includes:
• Low weight metal materials and high temperature alloys used in aeronautical engines and other aircraft components.
• The development of new materials and production processes.
• Materials that improve reparability and maintainability.
• The development of models and tools to predict the behavior of materials, with a view to extending their limits of use and reducing design and manufacturing restrictions.

MULTIFUNCTIONAL STRUCTURES

Aircraft structures must include new functionalities to save weight and optimize maintenance. That means:
• The development of new non-metallic materials with new functionalities.
• The development of structural elements based on these new materials to improve specific aspects such as conductivity, impact resistance, vibration damping, resistance to high temperatures in service, etc ...

AERODYNAMIC OPTIMIZATION

New configurations of both aircraft and engines must be developed to answer to the new requirements.
It includes the development of new calculation and optimization tools and technologies for continuous improvement of aerodynamic performance.



CONNECTED, INTELLIGENT, UNMANNED AND AUTONOMOUS VEHICLES

All new autonomous transport paradigms are included here (from single pilot aircraft, drones of any size and architecture, to autonomous passenger transport vehicles such as those being developed for air mobility in cities).
Also included are the technologies necessary for the integration of a system of systems, communicating in a safe and cyber-protected manner to various types of vehicles.

MORE EFFICIENT, QUIET AND SUSTAINABLE ENGINES

This includes:

- Progress in the state of the art of technologies, architectures and materials used in current engines and develop new propulsive and non-propulsive systems to exploit their potential in reducing weight, noise and emissions.
- Develop models and simulation tools to improve efficiency and reduce weight.
- New concepts and functionalities of secondary power systems.

NEW FORMS OF IN-SERVICE SUPPORT

This includes digitalization and massive use of data to:

• Reduce the time and costs of maintenance tasks.
• Propose new models of integrated customer services associated with missions.
• Develop new maintenance and learning techniques in the digital world using virtual and augmented reality.
• Develop new product update and MRO processes.

DEVELOPMENT OF FUTURE AIR TRAFFIC CONTROL SYSTEMS

It is necessary to develop new ATM systems evolving from the current ones to:

• Optimize times.
• Increase security.
• Reduce the environmental impact, optimizing operations, trajectories and missions.
• Integrate unmanned aerial systems.
• Serve new types of air operations through an automated and digital management ecosystem.

In the particular case of UAVs, in order to increase their operational safety, it is necessary to develop technologies of:

- Sense & avoid: obstacle detection capability and automatic collision avoidance.
- Passive positioning of UAVs.
- Secure autonomous flight termination systems.

INTEGRAL OPTIMIZATION OF NON-PROPULSIVE ENERGY

One of the most important areas for the energy efficiency of current aircraft is the optimization of the generation, distribution and storage of non-propulsive energy, including the hybridization of power generation systems (gas, batteries, etc.).

MAIN RECOMMENDATIONS

1. The guidelines given in this Agenda allow us to continue technological development in those areas in which Spain is already excellent growing from our strengths and at the same time, they introduce the emerging technologies in which we must invest to generate new niches of excellence and competitiveness.

2. By publicly disseminating the technological lines of action, it is intended to encourage both intra and inter-sectoral collaboration and the implementation of actions promoting them.

3. This Agenda is offered both to the State Administration and to those of the different Autonomous Communities to guide their own aeronautical technological development plans and defend national interests at European level.

4. It is necessary to have a National Aeronautical Technology Program similar to those that exist in the countries of our environment that allow us to compete on equal terms. The Agenda marks the main lines should be developed by this Program.

5. New instruments are needed for encouraging flexible collaborations between industries (of any size) and the scientific and technological sector throughout the entire technological development cycle.

6. Universities and technology centres have in this Agenda a guide to define their own R+D+I strategies and their training actions.