ACARE Italia

# THE ITALIAN VISION ON RESEARCH AND TECHNOLOGY DEVELOPMENT IN THE AERONAUTICAL SECTOR

Acare Italia

Advisory Council for Aeronautics Research in Europe - Italia

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# 1 Origin and objectives of the Vision

## Introduction

The Vision defines the strategic trends of research and technological development activities (R&TD)[1] in the Italian aeronautical sector, considering both their effect on the efficiency and quality of the air transport system in its global context, and its social relevance, economical value and contribution to the well-being and safety of the Nation.

The Vision was prepared bearing in mind both the necessities and interests of the Nation seen as a system, an entity, and the capability of the researchers and industrial operators, whose skill and professionalism are fundamental to ensure the growth of the sector.

The Vision is in harmony with the growth objectives set out in the document European Aeronautics - A Vision for 2020, with the purpose on one hand of maximising the efficiency of the national R&D system, placing it consistently within the European lines of research in the sector, and on the other hand safeguarding and promoting the special interests of the country.

Taking note of the growing terrorist threat and a worldwide geopolitical scenario, with the presence of new and numerous areas of tension and conflict, the Vision also sets out guidelines for aeronautical R&D in the area of Defence and dual applications.

## Guidelines for R&TD in the aeronautical sector in Europe

Air transport requirements in the 21st century, together with the continuous growth in the traffic volume (figure 1) and the new developing scenarios, require a significant increase and improvement of the ability to manage airspace and traffic flow in the air and in terminal/airport areas. Congestion which would otherwise have unacceptable consequences in terms of reduced safety, delays, disorder and inconvenience, with repercussions also on economic and social development, can thus be prevented.

1. Accordingly to the ACARE taxonomy, R&TD ranges from basic, up to applied research including system validation and demonstration.

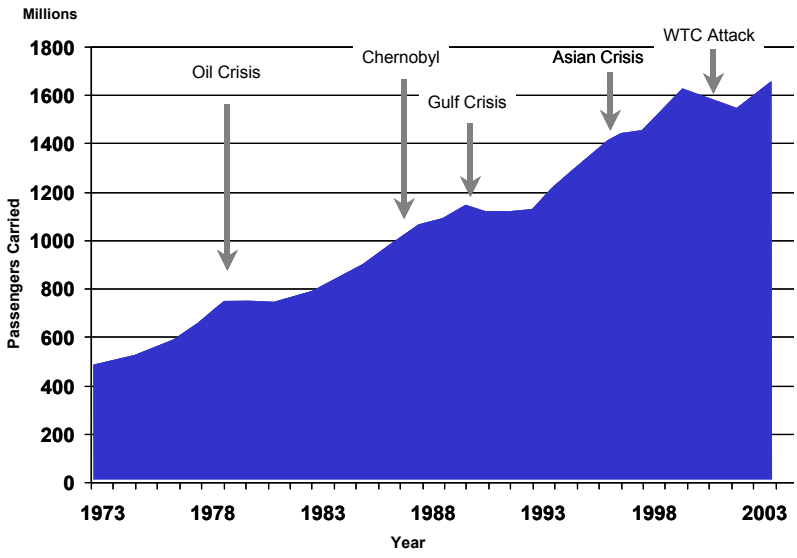



Figure 1 - **Passenger traffic per year (source ICAO)**

Recognising the problem and assigning a strategic role to the aeronautical sector as the driving force in the global technological and social development, the European Commission created the Group of Personalities in 2000 to produce the Vision for 2020, published in January 2001, in which two Top Level Objectives (TLO) are identified:

- to respond to the requirements of the European social community
- to overcom the worldwide challenge in the air transport sector

The "Vision for 2020" defines five strategic areas in which competitiveness, environment, safety, efficiency of air transport and, after the events of 11 September 2001, security, are to be assessed (challenges). Among the principal objectives are:

- a threefold increase in air transport handling 16 million flights per year
- 24-hour airport operation
- an increase in punctuality such that 99% of departures and arrivals occur within 15 minutes of the scheduled time in all weather conditions
- a fivefold reduction in the accident rate
- a drastic reduction in polluting emissions and noise

The subsequent establishment of the Advisory Council for Aeronautics Research in Europe (ACARE), consisting of representatives of all stakeholders in the air transport system, led in 2002 to the issue of the first Strategic Research Agenda (SRA) which specified in detail, the goals for R&D activities in Europe and defined the strategic lines of technological development necessary to achieve the TLO of the Vision.

In parallel, in July 2002, the STAR21 report for the Strategic Aerospace Review for the 21st Century was presented by AECMA (now integrated into ASD) and the European Commission thus increasing the area of coverage of the SRA by also dealing with the themes of Defence and Space.

The planned SRA biennial updating activities began at the end of 2003. The second issue (SRA-2), produced in March 2005, was based on the new High Level Target Concepts (HLTC)[2] and, for the first time, considered the various alternative changing scenarios of the air transport system; it suggested technologies and solutions for protecting the environment, reducing time and costs, and improving efficiency, safety and the passengers possibility of choice.

Vision for 2020 identifies high level strategic objectives (the TLO above) and the challenges over a timescale of 20 years, whereas both issues of the SRA[3] define specific objectives by identifying appropriate technologies and pointing out the role of the institutional enablers. The European Framework Programmes, with a timescale of at least 5 years, will finally identify individual research projects to achieve the various goals.

2. The highly customer oriented air transport system;
The highly time efficient air transport system;
The highly cost effective air transport system;
The ultra green air transport system;
the ultra secure air transport system.
3. The SRA with its associated objectives and roadmap is periodically updated.

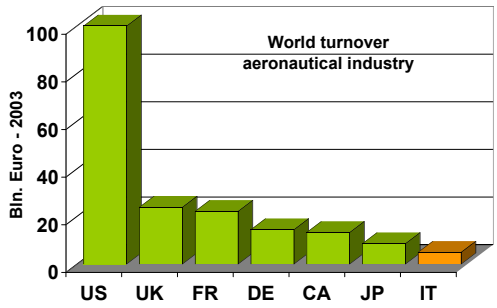



Figure 2 - Worldwide aeronautical industry turnover (Bln Euro 2003 - source: Finmeccanica calculations from ASD - AIAD data)

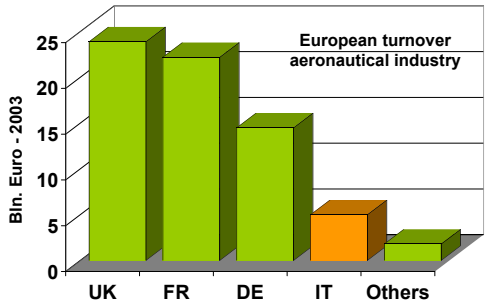



Figure 3 - Aeronautical industry turnover in Europe (Bln Euro 2003 - source: Finmeccanica calculations from ASD data)

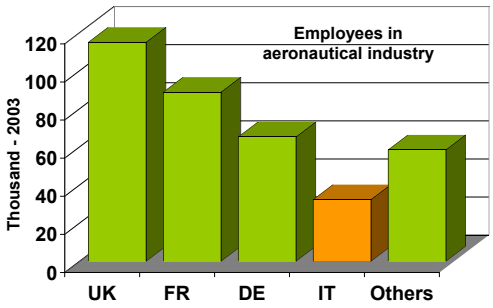



Figure 4 - Aeronautical industry employees (thousands - source: calculated by Finmeccanica from ASD figures - 2003)

The financing support necessary to meet the requirements of the research must be in line with the objectives defined by the European Council of Barcelona of March 2002, when it was decided to increase the R&TD and innovation expenditure in the Union to 3% of the gross internal product by 2010.

Vision for 2020 wishes to bring on, through the aeronautical R&TD, a very significant change in the air transport system, with beneficial results for the growth of our society. Such an ambitious challenge can only be met by working in a pan-European context, in which the SRA is implemented by means of new methods of cooperation between national and European research programmes, financed by companies and institutions, with the involvement of all stakeholders.

## A National Vision

Seventh in the world (figure 2) and fourth in Europe (figures 3 and 4), the aeronautical industry is one of the few remaining Hi-Tech sectors in Italy capable of producing innovation and generating Cross-fertilisation effects in other industrial areas. Aeronautical development has always been based on the use of advanced and innovative technologies, and the sector still represents today a model for the virtuous cycle - from research to technological innovation its integration into industrial products - which also encourages technology transfer to other more traditional areas.

Though of significant importance in the national industrial panorama, the sector is however, of relatively small size when compared with the great European and North American players; it shows critical areas in which recovery actions are slow, not always coordinated or effectively supported at an institutional level and sometimes lack an effective long-term strategy. All this when both the industrial assetts and the market, with its integrated supply chain, are in continuous development, emphasising the requirement for high performance and worldwide competitiveness in terms of technology, quality, cost and flexibility.

In this scenario, the ACARE Italia committee has prepared this Vision document that, based on the Vision for 2020, and after analysing the requirements and special needs of the Italian aeronautical sector, presents specific challenges and objectives shared by the stakeholders - government Institutions, industries, regulatory bodies, airlines, airport management companies, service companies, research centres and universities - and interprets the European R&D strategy in the same area on a national level.

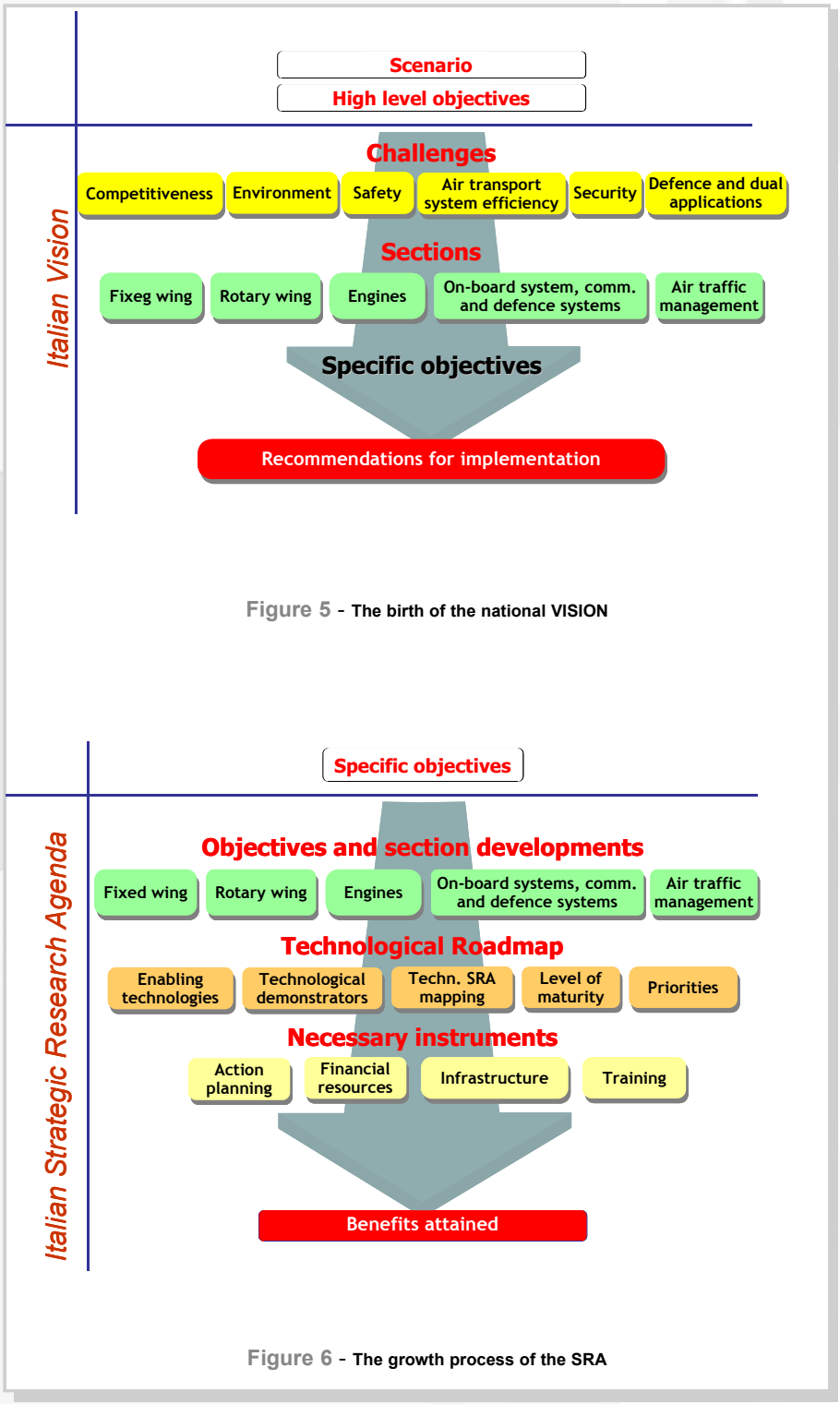



Figure 5 - **The birth of the national VISION**




Figure 6 - **The growth process of the SRA**

The origin of the Italian Vision, from the identification of the first challenges to the definition of the specific objectives for each segment of the sector, is shown in figure 5.

The primary purpose of the national Vision is to identify a long-term political-industrial strategy that could guide Italy to occupy and maintain a position of European and worldwide importance in the aeronautical sector, with a rational, competitive and synergistic R&D system, able to contribute incisively to the political and social role of Italy in the world scenario.

Having defined the strategic objectives of the Vision, the Italian SRA, through a developmental process in which all players must be committed in the long term, must translate the specific objectives into technological developments, outlining the areas on which their R&D activities must be focused and indicating priorities and methods of implementation (figure 6).

The National Aeronautical Research Plan, with a timescale of 5 to 6 years and supported by the necessary financial resources provided by national (MUR, MAP, Ministry of Defence, Ministry of Transport, local bodies) and community institutions, possibly supplemented by private financing, will represent an important driving force to carry out the defined developments and strategies.

# 2 The national scenario

## The Scenario

The role of Finmeccanica has confirmed to be especially important in the aeronautical sector since it has allowed, through a series of operations aimed primarly to reinforce the core business, to establish a large national industrial pole.

Finmeccanica first purchased Aermacchi which, jointly with OAN Officine Aeronavali, now completes its presence in the field of fixed-wing aircraft together with Alenia Aeronautica; the purchase of Westland instead, gave birth together with Agusta to AgustaWestland, of world-class position in the rotary-wing field. In the defence electronics area, agreements with BAE Systems led to a new group structured with three companies: SELEX Integrated Systems, SELEX Communications and SELEX Sensors and Airborne Systems. Finally, we should not forget Finmeccanica's participation in Avio (ex Fiat Avio).

Piaggio Aero, which is not a part of the Finmeccanica Group, completes the scenario of the large Italian aeronautical companies.

The support and complementary nature of the sector's small and medium companies capabilities, together with the research centres and Universities, provide a great opportunity to make the Italian aeronautical system competitive at an international level.

## Positioning

In 2004, the national companies members of AIAD (Aerospace and Defence Industries Association) have occupied over 38,000 units in the aerospace sector and produced a turnover of about 6,200 million euros; the R&D expenses - including the development of pre-production prototypes - ranked to about 850 million euros. The aerospace sector, while representing only 1% of the GDP, contributes an average of about 8-10% to the active determination of the national commercial balance.

## Areas of excellence

The Italian industry has a worldwide position in helicopters and in the production of radar and air traffic control systems, and a top position at European level for training aircraft.

It also has niche capabilities in turboprop-engined aircraft for regional transportation, military transport aircraft and in general aviation (executive and light aviation).

Aircraft engines and their associated subsystems, avionic systems and equipment, surveillance systems, defence electronics and secure communications are among the high technology and specialised areas in which the national industry is present.

In addition, Italy is among the largest producers in the world of civil and military aircraft structures, and has a significant presence in the functional equipment segment.

These areas of specialisation have created and maintain high levels of employment and provide special skills and a solid technology base, both for fixed and rotary-wing aircraft.

Overall, national companies occupy important market positions, both as independent companies and within European and major international cooperations; they control technologies that are critical and functional for the national security requirements.

## International collaborations

Italy takes part in important high technology content collaboration initiatives leading to the creation of joint ventures, forms of design cooperation and sharing of investment risk with other companies, both in Europe and in the United States, in the civil and military field.

## A COMPARATIVE ANALYSIS

The value of the Italian national segment is a little more than 8% of the European aeronautical turnover, while the weights for France (34%), United Kingdom (31%) and Germany (19%) are much higher (figure 7). There is therefore a lack of balance between the overall size of the Italian economy in the European Union (around 13% of the total European GDP for 2003) and the role, in the same context, of the national aeronautical sector. In addition, concerning the european GDP, the Italian aerospace industry contributes about 0.5%, compared with 1.6% in France, 1.5% in the United Kingdom and 0.7% in Germany.

While not wishing to focus on the United States, where the investment in R&D is outstanding, the Italian segment suffers from a competitive disadvantage compared to other European countries. The Italian weakness in terms of investment in national research is well known; in 2002, only 0.58% of the GDP was recorded compared with the average European value of 0.73%.

In the Universities, R&D activities are concentrated mainly on basic scientific and base technology disciplines - with public financing estimated to be in the order of 3 million euro per annum for aeronautical sector university component; with the developments in the field of applied research are carried out principally in industrial collaboration programs (participation in Ministerial programs) and international collaborations (participation within Framework Programs).

European research programs in the aeronautical sector, which up to now have been exclusively directed at R&D activities in the civil field, are concentrated principally on Framework Programs; these programs have financed Italian players, an 8 percent of the total during the year 2003 (figure 8), which can be matched with the average national return, on all programs of the 6th Framework Program, of a little over 9%. This result, while being on one side in line with the percentage of employees and turnover of the national aeronautical system, on the other side is still far away from the Italian contribution in the EU, which before the entry of the new Member States, stood at 13.4%.

| | Aeronautical turnover / total EU15 aeronautical turnover | Share of GDP out of total EU15 GDP | Aeronautical turnover / national GDP |
|---|---|---|---|
| IT | 8% | 13,4% | 0,5% |
| FR | 34% | 16,6% | 1,6% |
| UK | 31% | 18,6% | 1,5% |
| DE | 19% | 23,0% | 0,7% |

Figure 7 - **Volume of the aeronautical sector (source: ACARE Italia calculations from ASD and OCSE data for 2003)**

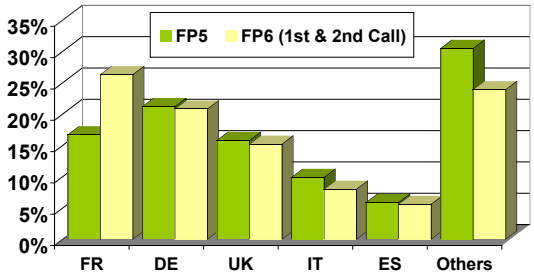



Figure 8 - **Financial return in the European aeronautical sector Framework Programs (source: MIUR)**

## THE PROPORTION OF THE MILITARY COMPONENT

Another element of complexity and diversity with respect to the other European countries is shown by the greater proportion of industrial activities in the military field compared to the civil one. In Europe, the civil sector aeronautical turnover exceeds 60% of the total, while in Italy this percentage falls to 40 giving the military sector a weight of about 60%. In spite of this, in Italy only 0.02% of the GDP is spent on military research, compared with 0.16% in Europe and 0.47% in the United States.

# 3 High level objectives

The challenge that the Italian aeronautical sector is about to stand up to in the European and world scene requires concentration in four areas.

## To increase competitiveness, positioning and occupational levels in the aeronautical sector

The aeronautical segment must achieve an even higher profile in Europe. For this purpose, certain essential steps need to be taken: achieve an appropriate critical mass in the main current assets so to bring Italy closer to the principal European players in the sector; focus on leadership in selected business areas/lines, with guidelines and objectives shared by all the players.

To improve competitiveness in the aeronautical sector it is necessary to develop greater synergies and maximise the existing ones, eliminating ineffective and costly duplication, and reinforcing internal collaboration networks. Quality in the platforms segment would be too exposed to competition if lacking the support of large systems and structures and, in the same way, excellence in the systems and subsystems field would be highly vulnerable and would suffer lack of access to the market in the absence of a recognised functional capability at platform level. It is particularly important to concentrate on activities of high added value, by developing common and transverse industrial policies.

The occupational benefits that arise from the growth of the aeronautical sector must be maximised. The level of employment, even though not high in numerical terms, is in fact quite significant in qualitative and strategic terms. Altogether, it is a question of a skill heritage among the most advanced in the working world; heritage that must be safeguarded and increased in line with the needs of modern society, where skill and professionalism are recognised as the main factors for success.

## To consolidate and extend leadership in areas of excellence

The Italian aeronautical industry must consolidate and extend the leadership in its areas of excellence by increasing the competitiveness of the products offered, by participating in the principal European aeronautical programmes, by increasing penetration into the principal export markets and generically by strengthening its commercial skills (marketing, sales, support).

The acquisition of positions of leadership will produce direct and indirect effects. As a direct effect, the Italian sector will acquire on one hand a position of privilege and greater decision-making power in industrial partnerships and, on the other hand, a greater commercial penetrating power. As an indirect effect, it will acquire more influence in the strategies and choices of the players engaged in common operating contexts.

## To contribute to the level of technological development of the country, by widening the Hi-Tech fall-out

The aeronautical sector, which is per se of strategic importance for the technological autonomy and security of the nation, must be the principal propulsion to the technological development of the country by stimulating research and innovation, cross-fertilising other industrial sectors, facilitating the development of knowledge Districts and accelerating the birth of new companies by means of spin-offs from universities, companies and research centres.

In addition, the Italian aeronautical sector, based on its specific characteristics, must promote the dual use (in the civil and defence fields) of funds intended for research and innovation, benefiting from the similarities and synergies of all the technological development processes found in both areas. In this way, investment can be rationalised and the returns optimised, as already occurs in other countries.

Because of the special nature of aeronautical systems, characterised as they are by the integration of a multiplicity of sophisticated disciplines, it is important to plan the development of technological demonstrators, which enable innovative technologies to be tested and evaluated, under conditions similar to their final application.

## To improve the quality of the R&D system with the involvement of all players

Improving the quality of the national R&D system means involving all the players in the sector. Investing heavily in the training of human resources and encouraging more cooperation between industries, research centres and the universities is a necessary step. This consideration is based on the clear awareness that industries, institutes and research centres must become partners, next to the universities, in student instruction and preparation, actively participating in the organisation of training courses with inter-sector and interdisciplinary exchanges to meet the expectations of the world of production. The will complement the academic knowledge with practical application experience and with the company's special skills.

The thrust in quality and efficiency of the aeronautical sector must be extended to the world of small and medium enterprises (SME), owners of niche technologies characterised by integrated and flexible company structures; these possess qualified human resources and are able to make a significant contribution to the competitiveness of the national aeronautical system. It is therefore necessary to strengthen and qualify the SME networks by their deeper involvement in the process of optimisation of the production cycle and the competitiveness of the finished product, as well as through outsourcing of the increasing amounts of work by the larger companies.

# 4 The challenges

Six major themes are defined across the various divisions of the aeronautical sector; these represent the same areas of challenge that the society, through the implementation of the national Vision counts on within the aeronautical segment expecting benefits, on an overall social and financial level.

## Competitiveness

The aeronautical products must be accepted by the public as a reliable and convenient means of transport, and must therefore become ever less expensive in terms of purchase and effectiveness, with low consumption and increased efficiency.
This challenge includes a reduction in product development time, design optimisation and improved comfort - environmental quality in the cabin.

## Environment

Aeronautical products and their operation must be more environmental friendly: directly, by reducing harmful emissions and noise particularly in airport areas, and indirectly, by increasing material recycling and improving the production processes.

## Safety

In consideration of the expected increase of flights, Flight Safety must be further improved to obtain a significant reduction in number of accidents, both for the commercial and the general aviation.

## Efficiency of the air transport system

The overall challenge is for a greater efficiency of the whole air transport system including the various aspects of capacity, ground and flight phases' travel time and costs, increasing punctuality and a general improvement in the quality of the service offered to customers.

## Security

Operational security levels must be improved in view of the threat of terrorism, involving actions on ground and on board that affect the whole air transport system (aircraft, airport and infrastructure areas).

## Defence and dual applications

The quality, effectiveness and efficiency of systems that contribute to the national defence including the performance of surveillance functions of borders and the territory must be increased. The latter should be integrated within the developing European system for defence. Attention must be concentrated on the development of dual systems that can potentially lead to applications in the civil and military fields.

# 5 Specific objectives

The definition of the high level objectives and identification of the challenging areas in the Italian Vision is based on two mainstays: consolidation of the existing quality and development of new levels of competitiveness. Within this mainframe, the Vision outlines:

- the areas of excellence to be consolidated in the various segments
- the new technological and product areas in which a higher level of skill and competitiveness must be acquired
- the goal benchmark to achieve with respect to the principal European and world players.

The most significant objectives for each segment are examined below.

## Fixed-Wing Systems

- To maintain, for each business segment, the complete aircraft system integrator capability as a combination of crosswise skills.
- To maintain a state-of-the-art capability to develop aircraft for defence, increasing the capacity to integrate the mission systems on platforms.
- To develop, validate and integrate unmanned aircraft technologies, which constitute a typical dual segment, which is in rapid expansion showing a large potential derived from the necessity to provide the system with decision-making autonomy, control robustness and secure and protected data-links.
- To safeguard and improve skills in aircraft structures engineering and production, concentrating on product innovation and the production process. This applies in particular to advanced materials and their extended use for all platforms, for the purpose of obtaining significant competitive advantages and obtaining a front position in the world classification. These capabilities constitute an asset in aeronautical industrial wealth and are a basic element for R&D activities, both for aircraft and systems.
- To increase and improve the presence in the regional transport and the general aviation segments (executive and light) through the development of dual-purpose aircraft with innovative characteristics.
- To take a leading role in military tactical transport aircraft, one of the few niches destined to grow and in which Italy is present with product of its own.
- To achieve European leadership for a start, and then world leadership in the military trainer segment, coherently with the current industrial assets and technological levels achieved.

## Rotary-Wing Systems

- To maintain competitiveness in the world market for helicopters in the "light" segment, with continuous integration of advanced platform technologies and systems.
- To maintain leadership and co-leadership in the world market for helicopters in the "medium" segment, which is understood to be the most efficient solution for air transport as an alternative to fixed wing aircraft.
- To create a market segment for the tilt-rotor configuration, which represents today the most important innovation in rotary wing aircraft, extending the capacity of the helicopter in terms of efficiency as a means of transport.
- To participate, with a high level of competitiveness, in any "heavy" segment helicopter developments which cover specific operations in both the defence and dual fields.
- To acquire the ability to develop unmanned VTOL[4] aircraft as integrated systems in both civil and dual applications, where the vertical takeoff and landing capability may be the main unique feature.

The above will be pursued through a series of actions: the continuous improvement of performance - in terms of autonomy, speed, quality of flight and interior comfort -; the improved integration of on-board equipment and advanced avionics; the improvement of integrated design and production efficiency - with the aim of a significant reduction in operating costs.

The complete integration of helicopters into the global air traffic system - both in terms of all-weather capability and for the purposes of developments in ATMs[5] developments - must be achieved validating the VTOL as a civil transport aircraft by reducing significantly the relevant environmental impact in terms of materials used, emissions produced and noise.

4. Vertical Take-Off and Landing
5. Air Traffic Management

## Engines and Propulsion

- To maintain excellence in the field of transmissions, of aircraft engine turbines and burners, space boosters and mechanical electronics.
- To develop smart technologies (sensors and intelligent monitoring systems, equipped with prediction functions) that can increase the added value of the product, and this way confirming the technology value.
- To develop advanced repair technologies to achieve complete independence in the repair of core products at highly competitive prices.
- To develop research lines for propulsion systems and/or their latest generation components and subsystems which become more efficient, with greater specific thrust, minimising the environmental impact and optimising costs and performance.
- To develop design technologies that succeed in optimising the robustness of the solution, increasing product safety.

## On-boardSystem, Communications and Defence Systems

On-board systems play a fundamental role in directly determining the performance of aeronautical platforms, flight safety and air transport efficiency. In addition, they contribute indirectly to reduce the cost and environmental impact. In this sector, the target has been set to achieve a primary role in Europe by increasing its capabilities in the following areas:

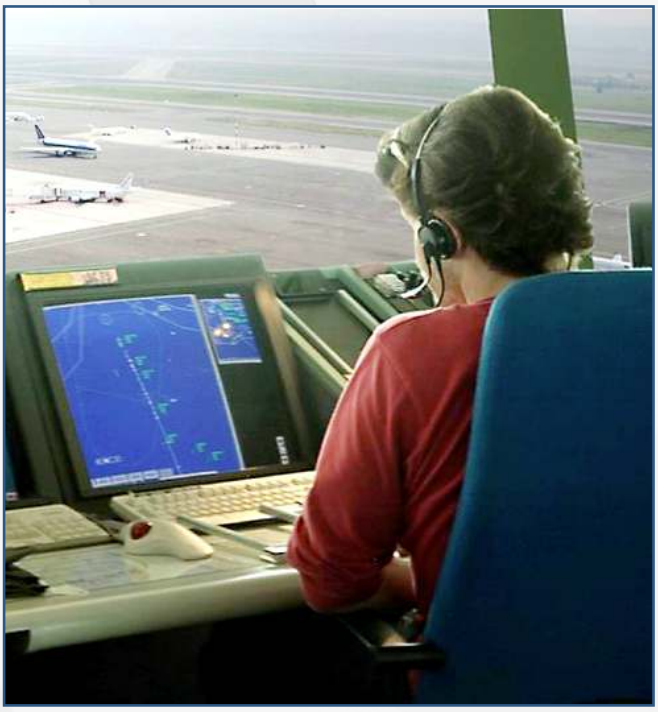
- On-board systems, concerning two specific areas:
  - Avionics, by innovating the range of products concerning, in particular, the conduct and safety of the flight and of the all-weather capability, including the development of advanced man-machine interfaces and new zero-maintenance and prognosis concepts. Emphasis must also be placed on the development of new integration and data - provided by future sophisticated sensors to be installed on platforms, both piloted and unmanned - analysis technologies.
  - Functional systems/equipment, through the development of aeronautical equipment and components for the improved safety and efficiency of air transport, which may also be obtained through improvements in the cost/effectiveness ratio of maintenance and assistance services on the ground.
- Communications, by implementing capabilities and technological solutions for:
  - Producing secure networks.
  - Producing broadband ground-air-ground systems.
  - Achieving interoperability between communication networks in a Network Centric Communications context.
  - Producing Ad hoc networks.
- Defence systems, by developing high technology applications, in particular, but not exclusively:
  - Laser systems (countermeasures, warnings, telemetry).
  - Guidance and control technologies.
  - C4ISR[6] architectures and integrated mission systems.
  - The technologies necessary to build platforms and sensors that can operate in Network Centric environments.
  - The sensors and systems necessary for data acquisition, surveillance and Situation Awareness.

6. **Command, Control, Communication, Computer, Intelligence, Surveillance, Reconnaissance**

## Air Traffic Management

Air traffic management is based on the CNS/ATM concept which makes use of all the functions performed by the Communication, Navigation and Surveillance (CNS) systems needed to perform both commercial and military services, in respect of the requirements for volume, security, economic viability and protection of the environment.
The following objectives are included in this area:

- To maintain a position of leadership in radar systems for air traffic control, supporting the development of new radar sensors and improving current technology.
- To reinforce the competitive positioning in air traffic management automated systems with particular attention to interoperability and integration between the on board and ground environments.
- To support the development of new on-board systems compatible with the functionalities required by the introduction of the CNS/ATM concept and thus the More autonomous aircraft.
- To support the development of the new digital communication systems necessary to support the functionalities required by the CNS/ATM in the air, ground and space segments.
- To develop solutions for air transport security, operating principally in the areas of cargo, baggage and passenger control, passenger identification, protection of the airport area and protection of aircraft on the ground and in flight. CNS/ATM systems (including ground and on-board communication systems) must be developed in line with what is requested by the new Single European Sky legislation and in compliance with the new European requirements (ICAO, Eurocontrol, JAA) for Security in the ATM segment.



In accordance with the objectives stated above, the following table indicates for each segment the research themes that have been identified in response to each challenge. These themes are described and detailed in the SRA document.

## SECTOR OBJECTIVES

| Challenges / Sections | Competitiveness | Environment | Safety | Efficiency of air transport system | Security | Defence and dual applications |
|---|---|---|---|---|---|---|
| Fixed-wing systems | Development of innovative configurations and materials<br><br>Improving the design process | Use of new materials and development of production and maintenance procedures for aeronautical structures<br><br>Development of configurations that reduce the environmental impact | Fault-tolerant design<br><br>Component monitoring systems | Development of configurations for regional transport and general aviation (executive and light) | Long endurance platforms for territory observation/surveillance | Optimised role configuration platforms<br><br>Development of unmanned aircraft |
| Rotary-wing systems | New design and production criteria integrated with the use of advanced materials<br><br>Development of non conventional aircraft configuration | Eco-compatible helicopter in terms of acoustics and use of recyclable materials | Fault-tolerant design<br><br>Component monitoring systems<br><br>Intrinsic all-weather capability | Integration of vertical takeoff aircraft in the air traffic system | Use of vertical takeoff aircraft for fight against terrorism and territory surveillance | Use of unmanned aircraft |
| Engines | Reduction of development costs<br><br>Reduction of operation and maintenance costs | Reduction of harmful emissions<br><br>Noise reduction<br><br>Reduction of environmental impact in the manufacturing and engine overhaul phases | Robust design | | | |
| On-board, communication and defence systems | Reduction of purchase, operation and maintenance costs<br><br>Increase in quality of cabin environment | Optimisation of airport areas trajectories | Development of advanced man machine interfaces<br><br>New integrated systems for managing threats (traffic, weather and ground collision) and increasing situational awareness<br><br>Increasing survivability | All-weather operating capability<br><br>Communication networks including broadband ground-air-ground systems<br><br>Prognosis systems | Secure and interoperable communication networks<br><br>Development of systems for controlling external threats to the aircraft<br><br>Critical flight functions automation | Territory surveillance Systems/sensors<br><br>Intelligent flight operating autonomy<br><br>Systems for Network Centric operations |
| Air traffic management | Development of new generation radar system (e.g. nanotechnology), Development of a systems' architecture for interoperability based air traffic management<br><br>Development of Satellite Navigation Systems for use in Air Traffic Management<br><br>Reduction in the product's "Life-cycle" costs | Trajectories and flight times optimized management | Use of integrated and collaborative systems for Air Traffic Management (Collaborative ATM)<br><br>Use of systems for Air Traffic Management with advanced levels of automation<br><br>Use of systems that integrate Meteorological data for optimised Air Traffic Management | Improvement in efficiency of Air Traffic Management with the use of Satellite Navigation Systems and advanced "CNS/ATM" architecture | Integrated travel management of passenger's point of departure to final destination (door to door)<br><br>Development and use of ATM sensors and systems complying with future European requirements for Security aspects | Development of dual radar sensors for ATM<br><br>Development and adoption of cooperating and interoperable Civil-Military ATM systems<br><br>Development of advanced digital communication systems |

# 6 Recommendations for implementation

Implementing the Vision requires not only the parties' direct R&D effort, but also entails identifying those mechanisms that make the research programs more effective, maximising the results.

## Sharing the objectives

The first aim is to check for convergence between the political and strategic actions stated in this document, which must be achieved through a continuous dialogue between the principal players in the aeronautical world and high level representatives in the institutions, optimising in this manner, the national research resources according to the common vision and objectives.

## To build a national strategy for aeronautical technology

Research and technological validation programmes at government level must be promoted in close collaboration with industries, universities and research centres with the object of increasing integration between scientific research and industrial applications.

For the effective industrial development of programmes it is fundamental that technological inventions generated by base technology research are made available to industry after being introduced into the supply chain through a process of validation of results: if the programs are to be successful, technology must be brought to a level of technical maturity that can support future developments of the product.

The strategy must therefore be concentrated on a limited number of research areas that tackle key problems and - above all - must initiate activities in those sectors in which the national system has the skills and excellence to ensure the success of the initiative.

## To create synergies by optimising the use of resources

Universities and research centres must play a driving and supporting role in aeronautical technological development while industry must invest in the creation of synergies and structures that engage research groups on strategic themes for the companies themselves and for the country, with resources consistent with the complexity of the objectives.

In general, wherever potential implementations and benefits for the society have been identified, new forms of collaboration must be set up between companies and institutions in which the latter benefit from the high technology services developed and offered by the companies taking care of their commercial promotion in the various sectors.

## To create a system of infrastructures

Adequate infrastructures must be provided to ensure that the results of R&D activities can be used effectively in industry and thereby transform research into innovation. These infrastructures must be seen as an integrated system that can be used at national level and which must include laboratories, advanced computer systems and platforms for verifying technologies.

## To create a new generation of researchers

Since it is not possible to develop aeronautical systems without a strong, prepared and competent workforce, personnel training initiatives must include programs aimed at supporting research activities, increasing the companies' degree of innovation, making the most of human resources and encouraging the mobility of researchers at national and international level.

It is important to attract the new generations to the aeronautical sector by creating interest and motivation. In support of a traditional core aeronautical sciences based education, a different, highly multidisciplined methodological approach capable of stimulating the creativity of students must be set up.

Finally, it is necessary to provide the tools to encourage the presence and professional development of young researchers in the universities and research centres.

## To invest in technology to increase competitiveness

Maximum efficiency is required from the industrial segment throughout the supply chain, not only to achieve the level of competitiveness necessary for a greater market share, but above all to derive the maximum benefit from industrial and institutional research and technology investments, that will permit the production of highly competitive products thanks to the adoption of new technologies.

Qualification and certification procedures must also be put in place to facilitate the introduction of new technologies in production models.

## To improve the quality of participation in international programs

Decisive action must be taken to improve the level of participation in European research programmes (civil and military) both from the economical value and technological relevance point of view.
It is appropriate to adopt methods of support and financial assistance to the leaders or core teams of European programmes, encouraging the development of a stronger trans-European synergism that will permit greater Italian participation in research programmes, increasing the national aeronautical sector's critical mass, skills and knowledge and giving them a greater role in the coordination of projects.

Special importance should be given to those areas that relate to programmes for which Italy is responsible, after checking their consistency with the national strategy, facilitating access of the above-mentioned subjects to the public resources for R&D. This for the purpose of supporting and empowering the research system in areas where it is successful at international level.

It is also necessary to encourage, support and increase Italian participation in highly innovative programmes of great strategic value for the country.

## To exploit to the full the benefits of dual applications

The interaction between public and private financing for the sector's strategic activities, in particular, possible where the research activity can be used for dual purposes (civil and defence).

Also worth mentioning in the current scenario dominated by the terrorist threat, are those applications associated with security and control of the territory, since the same systems that are used for surveillance and defence of the country are used for environmental control and can be of great use in case of natural disasters.

## To support investment for the Vision

Finally, the issue of the cost necessary to support the implementation of the Vision must be considered, and for this purpose the priorities and methods of intervention must be defined.

The current mechanisms for financing R&D can be improved. It is necessary to converge the financing resources of the various Ministries focussing them in aeronautics coherently with a strategy shared by the stakeholders; today they are mainly identified by generic rules and concepts and not defined by specific sector regulations.

In the coming years, more resources must be dedicated to the processes of development and technological innovation in the sector, attracting a more appropriate public participation. This involvement, together with a participation of private financing in the strategic activities of the sector, can support the high risks associated with large investments with long return timescales (15/20 years) and deferred profitability.

In this picture, the institution of the Joint Technology Initiatives (JTI) in the 7th Framework Program is significant. A combination of public and private financing, the JTI foresee achieving a significant broadening of the objectives, the resources, the participation and extension of the research programmes though simultaneously pursuing the more close-to-market aspects.

# 7 The role of ACARE Italia

Acare Italia must undertake those promotion, supervision and coordination actions that lead the Italian aeronautical world players: the Government institutions, Industries, research centres and Universities, to act in a coordinated and consistent way towards achieving the objectives outlined in the Vision.

ACARE Italia undertakes the following principal tasks:

- To promote and distribute the Vision as widely as possible, so that it is not only known to the Government, to the possible public and private financing bodies and companies in the sector, but also to users of the air transport system and the community.
- To offer a consulting contribution to the institutions, which is complementary to those of supervision and direction typical of the Government and the Ministries; this advising input is aimed at directing and harmonising financing and programmes to maintain consistency with the strategies described in the Vision improving the competitiveness of the industrial and research systems.
- To verify the suitability of the financing resources available for projects, supporting eventual requests for greater financing or reformulating the objectives when the resources appear insufficient.
- To promote synergies between all the players in the Italian aeronautical world for the purpose of implementing common strategies for shared guidelines with ever greater efficiency.
- To increase the role of national R&D at European level with a decisive action aimed to match and coordinate the national contribution to the future issues of the SRA, and to act in the context of the future Framework Programs in order to increase the national economic return.

ACARE Italia will support and assess the implementation of the Italian SRA, monitoring and revising the roadmap of R&D activities. The most efficient mechanisms will be activated for periodically checking the progress made with respect to the high level objectives, in agreement with the defined timescales and the available financing.

In order to organise the activities of the committee, an Implementation Group and a Strategy Group will be set up, aimed respectively at the supervision and management of the implementation of the SRA, and at the planning of future developments in the medium and long term.

**The Vision and the Strategic Research Agenda were written by ACARE Italia's Council.**
**The Council is composed by:**

| | |
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