PARE Article
Maintaining and Extending Industrial Leadership

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Based on

Chapter 3 of the 1st Year Report of the PARE project

Prepared by

PERSPECTIVES FOR AERONAUTICAL RESEARCH IN EUROPE

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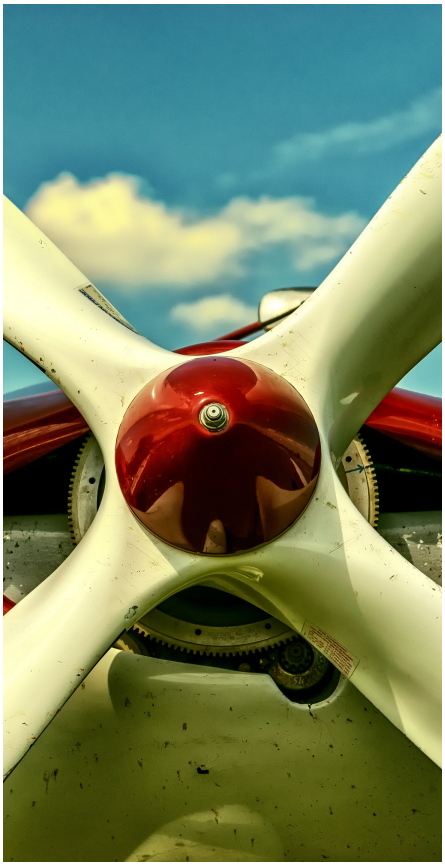
Maintaining and Extending Industrial Leadership

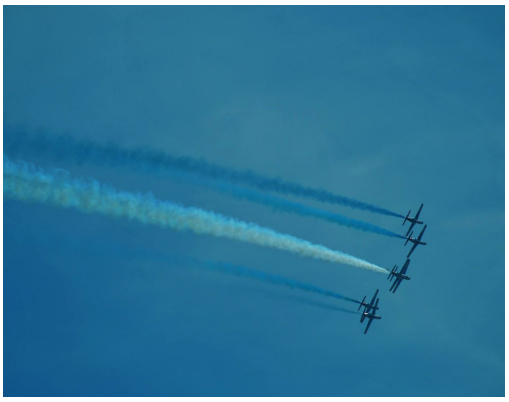
INTRODUCTION

By 2050, the innovative, sustainable and highly competitive European aviation industry must cement its place as the world leader and be recognized globally for its vehicles, engines, services and a large range of very cost effective and energy efficient products. This leading position should be secured though a seamless European research and innovation system that assures continuity through blue sky research, applied research, development, demonstration and innovation in products and services.



To assure that this overall goal is met, the Advisory Council for Aeronautics Research in Europe (ACARE) established the specific Flightpath 2050 goals 6 to 8, which concern the maintenance and extension of Europe's leading position in the aeronautical sector, the mastering of a wide range of technologies and the integration of these in an aircraft design and development program, respectively. The 3rd chapter of PARE's 1st yearly report, entitled "Maintaining and Extending Industrial Leadership" addresses these goals.

RETAINING AND STRENGTHENING MARKET SHARE



Nowadays, the European aeronautical industry sustains a near peer position with its worldwide competitors in almost all aerospace applications: large civil jet aircraft, regional aircraft, helicopters, military aircraft, missiles, satellites and launchers, engines and equipment. In 2050, it must be equally competitive, deliver the best products and services worldwide and have a share of more than 40% of the world market.

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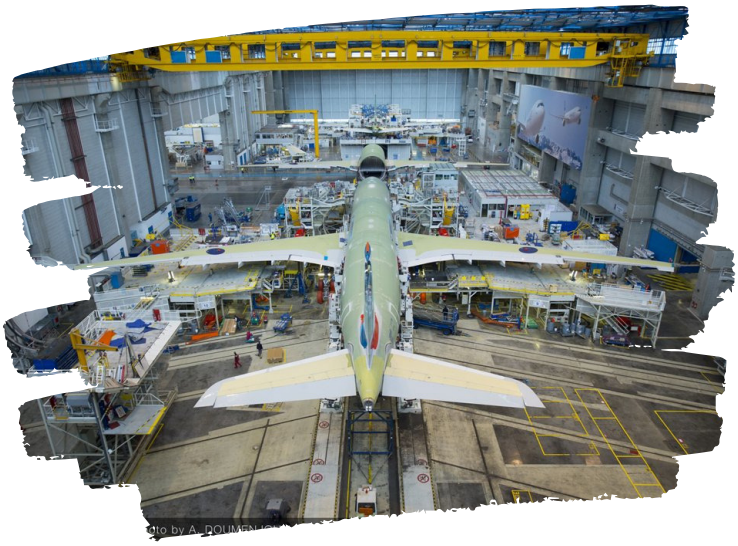
KEY FINDINGS

- Airbus has a share of 50% of world market for jet airliners with more than 100 seats and the Airbus – Boeing 'duopoly' dominates the market for jet airlines of more than 120 seats, with a full range of narrow and wide body aircraft;
- ATR is the leading supplier in the regional aircraft market;
- Airbus Helicopters (formerly Eurocopter) and Augusta – Westland are market leaders in helicopters;
- Dual use and specific technologies ensure an equally strong position in the world market for military aircraft, missiles, space launchers and satellites;
- Safran and Rolls – Royce rival Pratt & Whitney and General Electric in aero – engines and in the equipment sector, Liebherr, Safran, GKN and others are major suppliers of European and non- European aircraft.

These impressive achievements across a full range of aeronautical products depend on: leading – edge technologies in all the sectors contributing to the design of aeronautical vehicles and the integration of all these cutting – edge technologies in efficient aircraft production, certification and service support programmes.

KEY ACTIONS

It is recommended that a broad – based application – oriented research and development activity is maintained covering all sectors relevant to the global competitiveness of the European aircraft industry, which is part of the 6th Flightpath 2050 goal.



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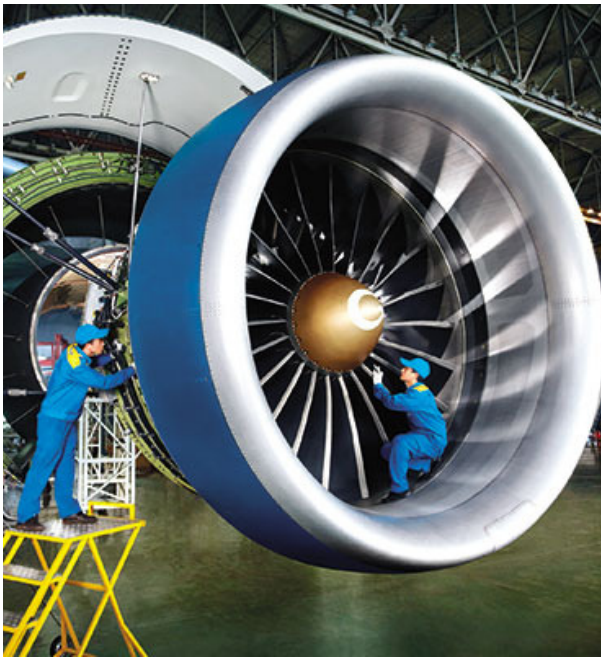
CUTTING-EDGE AT THE FULL RANGE OF TECHNOLOGIES

Modern Europe is facing several challenges, among which is the introduction of innovative technological solutions to the European aviation market. To be concrete, the competitiveness of the aerospace industry depends on mastering cutting - edge technologies over a wide range of 11 technological areas. Therefore, for Europe to remain competitive, it must retain leading edge design, manufacturing and system integration capabilities and jobs supported by high profile, strategic, flagship projects and programmes which cover the whole innovation process from basic research to flight demonstrators by 2050.



KEY FINDINGS

- The necessity to introduce new technological solutions results from the needs of society, new technologies that have appeared and new types of transport means and air transport systems;
- There are many challenges for aviation industry especially from the environmental side, being that the amount of greenhouse gases generated by the aviation industry accounts for about 13% of the total generated amount in the world;
- There are currently two aviation programs being implemented in Europe that give answer to Europe's challenges, which are Clean Sky 2 and SESAR 2020. Other smaller programs that contribute to the development of innovative cutting edge solutions are: EPATS (continued in the frame of SAT-Rdmp), FUSETRA, GABRIEL and ERA;
- Patents in the mentioned technological areas are an indicator of innovation in aviation. Since 1969, the peak in the number of patents in aviation per year was reached in 2016, with approximately 3500 patents in aviation.

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Although the European aerospace industry is currently quite competitive, there are a number of emerging technologies that could be used by current and new competitors to change the balance, which need to be monitored and supported to ensure Europe remains a leader in the aeronautical sector.

KEY ACTIONS

To achieve the 7th Flightpath Goal, it is recommended that a stable independent observatory of citizen needs, global trends in aviation and technological advances that could meet them, is supported to ensure that major breakthroughs occur first in Europe or are matched without delay in reaching the market.

EFFICIENT DEVELOPMENT AND LIFE - - CYCLE MANAGEMENT

The growing capability (related with certification) and complexity (frequently supported by new technologies) of the modern aircraft increases the relevance of life – cycle analysis that needs to be considered also at component level, such as batteries. Taking this into account, by 2050, streamlined systems engineering, design, manufacturing, certification and upgrade processes should have addressed complexity and significantly decreased development costs (including a 50% reduction in the cost of certification). Also, a leading new generation of standards should have been created.

AIRCRAFT	YEAR OF FIRST SERVICE	DEVELOPMENT COSTS (CONSTANT 2014 $)	DEVELOPMENT TIME IN YEARS
Douglas DC-3	1936	4.9 Million	2
Douglas DC-6	1946	173 Million	3
Boeing 707	1958	1.5 Billion	6
Boeing 747	1970	5.8 Billion	4
Boeing 777	1995	8.0 Billion	6
Airbus A380	2007	16.5 Billion	7
Boeing 787	2012	13.6 Billion	7
Airbus A350 XWB	2014	15.6 Billion	8

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KEY FINDINGS

- Rise in the cost of development (including certification) is correlated with the increased complexity of the machine;
- Two measures of aeronautical development efficacy are: specific development cost (SDC) and specific development period (SDP), both per number of model's passenger seats;
- Significant reductions on the measures mentioned before can be achieved by:
  - Intensive use of modelling and simulation instead of physical test and experiment;
  - More specific, flexible and adaptive regulatory requirements (standards) for certification, including the involvement of airworthiness authority in virtual design; and
  - A fully integrated multi – physics and multi – scale model of the complete aircraft should be coupled with aerodynamic and thermal models, eliminating ground test rigs completely.

To reduce CO2 emissions considerably, which is a challenge for the aviation industry, the interest in hybrid and/or electric aircrafts is increasing worldwide. This would require an efficient power source for the electric engine and, in view of its high energy density, long life, and rate capability, the lithium-ion battery is an ideal candidate for this purpose. However, batteries also introduce new safety concerns to aircraft that would have to be managed.

KEY ACTIONS

It is recommended that the architecture of industrial aviation programmes in analysed in order to identify best practices in matching design, development, certification, production, operations and maintenance in the most cost – effective and time – efficient manner. Also, the introduction of new technologies and stricter safety requirements should be accompanied by more efficient testing and validation to minimize time and cost.

For more information about these topics, you can access the full chapter **here**.