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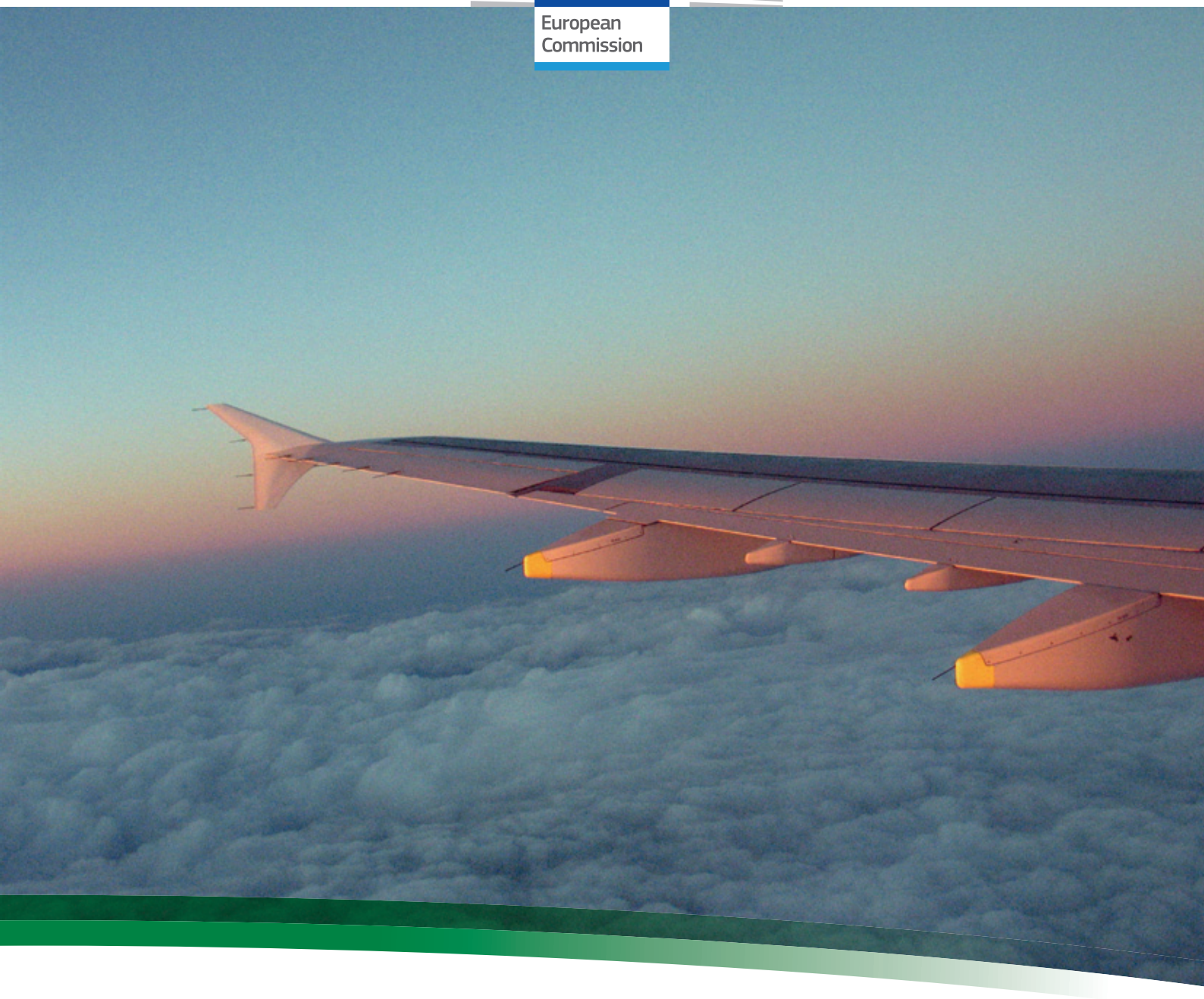

Thematic Research Summary

Air transport

COMMUNICATING TRANSPORT RESEARCH AND INNOVATION

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Transport

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Preface

This Thematic Research Summary (TRS) has been produced as a part of the activities of the Transport Research and Innovation Portal (TRIP). TRIP collects, structures, analyses and disseminates the results of EU-supported transport research and research financed nationally in the European Research Area (ERA), and selected global research programmes. The main dissemination tool used by TRIP is the public web portal www.transport-research.info.

The Thematic Research Summaries provide a structured guide to the results of research projects carried out mainly at EU level, either as part of a framework programme or as a study commissioned by the European Commission (EC). These summaries are intended for policy makers at European, national and local levels, stakeholders and researchers.

The Thematic Research Summary on Air Transport is one of 24 themes that provide:

- an overview of research on a specific aspect of transport focusing on EU-funded projects;
- analysis and compilation of research findings and recommendations.

An overview of the Thematic Research Summaries is presented in Table 1.

Table 1: Transport themes used in TRIP

Domains	TRIP Themes
Sector	Passenger transport
	Freight transport
Mode	**Air transport**
	Rail transport
	Road transport
	Urban transport
	Water transport (sea and inland)
	Multimodal transport
Policy	Financing, pricing and taxation
	Regulation, competition and public services
	Infrastructure and TEN-T
	Land use and transport planning
	Climate policy and energy efficiency
	Security and safety
	International cooperation and EU Neighbourhood Policy
	Awareness, information and user rights
Technology	Intelligent transport systems
	Innovative technologies
	Transport management
Evaluation	Long-term perspectives
	Assessment and decision support methodologies
	Environmental impacts
	Economic and regional impacts
	Accessibility, social and equity impacts

1. Introduction

With over 830 million passengers within the EU (2012), air transport plays a key role in mobility whilst being an engine for economic growth and international trade. In 2010, the sector commanded 5.1 million jobs in Europe and contributed EUR 365 billion or 2.9% to the GDP (Air Transport Action Group, 2012). Since deregulation in the 1980s, the passenger segment has grown steadily at a rate of circa 5% during the period 1986 to 2012 (World Bank, 2013). Global forecasts indicate that such growth rate will be sustained in the years to come (Airbus, 2012), whilst freight volumes are estimated to triple in the next 20 years (Boeing, 2010). This expected growth in air traffic will impose renewed operational management challenges as well as subsequent detrimental effects on the environment, notably through the continuous increase in CO_2 emissions (DEHSt, 2013).

While economic and job imperatives will impose the need to accommodate such market growth it is pivotal the latter will be achieved within a sustainable perspective (Transport White Paper; EC, 2011a) by mitigating the increased toll in traffic handling, safety and security demands and negative environmental influences. The higher expectations from users – private and business alike – in regard to the quality and responsiveness of transportation services will require the air transport system to reach deeper levels of integration with other transport modes towards evolving seamless door-to-door transport networks (EC, 2011a). Such over-arching goals will impose notably:

- Substantial reductions in CO_2, NO_x and particulate emissions, as well as noise production from aircraft and engines because of global warming, air quality, and local population health and living comfort considerations (ACARE, 2012).
- Management of the increasing numbers of aircraft in EU skies. In this context, new air management solutions emerging through the continued implementation of the seamless Single European Sky (SES) are already contributing to a more efficient use of airport and airspace capacity providing a leeway for handling current and expected air traffic growth (EC, 2013a). The latter will also require airport capacity to be optimised or where necessary expanded (EC, 2011a). Safety and security standards will have to evolve to adapt to such a growth and maintain public confidence in civil aviation (EC, 2005 and EC, 2011a). The EASA supports this objective with the development of a comprehensive European aviation safety strategy (EC, 2011a).

- A well-trained and motivated workforce capable of supporting the evolving needs for an internationally competitive aviation industry. This implies the establishment of minimum service and quality standards for workers (EC, 2011a) and attention being paid to improving education and training in all aspects of aviation.

On the invitation of the European Commission, the High Level Group on Aviation Research developed "Flightpath 2050 – Europe's Vision for Aviation" setting out the new challenges and longer term goals for the European air transport system and identifying potential solutions and subsequent research needs and priorities (EC, 2011b). In response to this Vision, the Advisory Council for Aviation Research and Innovation in Europe (ACARE) formulated a complementary Strategic Research and Innovation Agenda (SRIA) providing a strategic roadmap for aviation research, development and innovation in the European Union.

The research projects and studies presented herein are grouped under five themes according to the key challenges identified in Flightpath 2050:

- Meeting societal and market needs
- Maintaining and extending industry leadership
- Protecting the environment and energy supply
- Ensuring safety and security
- Prioritising research, testing capabilities and education.

This document provides an overview of the research areas that have and are being addressed in the Seventh Framework Programme (FP7). These projects have been grouped together under the ACARE SRIA themes and key action areas. Whenever particular projects address several themes, they are included only once within the most relevant theme.

2. Sub-Theme: Meeting Societal and Market Needs

Air transport plays a strategic role in both an economic and societal perspective, contributing to the EU's economic growth and mobility. To sustain this role it is necessary for the air transportation sector to be capable of facing the escalating challenges that it is confronted with in terms of service demands from customers, traffic growth, operational efficiency and cost-effectiveness, safety and security risks and negative environmental influences. Innovation will be core to tackling this manifold complex reality in a successful manner. EU-funded research supports the EU air transportation sector in such a quest, improving its competitiveness in a global world whilst providing the services its clientele – private and business alike – crave for.

As stated in Flightpath 2050 (EC, 2011b), air transport supports a range of economic activities across its value chain that impact on growth of the European economy, and therefore on its prosperity and jobs, on international trade and the exporting capability of Europe whilst enabling connectivity between people and goods that ensures cohesion on an EU-wide scale. From a societal angle, air transport connects citizens and businesses, opening a wide range of opportunities for leisure, tourism and trade. Research has to reflect such duality, addressing a value-chain perspective from the identification of the market needs through to devising the system solutions capable of fulfilling them. In such a context, research projects have been grouped as follows:

- **Customer-centric intermodal transportation systems**: supporting the development of air transport in the overall context of the whole transport system towards meeting passenger and business needs.
- **Travel management**: addressing the whole travel process, including aspects such as travel planning, journey information, disruption mitigation and protection of customer rights.
- **Integrated air transport**: towards intra and inter-modal integration of air and other transport modes, focusing infrastructure assets, including innovative communication and navigation systems.

Customer-centric intermodal transportation systems

FANTASSY (Future Aircraft design following the carrier-pod concept as an eNabler for co-modal seamless Transport, pAssenger Safety and environmental SustainabilitY, FP7, 2012–2014) is designing a hybrid concept aircraft that combines a carrier with a passenger pod. This concept could make air transport more efficient, flexible and safer. The design as proposed significantly modifies the basic form and operation of current aircrafts, which have not changed significantly since the 1940s.

MODAIR (Co-modal Airport, FP7, 2012–2014) is investigating the interconnectivity of European airports and high-speed train stations. A multi-stakeholder forum with parties from the air, rail and urban transport sectors has been setup, to contribute to the development and/or improvement of inter-modality for passenger services in European airports.

MYCOPTER (Enabling Technologies for Personal Air Transport Systems, FP7, 2011–2014) is developing a concept for personal air transport for commuter journeys to fly at low-altitude in urban areas. This concept is based on fully or partly autonomous personal aerial vehicles that do not require ground-based air traffic control. Technologies are also being investigated to deliver the operational infrastructure required for large-scale use of personal aerial vehicles.

CARGOMAP (Air Cargo Technology Road Map, FP7, 2011–2013) investigated the future role of air freight and developed a technology road map for a new aircraft. Based on an analysis of the current state of airfreight in Europe, potential bottlenecks and challenges were identified, and various business models proposed to identify future market needs and potential niches. The characteristics of a cargo aircraft customised to these new market niches were investigated and a technology roadmap for the aircraft was prepared.

ULTRA (Unmanned Aerial Systems in European Airspace, FP7, 2012–2013) addressed the issue of unmanned aerial systems (UAS), with special focus on civil light UAS. ULTRA provided a comprehensive set of recommendations for the incremental insertion of civil light Remotely Piloted Aircraft Systems (RPAS) in the European airspace in the short-term, provided specific recommendations for selected "Use Cases" to be explored as "quick win" business cases, and highlighted what needs to be done in order to unlock the full potential of the civil Light RPAS market in the long-term.

PPLANE (Personal Plane: Assessment and Validation of Pioneering Concepts for Personal Air Transport Systems, FP7, 2009–2012) identified new concepts for a personal air transport system of the future. A system was developed centred on the utilisation of a fully-automated, electric light aircraft capable of transporting up to four persons to a distance of up to 500 km. This aircraft can be remotely controlled by trained operators in the event of an emergency and shall meet the safety requirements that apply currently to commercial aeroplanes. As such it can be fully integrated in the global air transport system using a network of airports and personal plane ports and support 4D contract trajectories in a similar way to civil drones.

SAT-RDMP (Small Air Transport – Roadmap, FP7, 2011–2012) addressed the use of small aircraft to provide an affordable, accessible, energy-effective component for the air transport system. A roadmap was prepared to fill gaps in technology, regulations and operation related to small aircraft. The project improved the understanding of the role small aircrafts may play to satisfy transportation needs in regions of the world where transport networks are still underdeveloped. It also paved the way for small aircraft research within Clean Sky 2.

FUSETRA (Future Seaplane Traffic – Transport Technologies for the Future, FP7, 2009–2011) tackled seaplane and amphibian aircraft transport in Europe. The research was multi-fold and included notably:

- technical and mission requirements including cost considerations;
- identification and analysis of requirements for operational improvement;
- a new seaport concept of sea parks to improve accessibility of regions including tourist areas.

The research evidenced the approval of air and water operations by regulatory authorities, such as navy, police and local authorities as a key stumbling block for the establishment of an airline together with profitability considerations arising from competition from passenger water transport, such as ferries. Other open issues include notably the current deficit of qualified pilots and examiners in Europe, and the potential negative environmental impact that might be generated by the new sea parks.

Travel management

Air transport disruption

RESILIENCE2050.EU (New Design Principles Fostering Safety, Agility and Resilience for ATM, FP7, 2012–2015) is strengthening the resilience and adaptability of air traffic management systems against perturbations and disruptive events. Metrics are being developed to quantify the level of system resilience and the likelihood of perturbations in order to improve system response and to develop methods to mitigate propagation of disruptive events throughout the system.

META-CDM (Multimodal, Efficient Transportation in Airports and Collaborative Decision Making, FP7, 2012–2014) is addressing the question of collaborative decision making (CDM) to tackle major disruptive events in airports from a passenger perspective. A literature review was carried out on current CDM practices, including the Airport CDM concept implemented in most major airports in Europe for disruption handling and passenger-centric metrics. Interviews are to be conducted with key individuals in airlines, airports and other major stakeholders on CDM in the context of disruption handling. Based on the literature review and the results of these interviews, an upgraded CDM concept is being developed for better and more robust handling of disruptive events in future airports.

Customer rights and interests

ICARUS (Innovative Changes in Air transport Research for Universally designed Services, FP7, 2012–2014) is identifying facilities and services capable of improving access to aircraft for people with disabilities, and elderly people. The effectiveness, cost, risks, bottlenecks and technical and social obstacles associated with such facilities and services are being assessed to ascertain their fitness-for-purpose.

Study on Consumer Protection against Aviation Bankruptcy (European Commission, DG MOVE, 2009) investigated the reasons underpinning airline bankruptcies in the EU since 2000, and the magnitude of the impact of individual bankruptcies on travellers with pre-paid tickets. The study also analysed trends in airline bankruptcy and addressed the adequacy of current rules and regulations to protect travellers in such an event. As a result, a combination of measures – to be implemented by governments, airline companies and the courts – were proposed to ensure a firmer protection of consumer rights.

Review of Regulation 261/2004 (European Commission, DG MOVE, 2007) examined Regulation 261/2004 and its effect on cancellations, delays, denied boarding and down-grading by airlines. The Regulation has been strongly opposed by many airlines because it requires compensation for passengers, information provision and accommodation for passengers in the event of denied boarding. The study found evidence of lower occurrences of overbooked flights and of non-compliance to the Regulation 261/2004 by some airlines due to ineffective enforcement and lack of clarity in the drafting of some aspects of the Regulation 261/2014. As a result, introduction of dissuasive sanctions for non-compliance and changes to the Regulation were recommended.

Integrated air transport

Innovative CNS systems

PULSARPLANE (PulsarPlane: Worldwide Air Transport Operations, FP7, 2013–2015) is proposing a new navigation system based on signals received from pulsars. The feasibility of pulsar navigation for aviation is being investigated and schemes for a useable real-time navigation and timing system will be developed where achievable. Pulsar navigation will eliminate the need for ground-based or space-based equipment, being more flexible and robust and with lower operational costs than other more conventional alternatives.

AGEN (Atomic Gyroscope for Enhanced Navigation, FP7, 2012–2014) is assessing the feasibility of developing an inertial grade gyroscope for aircraft navigation. This new technology has smaller dimensions, less power consumption, and delivers higher performance than current ring laser gyroscopes. The new gyroscope can be used in a wide range of applications including unmanned commercial flights, marine, sub-marine and surface vehicle navigation.

SANDRA (Seamless aeronautical networking through integration of data links, radios, and antennas, FP7, 2009–2013) designed a high-performance integrated aircraft communication system capable of meeting the expected doubling of air traffic in Europe by 2025. The new system was validated by inflight trials and was designed and implemented based on an open architecture, a common set of interfaces and proven industry standards.

GAGARIN (GAlileo-Glonass Advanced Receiver INtegration, FP7, 2009–2011) contributed to the development of standardised worldwide GNSS solutions by merging GALILEO with GPS and GLONASS systems to adopt GALILEO for air transport applications in Russia. The project was carried out by companies in Russia and Europe and supported by research laboratories in these regions.

GRAMMAR (Galileo Ready Advanced Mass MArket Receiver, FP7, 2009–2011) investigated GPS/GALILEO receiver solutions targeted at mass markets. Functional prototypes of dual-frequency GPS/GALILEO receivers were developed including enhanced algorithms adapted to the requirements of the next generation of mass market receivers.

Cockpit integration

ALICIA (All Condition Operations and Innovative Cockpit Infrastructure, FP7, 2009–2014) is developing a new cockpit infrastructure to deliver enhanced situational awareness while simultaneously reducing crew workload, and improving aircraft safety under all conditions. The new cockpit enables the crew to process and act on information concurrently and intuitively, using a mixture of visual, tactile and audio senses. A common and open standard interface is to be fitted allowing for core applications in all aircraft types (fixed and rotary wings aircraft) while supporting challenging new applications in controlled and uncontrolled airspace.

SAFAR (Small Aircraft Future Avionics Architecture, FP7, 2008–2012) provided a generic, function-enhanced and proven avionics architecture allowing for a high degree of re-usable generic hardware and software components. Advanced functionality supported by the SAFAR architecture include automatic take-off and landing, auto land capabilities in an emergency and automatic four-dimensional flight vectoring.

Airport

INTERACTION (The INnovativeTEchnologies and Researches for a new Airport Concept towards Turnaround coordination, FP7, 2013–2016) is developing and validating prototypes and procedures for airport terminal, freight and ramp operations with the goal of improving time efficiency in airport processes. A fuller operational coordination with shorter and more efficient aircraft turnaround shall be ensured, and the predictability of processes associated with turnaround improved.

2050AP (The 2050+ Airport, FP7, 2011–2014) is investigating new airport concepts for the future that evolve around three distinct rationales; increasing passenger time efficiency; climate neutrality; and cost reduction. A methodology is being developed to evaluate such airport concepts by identifying benefits of each approach and their implementation challenges. This should eventually aid airports in the preparation to meet future market and regulatory requirements.

ENDLESS RUNWAY (The Endless Runway, FP7, 2012–2013) investigated the potential of a circular runway concept to reduce the environmental footprint of an airport. The runway enables aircraft take-off or landing within the circle where winds are optimal in view of reducing environmental nuisances. The concept is based on the use of forthcoming technological developments notably GNSS guidance. The work addressed the key technical and operational constraints in aircraft design, runway operating requirements, taxiway and airport layouts, and ATM aspects affecting the concept in view of identifying the appropriate solutions – in new aircraft design, new organisation and taxiway optimisation – to make it viable.

TITAN (Turnaround integration in trajectory and network, FP7, 2009–2012) addressed the aircraft turnaround process that is the cause of many delays in air operations. The research highlighted the external factors that impact the turnaround process, such as passenger flows and baggage handling, and developed measures to mitigate delays and to improve incident management. Based on these findings a concept for a decision-making tool was developed to give airlines a firmer grip on the aircraft turnaround process – enabling higher time precision at which the aircraft will commence movement associated with departure (off-block time). Application of these operational concepts demonstrated that the percentage of delayed flights and aircraft turnaround time can be decreased.

AAS (Integrated Airport Apron Safety Fleet Management, FP7, 2008–2011) investigated the implications of the deployment of high-tech systems for comprehensive monitoring and control of Ground Service Equipment vehicles and movement on the apron area. It demonstrated that such systems do enhance the safety and efficiency of the apron, with a reduction in congestion and accident rate in ramp areas, whilst significantly enhancing environmental sustainability by reducing movements and fuel consumption.

ASSET (Aeronautic Study on Seamless Transport, FP7, 2008–2011) developed solutions for improving time efficiency of airport ground operations, through an integrated approach that applies to passengers, baggage and aircraft turnaround. It was demonstrated that the proposed concept raises air transport efficiency by decreasing the variance in off-block times.

ICOA.10.09 (International Conference on Airports, October 2009 Paris, FP7, 2008–2010) was a two-day conference on airports and their challenges that brought together a representative cross-section of airport operators and policy makers. The conference enabled the pooling of information amongst its attendees, to discuss relevant developments and to share innovative ideas on safety, security, environment, customer satisfaction and intermodality. A broad, dynamic vision of the evolution of airports in Europe in a 15–20 year timeframe was developed and set against a backcloth of wider global challenges, uncertainties and constraints.

Airspace – Seamless operations

METROPOLIS (Urban Design Airspace, FP7, 2013–2015) is investigating radically new airspace design concepts for two new types of aircraft: personal air vehicles and unmanned, autonomous flying cargo aircrafts. Four types of airspace design are to be investigated: full mix, layers, zones and tubes. The relationship between metrics determining the quality of the airspace concepts and air traffic patterns and flows, and control options will be investigated.

4DCO-GC (4 Dimension Contracts – Guidance and Control, FP7, 2010–2013) explored 4-D contract guidance and control of an aircraft for both improving air space management and ensuring efficient guidance of the aircraft trajectory. Software and tools were developed to define, model and fine tune the envisaged 4-D contract concepts. The latter and related operations, were eventually assessed through real-time simulation. Based on this assessment, recommendations and standards for future 4-D transport systems were prepared.

Evaluation of Functional Airspace Block (FAB) initiatives and their contribution to performance Improvement (European Commission, DG MOVE, 2008) assessed current initiatives for evaluating Functional Airspace Blocks (FAB). Best practice guidelines for drawing up safety cases and cost-benefit analyses were prepared. The work wrapped-up by proposing recommendations for facilitating FAB creation through amendments to the current governance, legal and regulatory frameworks.

The European Common Aviation Area (ECAA) and the Western Balkans: Domestic Reforms and Regional Integration in Air Transport (European Commission, DG MOVE, 2007) examined the extension of the European Single Market for air transport to South-Eastern Europe, based on an ECAA agreement signed in June 2006 by the EU and ten neighbouring countries. The extension contributed to a broader regional integration, boosting the potential for tourism and business travel. With the implementation of legislation in 2010, the Western Balkans became part of a fully integrated aviation market serving 500 million people in Europe.

3. Sub-Theme: Maintaining and Extending Industrial Leadership

Strengthening the leadership role of the EU aviation industry in global markets is of paramount importance. Such a goal can only be fulfilled by spearheading innovation in products and processes, providing EU suppliers with the capability to produce and service the solutions for tomorrow's customers. EU research has to be at the core of such an innovation thrust, supporting the EU aviation industry in its continuous search for excellence.

Aviation contributes more than EUR 365 billion annually to the EU economy and supports circa five million direct and indirect jobs, including more than 500 000 high-quality manufacturing jobs. It is a major exporter that generates a positive trade balance, which in 2009 was EUR 10 billion (EC, 2011b). As competition in the aviation sector becomes fiercer due to competition from emerging economies, the shortening of business and technology cycles, there is a need for EU companies to radically rethink their market profiling and positioning – in products and services – to at least maintain current levels of business while striving to lead and innovate in meaningful ways. The EU has a role to play to ensure the development of appropriate incentive schemes to accelerate innovations in such new business environments and perspectives.

A set of FP7 research projects support this quest of industrial leadership by the EU aviation industry. These projects are grouped as follows:

- **Innovative aircraft industry**: addressing the development of new technologies and innovative air transport vehicles.
- **Development and manufacturing process**: focusing on innovative and competitive manufacturing processes for the aircraft industry.
- **Innovative business models, regulations and incentives**: studies on incentive and regulatory schemes to accelerate the development and take-up of innovations in air transport.

Innovative aircraft industry

Innovative vehicles

ANULOID (Investigation of novel vertical take-off and landing (VTOL) aircraft concept, designed for operations in urban areas, FP7, 2013–2015) is investigating the feasibility of the vertical take-off and landing aircraft (VTOL) in urban areas. This includes a comparative analysis of new VTOL concepts with more conventional alternatives – such as helicopters, tilt rotor aircraft and current VTOL aircraft concepts – based on simulation and experimental data to draw conclusions with regard to flight properties and flying qualities.

HYPMOCES (Hypersonic Morphing for a Cabin Escape System, FP7, 2012–2015) is addressing the critical technologies enabling the use of morphing in escape systems for hypersonic transport aircraft. These include issues relating to structures, aerothermodynamics, control, mission and systems. Particular attention will be devoted to the integration of the structures, material and mechanism of the deployed elements, and systems within the escape system.

CROP (Cycloidal Rotor Optimized for Propulsion, FP7, 2013–2014) is introducing a high-thrust-level and low-weight cycloidal rotor concept for aircraft propulsion systems. The concept is designed to power new air-vehicle concepts and to enhance short take-off, landing and hovering capabilities.

ESTOLAS (A novel concept of an extremely short take-off and landing all-surface hybrid aircraft: from a light passenger aircraft to a very high payload cargo/passenger version, FP7, 2012–2014) is validating and developing the conceptual design of a hybrid aircraft combining the best qualities of an airship, an aeroplane, a helicopter and a hovercraft. The main component of this concept is a disk-shaped centre filled with helium, enabling the aircraft to take off and land on any surface, and making it safe and reliable.

HEXAFLY (High-Speed Experimental Fly Vehicles, FP7, 2012–2014) is adapting an experimental high-speed, self-propelled vehicle for future flight tests. This includes the identification of inherent technological risks. The project will increase the technology readiness level of the developments carried-out in previous high-speed aeronautical projects, such as ATLLAS I & II and LAPCAT I & II, and paved the way for the international initiative HEXAFLY-INT for a scaled model flight test in 2018.

HIKARI (High speed Key technologies for future Air transport – Research and Innovation cooperation scheme, FP7, 2012–2014) is creating synergies between Japanese and European programmes on high speed aviation to establish a common strategy and roadmap for technology development and demonstration. Studies on fuel and environmental impacts, thermal and energy management and propulsion are carried out. Ascertaining the economic feasibility of high speed transport and addressing the relevant factors for gaining public acceptance will be part of the whole study process.

MAAT (Multibody Advanced Airship for Transport, FP7, 2011–2014) is investigating a concept for a cruiser-feeder system for medium and long-range transport. The cruiser is a large aircraft that can remain airborne for long periods of time on stable world routes. Feeders would transfer passengers and freight to and from the cruiser at interception points in flight. The MAAT cruiser-feeder system would be expected to have lower environmental impacts when compared to today's air transport alternatives.

LAPCAT-II (Long-term Advanced Propulsion Concepts and Technologies II, FP7, 2008–2012) addressed high-speed technology to reduce antipodal flights to two to four hours. The project investigated the scenarios of flight time reduction using the performance figures of a Mach 5 and a Mach 8 vehicle. The key conclusions of this assessment were incorporated into a roadmap for a future supersonic vehicle design.

New technology

ESPOSA (Efficient Systems and Propulsion for Small Aircraft, FP7, 2011–2015) is developing and integrating modern propulsion units for small gas turbine engines. Implementation of these novel technologies will improve the industry's ability to develop and use affordable, environmentally acceptable, and safe propulsion units while minimising operating costs. These new propulsion units have the potential to improve safety and reduce environmental impacts.

RECREATE (REsearch on a CRuiser Enabled Air Transport Environment, FP7, 2011–2015) is investigating cruiser-feeder operations for air transport of the future. This includes airworthy operational concepts for cruiser-feeder operations, such as air-to-air refuelling. Equally, preliminary design studies will be carried out on the aircraft, automatic flight control, on means to ensure reductions in overall CO_2 emissions and on concepts to transfer passengers, supplies, and waste.

ACHEON (Aerial Coanda High Efficiency Orienting-jet Nozzle, FP7, 2012–2014) is developing a thrust-vectoring propulsive concept with a multi-purpose objective: to enhance manoeuvrability that will result in shorter take-offs and landing spaces; and to improve affordability in aircraft production, by simplifying deflection systems and improving precision in jet attachment control.

ALASCA (Advanced Lattice Structures for Composite Airframes, FP7, 2010–2013) developed manufacture-optimised lattice fuselage structures based on proven space technology designs. The lattice design meets airworthiness requirements and reduces weight and costs compared to other types of fuselage structures.

COLTS (Casting of Large Ti Structures, FP7, 2010–2013) was a strategic partnership established between China and the EU. It studied cost-effective titanium alloy-based solutions for enabling significant weight savings in airframes. Adoption of such solutions have a clear potential for improved fuel economy and reduced emissions. The work addressed both the relevant material technology and manufacturing process aspects, the latter notably to allow for casting of large titanium components.

FAST20XX (Future high-altitude high-speed transport 20XX, FP7, 2009–2012) addressed the dichotomy between aeronautics and space in Europe, and addressed potential synergies through the analysis of two possible bridging-concepts:

- ALPHA, a vehicle air-launched from a carrier plane before igniting a hybrid rocket;
- SpaceLiner, an all-rocket powered design with the capability to transport approximately 50 people, long distance and in extremely short times.

Products based on the ALPHA concept could be envisaged in a horizon of five to ten years, while those based on the SpaceLiner concept would not be feasible prior to the second half of this century. FAST20XX also looked into regulatory issues that the introduction of sub-orbital flights in Europe could create.

New technologies and systems

BOPACS (Boltless assembling Of Primary Aerospace Composite Structures, FP7, 2012–2016) is developing bolt-free joining techniques for the construction of aerospace structures. State-of-the-art research and EASA airworthiness requirements indicate that the new joints could considerably reduce the weight of aerospace structures as well as the costs of their manufacture.

BUTERFLI (BUffet and Transition delay control investigated with European-Russian cooperation for improved FLIght performance, FP7, 2013–2016) is improving the performance of aircraft wings. Current wing designs are susceptible to flow instabilities, known as buffet, which generate structural vibrations that negatively affect their aerodynamic behaviour. Methods and tools are being developed for enhancing the performance of aircraft wing designs.

RESEARCH (Reliability and Safety-enhanced Electrical Actuation System Architectures, FP7, 2013–2016) is defining an electrical architecture for Flight Control System, capable of controlling a flight control surface on an Aircraft with the help of electrical operated actuators, thus replacing the hydraulic actuators commonly used in current Aircraft designs. The goal is to find a robust architecture to meet the constraints imposed by safety regulations while keeping other system performances such as weight or reliability.

STORM (Efficient ice-protection Systems and simulation Techniques Of ice Release on propulsive systeMs, FP7, 2013–2016) is validating a new component in aircraft engine architecture by simulating an ice trajectory. The investigations address ice accretion and release models and include the use of ice-phobic coatings and low-cost and low-energy anti-icing and de-icing systems. The results of the project will have the potential to strengthen the predictability of current industrial design tools, allowing narrower margins in the design of aircraft systems, thus reducing energy consumption.

TOICA (Thermal Overall Integrated Conception of Aircraft, FP7, 2013–2016) is improving modelling and simulation techniques for the thermal behaviour of airframe systems, equipment and components. The whole aircraft's thermal behaviour is being improved, and the behavioural digital aircraft environments are being extended with new capabilities that support architectural decisions.

ATLLAS II (Aero-Thermodynamic Loads on Lightweight Advanced Structures II, FP7, 2011–2015) investigates material requirements for high-speed aircrafts – notably lightweight and high-temperature resistant materials for Mach 5–6 vehicles. Based on combined aero-thermal-structural experiments, a detailed layout will be developed for a high-speed aircraft to alleviate sonic boom and emissions at high altitudes.

DISPURSAL (Distributed Propulsion and Ultra-high By-pass Rotor Study at Aircraft Level, FP7, 2013–2015) is addressing new propulsion concepts and their effects on power generation, engine-airframe integration and aircraft performance, and emissions. Making use of the results from two case studies embodying multiple propulsive devices and different propulsive fuselage concepts, a technology roadmap elaborates on the core issues underpinning the take-up of these new concepts.

FUTUREWINGS (Wings of the Future, FP7, 2013–2015) is investigating the use of piezoelectric fibres in wing structures laminates. It develops an aircraft that can fly without traditional high-velocity control surfaces, with the capability to deform its aerodynamic surface according to the requirements of the flight. The design and theoretical validation of the concept is to rely on theoretical and computational analyses to test aircraft manoeuvrability without mechanical failure. These studies will be conducive to a complete mathematical model of an aircraft with the new capability.

GO4HYBRID (Grey-area mitigation for hybrid RANS-LES methods, FP7, 2013–2015) is assessing large-eddy simulation approaches in computational fluid dynamics. The purpose is to quantify its advantages in terms of increased predictive accuracy, reduction of computational costs and enhanced professional-user friendliness.

IN-LIGHT (Innovative bi-functional aircraft window for LIGHTing control to enhance passenger comfort, FP7, 2012–2015) is investigating a new concept for a bi-functional aircraft window that combines electrochromism and Transparent Organic LED lighting. The combination of these technologies will create a versatile home/office cabin environment fully controllable by the passenger.

SARISTU (Smart Intelligent Aircraft Structures, FP7, 2011–2015) is developing smart intelligent structural concepts to reduce aircraft weight and operational costs. Material concepts for the shape and functionality of specific airframe areas are being developed and the structural feasibility of individual morphing concepts of wing design demonstrated.

STARGATE (Sensors Towards Advanced monitoRing and control of GAs Turbine Engines, FP7, 2012–2015) develops advanced sensors, instrumentation and related systems to facilitate the development of the next generation of greener gas turbine engines. In particular, the project focuses on various ultra-high-temperature pressure probes that undergo testing and evaluation.

TIDE (Tangential Impulse Detonation Engine, FP7, 2013–2015) is assessing the feasibility of functionally simpler but effective propulsion system technology capable of replacing the gas turbine in an aviation engine. The work will focus on a stable and efficient compressor, to supply the power distribution centre with the required air flow and pressure within the set of variable downstream pressure conditions. The new technology is designed to provide power to accelerate the compressor to the required speeds, whilst allowing for sufficient excess energy to power up the aircraft.

ACTUATION2015 (Modular Electro Mechanical Actuators for ACARE 2020 Aircraft and Helicopters, FP7, 2011–2014) is developing and validating improved and standardised electro mechanical actuators (EMA) for use in flight control, high-lift devices, main landing gear and doors. The EMAs are being enhanced to meet cost, reliability and weight requirements.

BRAINFLIGHT (Brain controlled aircraft flight using multiple feedback mechanisms, FP7, 2012–2014) is investigating the feasibility of performing aircraft control using neural signals emitted by the brain. The performance of this concept is being assessed with focus on identifying the best approaches for fast learning on how to control an aircraft using brain-emitted signals. The ability of pilots to multitask while using brain control will be tested as part of the research.

CERFAC (Cost Effective Reinforcement of Fastener Areas in Composites, FP7, 2010–2014) is improving the design and manufacturing of composite aero-structures towards reducing the cost of manufacture. New design concepts are developed that increase the strength-to-cost ratio and the damage tolerance of fastener areas in composite structures without reducing material stiffness.

NOVEMOR (Novel Air Vehicles Configurations: From Fluttering Wings to Morphing Flight, FP7, 2011–2015) is researching innovative aircraft configurations with new lifting concepts and morphing wing solutions to enhance aircraft lift and manoeuvrability. The new configuration is directed towards improving aircraft efficiency and aerodynamic performance whilst reducing structural loads and weight.

VR-HYPERSPACE (The innovative use of virtual and mixed reality to increase human comfort by changing the perception of self and space, FP7, 2011–2014) is investigating the requirements for a minimum physical space fulfilling a high-level of comfort and satisfaction to air passengers. A radical new approach to aircraft cabin design is being investigated for this purpose. This state-of-the-art work builds upon multidisciplinary research, including neuroscience, psychology of perception, and future visions of virtual and mixed reality technologies.

WASIS (Composite fuselage section Wafer Design Approach for Safety Increasing in Worst Case Situations and Joints Minimizing, FP7, 2011–2014) is developing an innovative composite fuselage structure concept with the potential to overtake current solutions in terms of safety and environmental performance at higher-levels of affordability. The structure is based on lattice stiffening enabling the optimisation of the geometrical and mass properties of transition zones.

CREAM (Innovative Technological Platform for Compact and Reliable Electronic integrated in Actuators and Motors, FP7, 2009–2013) improved the performance and reliability capabilities of electro mechanical actuators (EMA) in harsh thermal environmental conditions. An advanced, smart, miniaturised and reliable electronic platform that can integrate compact technologies was produced, suited for applications such as temperature control in valves and pumps. It was demonstrated that the development of this type of platforms helps reach higher levels of performance and reliability for EMAs operating in harsh conditions.

DAPHNE (Developing aircraft photonic networks, FP7, 2009–2013) increased the use of telecoms and industrial optical networking technology in aircrafts produced in Europe. Use of fibre optics and photonics provides size, weight and bitrate advantages beyond what is currently considered as state-of-the-art solutions in aircraft systems.

ELECTRICAL (Novel Aeronautical Multifunctional Composite Structures With Bulk Electrical Conductivity And Self-Sensing Capabilities, FP7, 2010–2013) developed electrical conductivity and self-sensing capabilities for application in new multifunctional composite structures. Alternative processes for manufacturing nano-reinforced carbon based composites have been developed that are fully compatible with current industrial manufacturing technologies for composite's production.

COALESCE2 (Cost efficient advanced leading edge structure 2, FP7, 2009–2012) developed integrated technology and design approaches for fixed leading edge structures. Application of these new concepts leads to reductions in manufacturing and assembly costs by 30% compared to current highly fabricated structures.

ISPACE (Innovative Systems for Personalised Aircraft Cabin Environment, FP7, 2009–2012) developed new concepts for enhanced aircraft cabin environment and passenger comfort with regard to temperature, humidity, ventilation, and well-being by controlling individual passenger climate. The work focused on the critical technologies and on the simulation tools enabling enhanced individual passenger cabin environments, and wrapped-up by issuing recommendations for current and future commercial aircraft.

SCARLETT (Scalable & Reconfigurable Electronics Platforms and Tools, FP7, 2008–2012) was a follow up to the EU-funded projects PAMELA, NEVADA and VICTORIA. SCARLETT validated innovative architectural concepts for integrated on-board electronics. The proposed avionics platform has a wide range of applicability, including a multitude of different aircraft types worldwide.

TAUPE (Transmissions in Aircraft on Unique Path Wires, FP7, 2008–2012) designed a concept for supplying an aircraft with power and data via a common cable. This was achieved by a simplification of the electrical architecture of an aircraft, notably entailing a reduction in the length and mass of the installed cables, and by the introduction of PowerLine Communication or Power over Data technologies.

TRIADE (Development of Technology Building Blocks for Structural Health Monitoring Sensing Devices in Aeronautics, FP7, 2008–2012) developed a prototype of a structural health monitoring (SHM) system, with the capability to ensure power generation, power conservation and energy management. The prototype builds upon a concept of technology building blocks which are integrated within a common platform.

EUROTURBO 8 (Support to Eighth European Conference on Turbomachinery Fluid Dynamics and Thermodynamics, Graz, March 2009, FP7, 2008–2009) focused on the theme fluid dynamics and thermodynamics in turbo-machinery design and operation to improve the technological level and competitiveness of turbomachinery design products and their operation, as part of propulsion systems and energy conversion processes.

Development and manufacturing process

ASHLEY (Avionics Systems Hosted on a distributed modular electronics Large scale dEmonstrator for multiple tYpe of aircraft, FP7, 2013–2017) is promoting the emergence and scope of the second generation of Integrated Modular Avionics (IMA2G). Based on SCARLETT and other EU and national programmes, ASHLEY…

- extends the concept of Distributed Modular Electronics (DME) to the cabin and the open world (operator and traveller) domains;
- evaluates the benefits of photonics and smart sensors and actuators;
- provides common database services both to the avionics and open world systems;
- and provides a comprehensive tool suite as a framework for the development of applications.

Four large scale simulators are developed and interconnected to validate the extended set of components and processes at (aircraft) system level.

ALAMSA (A Life-cycle Autonomous Modular System for Aircraft Material State Evaluation and Restoring System, FP7, 2012–2016) is developing an autonomous modular system for monitoring and healing aircraft structures. A crucial step of the whole process regards the development of a material with "in situ" wound healing capabilities and notably a built-in capacity to restore its mechanical properties. The restoration process enables multiple damages at the same location to be repaired.

CANAL (CreAting NonconventionAl Laminates, FP7, 2013–2016) is gathering expertise and developing tools to create optimal composite structures with reduced weight and manufacturing costs when compared to current designs. CANAL is a follow up to the AUTOW project, which develops a novel, cost-effective dry fibre placement. The present work relies on these results to develop new non-conventional composite laminate configurations using dry fibre placements.

CORSAIR (COld spray Radical Solutions for Aeronautic Improved Repairs, FP7, 2013–2016) addresses cold spray technology for maintenance and repair of aeronautic frames and components. A specific cold spray process is considered that offers advantages in powder properties and production as well as in plant design and construction. Simulation tools will be developed using predictive models to reduce the need for experimental testing in order to validate cold spray processes.

HIPOCRATES (Self-healing Polymers for Concepts on Self-repaired Aeronautical Composites, FP7, 2013–2016) is developing expertise, technologies and procedures to deliver self-repairing composite aero-structures. The self-healing performance will be enhanced via nano-technologies that are tailored to the requirements of the aviation industry. A roadmap is developed to outline a strategy of how self-repairing composite structures could become a mainstream technology.

LOCOMACHS (LOw-COst Manufacturing and Assembly of Composite and Hybrid Structures, FP7, 2012–2016) is addressing the enhancement of the performance of composite production lines by means of incorporation of advanced technology and removal of non-value added operations. Manufacturing processes for complex structural parts are to be defined and validated – including information on geometrical tolerances and variation management and increased levels of automation for part-joining operations – acting as reference baseline for the work. These procedures can result in improvements with direct benefits on the way they are manufactured and assembled.

NIOPLEX (Non-Intrusive Optical Pressure and Loads EXtraction for aerodynamic analysis, FP7, 2013–2016) develops and assesses flow-diagnostic techniques for improving aerodynamic analysis. In particular, the project further develop a new PIV based technique in order to convert it into a reliable post-processing tool for routine use in experimental aerodynamics research.

POLARBEAR (Production and Analysis Evolution for Lattice-related Barrel Elements under Operations with Advanced Robustness, FP7, 2013–2016) is addressing the development of automated manufacturing processes for specific aeronautical applications. These include the protection layer in the winding process, pre-impregnated materials, buckling analysis of non-rectangular skin bays, damage tolerance and fatigue of rib-structure. Development in these processes can increase the safety and reduce the costs of such automated manufacturing.

PUL-AERO (High-quality Curved Aerospace Composited using Pultrusion Manufacturing, FP7, 2013–2016) is engineering an advanced pultrusion line for production of curved aerospace composites. The pultrusion process creates the potential for a continuous production of this type of structures, ensuring both process repeatability and reduced production costs. Its application can therefore lead to an optimal, cost-effective and reliable processing of curved carbon fibre reinforced plastics that adhere to aerospace quality standards.

RBF4AERO (Innovative Benchmark Technology for Aircraft Engineering Design and Efficient Design-phase Optimisation, FP7, 2013–2016) is developing a parametric CFD model for particular aspects of aircraft numerical design, optimisation and other relevant aircraft design studies. This model is in line with the RBF4AERO benchmark, which enables the building up of novel optimisation environments on the basis of legacy numerical models and computing platforms. The main goals are threefold: the increase of computational speeds, the extension of the domain of numerical applicability and the increase in accuracy.

REPAIR (Future REPAIR and maintenance for the aerospace industry, FP7, 2013–2016) is proposing a paradigm shift from the current maintenance and repair procedures into part re-making and re-working. This shift is aided by the potential brought in by additive manufacturing techniques that enable development of innovative repair processes for aircraft. New processes following such philosophy are designed focusing notably on the reduction of the certification effort for the additively manufacturing of spare parts, minimising both industrial setup times and production costs.

UMRIDA (Uncertainty Management for Robust Industrial Design in Aeronautics, FP7, 2013–2016) is assessing current robust design and uncertainty management methods to enhance the level of confidence in uncertainty-based design and simulation. Industry-grade robust design and uncertainty management methods and relevant tools capable of handling large numbers of operational and geometrical uncertainties within acceptable turnaround times are developed. These should enable further integration of uncertainty within the design and simulation-based decision processes.

VIBRATION (Global in-flight health monitoring platform for composite aerostructures based on advanced VIBRATION-based methods, FP7, 2013–2016) is developing a prototype, "in-flight" vibration-based SHM platform for composite aerostructures which operate using a reasonable number of sensors, and which account for the actual in-flight conditions of aerostructures.

CHANGE (Combined Morphing Assessment Software using Flight Envelope Data and Mission Based Morphing Prototype Wing Development, FP7, 2012–2015) addresses the design of a novel morphing system for aircraft wings. The proposed morphing system adapts the wing shape to changing requirements. Work is directed towards reducing wing fuel consumption while improving aerodynamic controllability and manoeuvrability.

QUICOM (Quantitative inspection of complex composite aeronautic parts using advanced X-ray techniques, FP7, 2012–2015) is implementing innovative platforms for detailed inspection of composite materials. Whilst the latter make aircraft more energy-efficient, they are difficult to inspect using conventional non-destructive testing methods. For the short term, current inspection methods are being improved with advanced X-ray technology. These are expected to replace existing techniques in the long term.

AIM2 (Advanced In-flight Measurement Techniques 2, FP7, 2010–2014) is improving measurement techniques for flight tests that will validate new and modified aircraft designs. A previous project (AIM) tackled a similar problem through the application of modern optical measurement techniques commonly used in industrial wind tunnels. AIM2 extends ground-based AIM techniques to in-flight testing, with a view of reducing both testing times and costs.

INMA (Innovative Manufacturing of complex Ti sheet aeronautical components, FP7, 2010–2014) is developing a knowledge-based, flexible manufacturing technology for titanium shaping. The work is directed towards reducing tooling costs for titanium parts by 80%, product lead time by 90%, and buy-to-fly ratios by 20%.

PRIMAE (Packaging of futuRe Integrated ModulAr Electronics, FP7, 2010–2014) is developing techniques for reducing the volume and weight of electronics packaging in aircraft systems which will lead to a reduction in cost and lead-time. After undergoing standardisation, it is intended to replace the 35-year old ARINC 600 standard for packaging.

RECEPT (RECEPTivity and amplitude-based transition prediction, FP7, 2011–2015) is designing advanced transition control devices that achieve a reduction in fuel consumption and thus emissions. Theoretical and numerical studies have been performed, culminating in the development of an amplitude-based prediction method for analysing flow patterns, disturbances and turbulence in wind tunnels and free-flight conditions. These techniques will contribute towards devising more robust design approaches that will reduce the environmental impact of future aircrafts.

AFDAR (Advanced Flow Diagnostics for Aeronautical Research, FP7, 2010–2013) developed new three-dimensional analysis techniques for future aircrafts and external components. Particle image velocimetry (PIV) for measurement of the flow field around aerodynamic bodies and a high-speed version of the (planar) technique for analysing unsteady aerodynamic problems were at the core of the developed techniques.

DAEDALOS (Dynamics in Aircraft Engineering Design and Analysis for Light Optimized Structures, FP7, 2010–2013) developed techniques to predict the forces acting on fuselage structures and energy dissipation around the load. These techniques will contribute to defining more realistic design loads that ensure significant benefits in terms of weight reduction and improvement of aircraft safety.

DESIREH (Design, simulation and flight Reynolds number testing for advanced high-lift solutions, FP7, 2009–2013) improved laminar wings' industrial design process for purposes of enhancing the efficiency of the high-lift design process and reduction in development costs. These improvements will lead to more robust and cost-effective design approaches with the potential to significantly improve the quality and decrease the time-to-market for new wings.

DOTNAC (Development and Optimization of THz NDT on Aeronautics Composite Multi-layered Structure, FP7, 2010–2013) developed a safe, contact-free, high resolution, non-destructive technique (NDT) based on THz waves, with the potential for use in on-site testing. In particular, this will enable aircraft manufacturers to perform on-site inspection of composite materials during production, fulfilling needs that cannot be met with established NDT approaches.

IDIHOM (Industrialisation of High-Order Methods – A Top-Down Approach, FP7, 2010–2013) worked on fast and accurate numerical methods to support CFD-aided design in the aerospace industry. These advanced CFD methods fulfil the requirements for the analysis of highly complex flows, enabling a cost-effective method to achieve higher predictive accuracy when compared to current practices.

INFUCOMP (Simulation based solutions for industrial manufacture of large infusion composite parts, FP7, 2009–2013) developed a full simulation chain for Liquid Resin Infusion (LRI) manufacturing of large aerospace composite structures dedicated to solutions required by the European aircraft industry. Extensive materials testing for a range of dry fabrics and permeability characterisation has been conducted from which new constitutive laws were developed. Software developments were implemented into an existing infusion code PAM-RTM which was developed for Resin Transfer Moulding (RTM) processes.

MAAXIMUS (More Affordable Aircraft Structure through Extended, Integrated, and Mature Numerical Sizing, FP7, 2008–2013) demonstrated the fast development and right-first-time validation of a highly-optimised composite airframe. This was achieved through coordinated developments on a physical platform (development and validation of appropriate composite technologies for low weight aircraft) and a virtual structure development platform (towards identifying faster and validating earlier the best solutions).

ACCENT (Adaptive Control of Manufacturing Processes for a New Generation of Jet Engine Components, FP7, 2008–2012) applied adaptive control techniques to components manufacturing, directed towards reducing process time, and to guarantee a more consistent quality in terms of geometry, surface and sub-surface properties. Activities focused notably on the optimisation of tool usage, the elimination of costly part re-validation, and quality improvements through optimisation of machined surfaces.

ADMAP-GAS (Unconventional (advanced) manufacturing processes for gas-engine turbine components, FP7, 2009–2012) responded to market demand for more efficient, reliable and affordable gas turbines. Particular emphasis was devoted to the use of alternative more cost-effective and flexible manufacturing processes to replace the conventional production methods used nowadays in gas turbine production. The objectives where fulfilled through reductions in tool manufacturing and maintenance costs, and the adoption of continuous production processes and flexible production lines.

ALEF (Aerodynamic loads estimation at extremes of the flight envelope, FP7, 2009–2012) created aerodynamic models of a complete aircraft for predicting aircraft loads during extreme conditions of the flight envelope, therefore significantly reducing the needs for costly wind tunnel testing.

ATAAC (Advanced turbulence simulation for aerodynamic application challenges, FP7, 2009–2012) made further improvements to computational fluid dynamics (CFD) methods for aerodynamic flows – notably in regards to the accuracy of turbulence modelling of high Reynolds numbers flows which are characteristic of real-life conditions.

ATOS2012 (International Air Transport and Operations Symposium 2012, FP7, 2012) explored ways to deliver sustainable value in the aviation business in a demanding economic environment. The symposium encouraged a shift to a new value-added operations methodology to raise the profile of operations as well as an increased emphasis on aircraft research with a view to heighten performance in terms of costs, environment, safety and capacity.

CRESCENDO (Collaborative & Robust Engineering using Simulation Capability Enabling Next Design Optimisation, FP7, 2009–2012) improved the aeronautics supply chain through the provision of advanced complex products management techniques. The latter included advanced analysis and design methods and tools all compounding to enable overall reductions in product cost and time to market.

ELUBSYS (Engine LUBrication SYStem technologies, FP7, 2009–2012) improved the performance of lubrication systems for turbines through better understanding of oil behaviour and of innovative seal technologies. Such insight led to improvements in the monitoring of engine oil quality, with consequent benefits in terms of reduction of the complexity and the mass of the lubrication system, and enhancements to the bearing capacity and the reliability of the latter.

EXTICE (EXTreme ICing Environment, FP7, 2008–2012) tackled the development of improved methods and tools for aircraft design and certification in an icing environment – in the wake of the many reported incidents caused by super-cooled Large Droplet conditions. These new techniques will enable safer designs with reduced development costs.

FANTOM (Full-field Advanced Non Destructive Technique for On-line Thermo-mechanical Measurements on Aeronautical Structures, FP7, 2008–2012) developed an advanced non-destructive technique (NDT) for aeronautic composite structure inspection. The new technique combines thermography and holography/shearography methods, which are non-contact full-field optical techniques already applied individually in the aeronautical sector, within a powerful and robust combination that enhances the capability and reliability of the inspection processes for these types of components.

FFAST (Future Fast Aeroelastic Simulation Technologies, FP7, 2010–2012) developed, implemented and assessed a range of numerical simulation technology candidates that can accelerate future aircraft design. FFAST focused on the reduction of the number of critical load cases analysed, on the extraction of aerodynamic and aeroelastic reduced order models (ROMs). These were suitable for loads analysis, from complex full order models, and on the reduction of the time needed for each simulation, by using innovative mathematical techniques.

FLEXA (Advanced Flexible Automation Cell, FP7, 2008–2012) created a production unit for aircraft manufacturing based on the use of state-of-the-art flexible automation technology developed by the automotive sector. The proposed concept reduces manufacturing costs and enhances production flexibility when compared to the practices used currently by the European aerospace industry.

GLFEM (Generic linking of finite element based models, FP7, 2009–2012) explored and improved the capabilities of multi-scale finite element coupling techniques in the design of thin-walled airplane components. Interactions between finite element models were defined in order to enable automatic coupling between local and global finite element analyses leading to more robust, effective and easy to use methods that are in clear advance over current approaches.

HIRF SE (HIRF synthetic environment, FP7, 2008–2012) designed a computational environment for airframes that has the feature of including electro-magnetic components in the airframe design in an early stage of the development process. This approach has the potential to significantly reduce costs throughout the airframe development process notably by lowering the need for potential re-work required by the optimisation of electro-magnetic components integration which nowadays is only carried out during the test phase.

IAPETUS (Innovative Repair of Aerospace Structures with Curing Optimisation and Life Cycle Monitoring Abilities, FP7, 2009–2012) developed innovative material and repair technologies for metallic and composite aircraft applications based on new hybrid composite systems which incorporate carbon nanotubes both in the composite matrix and in the adhesive. The new repair method has enhanced performance in reducing galvanic corrosion, enhancing fatigue resistance, and inhibiting crack propagation.

IMAC-PRO (Industrialisation of Manufacturing Technologies for Composite Profiles for Aerospace Applications, FP7, 2008–2012) outlined an integrated process for the cost-effective serial production of optimised carbon-fibre-reinforced polymer stiffener profiles (e.g., frames, stringer, struts, floor beams, drive shafts).

MISSA (More Integrated Systems Safety Assessment, FP7, 2008–2012) developed system safety analysis methods and tools that led to a reduction in development costs. MISSA delivered capabilities at the three Aircraft Systems Development Levels – at the Aircraft level, the Systems Architecture Level and the Systems Implementation level. MISSA has also considered the transverse aspects of systems development related to safety argumentation, evidence synthesis, traceability and configuration control.

PICASSO (imProved reliabIlity inspeCtion of Aeronautic structure through Simulation Supported POD, FP7, 2009–2012) investigated the use of non-destructive testing techniques (NDT) to obtain Probability of Detection (POD) curves which is a pivotal concept in the maintenance of metallic parts within the engine and aircraft industry. An innovative technique for simulation-supported acquisition of POD curves was developed based on a combination of data from real and simulated NDT inspections. The latter enables not only an increase in the accuracy of the whole process but also a reduction in the costs of data collection during the POD campaigns – through replacing or complementing direct measurements with simulated data.

AISHA II (Aircraft Integrated Structural Health Assessment II, FP7, 2008–2011) developed an advanced monitoring system for assessment of the structural state of an aircraft based on the use of extended sensor networks. By ensuring continuous damage assessment, this monitoring system enables switching to condition-based maintenance schedules which may conduce to significant cost and time gains for aircraft operators.

EVITA (Non-destructive EValuation, Inspection and Testing of primary Aeronautical composite structures using phase contrast X-ray imaging, FP7, 2008–2011) developed a technique for improving the evaluation and inspection of primary aeronautical composite structures based on grating-based phase contrast X-ray imaging (XPCI) technology. The latter increases the speed, resolution and versatility of the inspection processes and is applicable to a wide range of composites. The new technique was devised as a means to support inspection activities linked to the design, manufacturing and assembly of such structures.

VISION (Immersive Interface Technologies for Life-cycle Human-oriented Activities in Interactive Aircraft-related Virtual Products, FP7, 2008–2011) specified and developed key interfaces to enhance the realism of aircraft-related virtual reality (VR) environments. The goal was to raise acceptability of the VR simulation by users, leading to an optimised human-virtual product integration.

Innovative business models, regulations and incentives

Study on the Impact of Directive 96/67/EC on Ground Handling Services (European Commission, DG MOVE, 2009) evaluated the impact on new EU Member States of the application of Council Directive 96/97/EC (on the liberalisation of ground handling at EU airports) and updated the International Air Transport Consultancy report with additional information on employment, safety and security issues. This latter report focused on measures that decrease prices and at increasing competition in ground handling services.

4. Sub-Theme: Protecting the Environment and the Energy Supply

Continued growth of the EU aviation sector largely depends on the ability to reduce the environmental impacts of such increased operation whilst securing a sustainable energy-supply for the sector. The development and implementation of green technologies and alternative energy sources as well as changes in current operational practices are deemed pivotal to guarantee that ambitious policy goals on sustainable air transport are feasible and capable of being delivered.

In 2011, the global aviation sector produced 650 million tonnes of CO_2 emissions, representing 2% of human-induced CO_2 emissions (EC, 2011b and IATA, 2011). Air traffic is forecast to continue growing (Airbus, 2012 and EC, 2013b). Unless major operational and technological changes are undertaken, CO_2 emissions and other environmental impacts of air transport, such as noise nuisances and air pollution, will continue to increase, eventually hampering the capability to sustain the forecast growth of the sector. To enable a decrease in the EU's aviation environmental footprint towards environmentally sustainable air transport (EC, 2011a), innovation has to be considered from a holistic perspective that encompasses the development of more efficient and environmentally-friendly aircraft and engines, alternative energy sources, re-engineered air operations that are ultimately kinder for the environment, all compound towards supporting new multifaceted policy frameworks – cf. aviation, trade, environment, climate change – able to better and more cost-effectively promote the sustainability of air transportation.

Research projects are grouped as follows:

- **Dynamic allocation of targets and research priorities**: definition, implementation and assessment strategies for environmentally-related research activities.
- **Air vehicles of the future**: innovative technologies and vehicle concepts to strengthen environmental sustainability.
- **Air operations and traffic management**: restructuring of air traffic management for reducing emissions from aviation.

- **Airport environment**: developing customer-oriented airport services while mitigating negative environmental impacts.
- **Alternative energy sources**: affordable, sustainable and alternative energy sources for commercial aviation.
- **Mastering aviation's climate impact**: developing the scientific understanding of the aviation's climate impacts.
- **Incentives and regulations**: developing an appropriate legislative framework to increase the sustainability of air transport.

Dynamic allocation of targets and research priorities

No research has been conducted in this area.

Air Vehicles of the future

Noise reduction

COBRA (Innovative Counter-Rotating Fan System for High Bypass-ratio Aircraft Engine, FP7, 2013–2017) is a joint co-operation between EU and the Russian Federation to reduce the noise levels of counter-rotating fans, by exploring higher bypass ratios and increased diameters. This will result in a reduction of blade tip speed and blade counts while maintaining or increasing the aerodynamic efficiency of the fan. The counter-rotating fan is an important asset for noise reduction and the present work reinforces the co-operation in aeronautical research and innovation between the EU and the Russian Federation.

IDEALVENT (Integrated Design of Optimal Ventilation Systems for Low Cabin and Ramp Noise, FP7, 2012–2016) is modelling innovative noise reduction technologies targeted at the design of ventilation systems. Flow and acoustic interactions are being analysed and simulated to have a better grasp on the related phenomena and novel components based on butterfly valves and fans with inlet distortion or downstream obstacles which will be trialled.

JERONIMO (JEt noise of high bypass RatiO eNgine: Installation, advanced Modelling and mitigatiOn, FP7, 2012–2016) is addressing jet noise characterisation in ultra-high bypass ratio engines. The results will reduce the uncertainties in the characterisation of jet noise, through improvements in simulation tools for prediction of flight stream effects and the availability of a consistent database for noise test facilities for use by engine and aircraft manufacturers. This will contribute towards improving the efficiency of new ultra-high bypass ratio engines and to facilitate their testing.

RECORD (Research on Core Noise Reduction, FP7, 2013–2015) is broadening the understanding of noise generation and propagation in aero-engines. The goal is to reach more reliable and robust prediction tools, combining analytical and numerical approaches, for supporting core noise reduction as a further contribution to the deployment of low-noise propulsion and low-emission aircraft.

ORINOCO (cOoperation with Russia in the field of advanced engIne NOise COntrol based on plasma actuators, FP7, 2010–2014) is investigating advanced engine noise control based on the use of plasma actuators. Theoretical, numerical and experimental investigations are being carried out for establishing the performance of plasma actuators-based control in the reduction of jet noise emissions.

NINHA (Noise Impact of aircraft with Novel engine configurations in mid- to High Altitude operations, FP7, 2010–2013) assessed whether en-route aircraft noise poses a hazard for the introduction of a new generation of counter-rotating open rotor (CROR) aero-engines designed for reducing fuel consumption and CO_2 emissions. Long-range noise prediction models and CROR noise source prediction models were developed and used to gain insight into en-route noise metrics and noise annoyance and perception. Based on these findings, recommendations on possible future en-route noise evaluation processes are drafted.

OPENAIR (OPtimisation for low Environmental Noise impact AIRcraft, FP7, 2009–2013) investigated numerical and active control techniques for reducing noise emissions from aircraft engines, landing gear and wings. The application of such techniques – notably of computational aero-acoustics applied to the major noise sources and the use of adaptive and flow control techniques – enabled the delivery of a 2.5 dB step change in noise reduction.

COSMA (Community Oriented Solutions to Minimise Aircraft Noise Annoyance, FP7, 2009–2012) developed engineering criteria for future aircraft design and operations to reduce external aircraft noise in airport surrounding areas.

FLOCON (Adaptive and Passive Flow Control for Fan Broadband Noise Reduction, FP7, 2008–2012) developed innovative concepts for reducing fan broadband noise – which is a significant noise source in modern aircraft – based on the use of flow control technologies. The design, assessment and development of such noise reduction concepts was supported through both research on gaining further understanding of the fan mechanisms and simulation studies using high fidelity numerical models.

TEENI (Turboshaft Engine Exhaust Noise Identification, FP7, 2008–2012) increased the understanding of aeronautical noise of engine modules, and notably the contribution of turboshafts. Sensors for full-scale measurement of engine noise were developed providing the means for the set-up of a comprehensive full-scale engine test database.

VALIANT (VALidation and Improvement of Airframe Noise prediction Tools, FP7, 2009–2012) investigated broadband noise generated by turbulent flow around airframes and notably landing gears, slats and flaps. High-quality experimental data was collected and validated serving as a basis for improving current simulation tools for airframe noise prediction.

Emission reduction through engine efficiency

ENOVAL (Engine mOdule VALidators, FP7, 2013–2017) is seeking to develop optimal propulsion system concepts, with reduced fuel consumption and noise emissions, addressing the design and mission requirements of small- to medium-range and long-range applications. The goal is to be achieved through a combination of state-of-art technologies that are fit for purpose. The use of a range of established industrial preliminary engine design tools and methods is a given requirement of the research in order to accelerate the take-up of the new concepts once proven successful.

E-BREAK (Engine Breakthrough Components and Subsystems, FP7, 2012–2016) is adapting new aero-engine sub-systems to deliver higher thermal and propulsive efficiencies resulting in reduced fuel burn, emissions and noise. This is to be achieved through the improvement of the overall pressure ratios and the bypass ratios of the engines.

IMPACT-AE (Intelligent Design Methodologies for Low Pollutant Combustors for Aero-Engines, FP7, 2011–2015) is developing and validating highly efficient aero-engine combustors. The new designs reduce NO_x emissions, allow scaling of the combustor to different types of engine structures, and optimise the combustor for delivering high combustion efficiency.

LEMCOTEC (Low Emissions Core-Engine Technologies, FP7, 2011–2015) is working towards the improvement of the thermal efficiency in engines by increasing overall pressure ratios. This leads to reductions in CO_2 and NO_x emissions. New engine designs are being evaluated in an extensive manner using both simulation and experimental techniques.

AHEAD (Advanced Hybrid Engines for Aircraft Development, FP7, 2011–2014) is investigating a hybrid-engine concept incorporating bleed cooling and dual hybrid combustion systems using hydrogen and bio-fuels. The feasibility of the concept and its potential to substantially reduce engine emissions, installation drag, and noise for future air vehicles has proven very promising.

FACTOR (Full Aero-thermal Combustor-Turbine interactiOn Research, FP7, 2010–2014) is optimising combustor-turbine interactions enabling lower-cost and lighter turbines with reduced emissions. An innovative test platform is developed for aerodynamic and aero-thermal measurements under engine representative conditions. Collected data will be fed into design and simulation techniques for the purpose of optimising high-pressure turbine (HPT) components – most notably, future combustor-turbine systems for the next generation of lean burn combustion systems that have complex and severe flow constraints.

ERICKA (Engine representative internal cooling knowledge and applications, FP7, 2009–2013) tackled the improvement of turbine blade cooling technology for increasing engine efficiency. This was based on the development of new simulation and optimisation tools and enhanced test measurement practices for prediction and characterisation of flow and heat transfer fields in the turbine.

DREAM (Validation of radical engine architecture systems, FP7, 2008–2010) worked on reducing CO_2 and NO_x emissions and noise of engines by considering the whole engine architecture, and the application of innovative systems, like direct drive open rotor and alternative fuels demonstrations.

Emission reduction through weight reduction

SHEFAE (Surface Heat Exchangers for Aero-Engines, FP7, 2013–2016) is developing and demonstrating an advanced, light and cost-efficient structural surface cooler mounted in an appropriate core fairing composite structure. The latter will use novel structural design and advance manufacturing techniques, as well as new concepts in utilising air washed surfaces on the engine. Light and durable joints with a strong load path are being investigated to handle dissimilar degrees of thermal displacement.

ENCOMB (Extended Non-Destructive Testing of Composite Bonds, FP7, 2010–2014) is identifying, developing and adapting methods for the assessment of adhesive bond quality in composite material structures. The enhanced quality assurance enabled by advanced methods increases the leeway for the use of lightweight composite materials in aerospace structures, with subsequent benefits in the reduction of airframe weight and CO_2 emissions.

HYSOP (Hybrid Silicide-Based Lightweight Components for Turbine and Energy Applications, FP7, 2010–2014) is developing novel solutions for the manufacturing of lightweight, high temperature turbine components including new coating systems resistant against oxidation and water vapour. Application of such components lead to increased turbine efficiency by reduction of weight, fuel consumption and cooling requirements.

ADVITAC (ADVance Integrated composite TailCone, FP7, 2009–2012) improved understanding of automatic manufacturing processes for lightweight airframe structures and materials to develop cost-effective approaches for aircraft weight reduction, in particular for complex parts such as the tailcone.

FUTURE (Flutter-free Turbomachinery Blades, FP7, 2008–2012) improved aeromechanical analysis and design methods for lightweight blades in high efficiency and lower emissions aero-engines and turbines. The use of such blades contributes to an efficient management of flutter problems that reflect positively on the reduction of aircraft development costs.

SADE (Smart High Lift Devices for Next Generation Wings, FP7, 2008–2012) evaluated the feasibility of advanced morphing technologies in shape-changing airframe structures. High lift morphing devices for laminar wing concepts were devised to reduce system complexity and mass, enabling steeper climb during take-off, and lessening of noise emissions and energy consumption. A scaled prototype was tested in wind tunnel.

Flight efficiency

AFLONEXT (Active FLOw loads and noise control on NEXT generation wing, FP7, 2013–2017) is developing methods to increase performance in take-off and landing as well as in low- and high-speed cruising conditions through the application of flow-control technologies in the optimisation of: hybrid laminar flow for friction drag reduction; flow conditions on wing trailing edges; airframe noise during landing; and, vibrations in the undercarriage area.

MORPHELLE (MORPHing enabling technologies for propulsion system nacELLEs, FP7, 2013–2015) is investigating and evaluating new active nacelles concepts for improving aerodynamics, aero-acoustics and engine performance in multiple flight conditions. The emphasis is on nacelle inlets and cowling, as well as on a smooth and continuous shape change. A promising morphing nacelle concept will be selected for in-depth research, with its performance and feasibility assessed by both numerical simulation and mechanical testing. The results of this overall effort are used in developing a technology roadmap.

PEL-SKIN (PEL-SKIN: A novel kind of surface coatings in aeronautics, FP7, 2013–2015) is researching the effects of a novel airfoil coating technique using flexible fibres to reduce drag and to improve aerodynamic performance and manoeuvrability, therefore to lessening the environmental impacts of future aircraft.

SOAR (DiStributed Open-rotor AiRcraft, FP7, 2013–2015) is assessing a revolutionary horizontal-axis open-rotor configuration, capable of generating thrust over the entire span of the wing by means of a full-span cross-flow fan. A cross-flow fan-propelled wing section is being built and optimised by means of both computational fluid dynamic simulations and wind tunnel testing. Technology readiness level will be evaluated, potential barriers identified, and a roadmap prepared for the continued development of the SOAR technology.

TFAST (Transition Location Effect on Shock Wave Boundary Layer Interaction, FP7, 2012–2016) is examining the effects of flow separation on reducing drag and losses. Case studies are performed on shock waves on wings, turbines, compressor blades and supersonic intake flows. These studies support the investigation of novel flow control techniques with the potential to contribute towards greener aircraft.

MARS (Manipulation of Reynolds Stress for Separation Control and Drag Reduction, FP7, 2010–2013) investigated the behaviour of Reynolds stresses on flow control techniques. Such insight has led to significant improvements in the control of effective separation and in drag reduction, contributing to enable the control of larger scale structures.

PLASMAERO (Useful PLASMa for AERODynamic control, FP7, 2009–2012) demonstrated the use of surface and arc discharge plasma actuators in optimising aerodynamic performance, therefore contributing to the development of greener aircraft.

ACFA 2020 (Active Control for Flexible 2020 Aircraft, FP7, 2008–2011) developed a multi-channel control architecture for load alleviation of blended wing body aircrafts, which improves ride comfort and the handling qualities of such aircraft. The new solutions are also conducive to an increased efficiency and reduced structural weight.

Energy efficiency

DERPHOSA (Technology Development of Remote Phosphor for Avionic Cockpit Displays, FP7, 2012–2014) is improving avionic displays in cockpits of fixed wing aircraft and helicopters. Current Liquid Crystal Displays are being adapted with LED backlight to colour conversion concept based on remote phosphor. The adaptation simplifies the avionic displays, improves quality, reliability and power efficiency, while reducing product cost and the needs for maintenance.

FIRST (Fuel Injector Research for Sustainable Transport, FP7, 2010–2014) is developing key technologies for reduction of combustion emission through better control of fuel injection, atomisation and mixing. Design tools and techniques for modelling and controlling fuel sprays and soot have been improved as a support to the fulfilment of the project's objectives.

KIAI (Knowledge for ignition, acoustics and instabilities, FP7, 2009–2013) delivered new CFD tools for assessment of unsteady phenomena caused by the instability of low NO_x technologies. The new tools are to be used in the design of conventional combustors and in the prediction of the behaviour of low NO_x combustors, enabling the development of cleaner combustors through a deeper understanding of the relevant combustion phenomena.

TECC-AE (Technologies Enhancement for Clean Combustion in Aero-Engines, FP7, 2008–2012) assessed the feasibility of lean combustion by means of the use of internally staged injectors capable of providing full combustor operability during all cycles and of suppressing the occurrence of thermo-acoustic instabilities. This novel technology contributes notably to the reduction of NO_x emissions.

Other projects

AEROMUCO (AEROdynamic Surfaces by advanced MUltifunctional COatings, FP7, 2011–2013) developed and evaluated alternative, active and passive surface protection systems against the impact of sand, water droplets, insects, ice crystals and other particles during flight. Through comprehensive testing and assessment of the kinetic enzyme processes in coating materials, a methodology for customising coatings for specific aircraft components was developed. These developments are expected to contribute to both fuel savings and reductions in CO_2 and NO_x emissions.

MERLIN (Development of Aero Engine Component Manufacture using Laser Additive Manufacturing, FP7, 2011–2014) is addressing novel techniques for the manufacturing of civil aero engines using laser additive methods. The application of these techniques results in almost 100% of material utilisation, reducing losses and minimising the environmental impact of engine production.

Improved air operations and traffic management

REACT4C (Reducing Emissions from Aviation by Changing Trajectories for the Benefit of Climate, FP7, 2010–2012) assessed the feasibility of adopting new routes and flight altitudes that lead to reduced fuel consumption and emissions – using numerical techniques that combined atmospheric models and air traffic management tools.

Airport environment

No research has been conducted in this area.

Alternative energy sources

HYPSTAIR (Development and Validation of Hybrid Propulsion System Components and Subsystems for Electrical Aircraft, FP7, 2013–2016) is designing a hybrid propulsion system in certifiable form for standard category general aviation aircraft. All components of the hybrid drive system will be sized both for individual efficiency and total system efficiency and performance. A specific human-machine interface is being designed, developed and validated to enable the pilot to intuitively exploit the benefits of hybrid propulsion for purposes of energy and safety efficiency and to reduce pilot workload compared to operating a piston engine. The hybrid propulsion system will be fitted into an integrated laboratory platform incorporating all aspects of safe and efficient control to form a total integrated power solution. Requirements for regulations for hybrid drive systems are to be defined in collaboration with the relevant regulatory authorities, paving the way for market introduction.

CHATT (Cryogenic Hypersonic Advanced Tank Technologies, FP7, 2012–2015) is developing novel technologies required for systems using new propellants, such as liquid hydrogen, liquid methane and liquid oxygen. These involve new materials and design concepts with potential to lead to a reduction in tank weight and an increase in structural performance.

ITAKA (Initiative Towards sustAinable Kerosene for Aviation, FP7, 2012–2015) is facilitating the use of biofuels in aviation. It addresses the relevant social, environmental and economic factors associated with the use of biofuels. A European supply chain for sustainable kerosene (focusing on the HEFA pathway) is being developed on a scale large enough to enable operational and technical testing in logistic systems and flight operations to be performed.

SOLAR-JET (Solar chemical reactor demonstration and Optimization for Long-term Availability of Renewable JET fuel, FP7, 2011–2015) is assessing the feasibility of using solar thermochemical kerosene as a sustainable and scalable supply of renewable aviation fuel. This alternative of producing kerosene involves the combination of sunlight and CO_2 and H_2O in a Fischer-Tropsch type process presenting potential economic benefits and a greener fuel source when compared with other available production options.

GABRIEL (Integrated Ground and on-Board system for Support of the Aircraft Safe Take-off and Landing, FP7, 2011–2014) is investigating whether magnetic levitation assisted take-off and landing is both feasible and cost effective. This is based on the rationale that using ground power to launch an aircraft would reduce both the required take-off thrust and, aircraft weight, therefore reducing noise and CO_2 and NO_x emissions.

ALFA-BIRD (Alternative Fuels and Biofuels for Aircraft Development, FP7, 2008–2012) addressed alternative fuels for aviation. On the basis of the performance of experiments and operational tests, the adequacy to aircraft requirements of five alternative fuels was assessed, together with their environmental and economic performance.

GREENAIR (Generation of Hydrogen by Kerosene Reforming via Efficient and Low Emission new Alternative, Innovative, Refined Technologies for Aircraft Application, FP7, 2009–2012) investigated methods for generating hydrogen from kerosene allowing for the continuous operation of a fuel-cell system on board of an aircraft. The fuel cells generate additional electric power on board, greatly simplifying the secondary energy systems of an aircraft.

Mastering aviation's climate impact

TOSCA (Technology Opportunities and Strategies towards Climate-friendly Transport, FP7, 2009–2011) identified promising technologies as well as fuel pathways with potential to reduce greenhouse gas emissions from transport in the short and long term. Results of the technical and economic feasibility studies indicate that energy consumption could potentially be reduced by 30 to 50% in most transport modes using technology that is expected to be commercialised in the 2020s. Despite this performance, it is not expected that exploiting the full potential can be done without some form of regulatory intervention. By 2050, however, technology measures alone will not lead to a sufficient reduction in transport greenhouse gas emissions in line with EU climate goals. The challenge will be then to a gain better insight of potential for behavioural measures, such as reducing the need for transport and shifting to low-emission transportation modes, as means to mitigate greenhouse gas emissions.

Incentives and regulations

RETROFIT (Reduced Emissions of TRansport aircraft Operations by Fleetwise Implementation of new Technology, FP7, 2010–2012) identified potential retrofitting programmes to cut emissions from aircrafts currently in service in the EU. Requirements in research and technology development were specified to support the aircraft industry in implementing such retrofit programmes to enable they have sufficient impact. Three promising retrofitting technologies were subjected to cost-benefit analysis:

- avionics compatible with technology and operational guidelines developed by SESAR;
- new high-bypass-ratio engines for the A320 aircraft;
- technology for taxing using internal power.

Recommendations were made for the inclusion of a retrofit element in all research projects pursuing the development of new aircraft technology, and for virtual testing and certification-related research to decrease the time and cost of certification of aircraft retrofits.

TEAM_PLAY (Tool Suite for Environmental and Economic Aviation Modelling for Policy Analysis, FP7, 2010–2012) investigated the interdependencies and trade-offs between noise, gas emissions, and environmental and economic impacts in air transport through the application of an improved set of modelling techniques. The latter provide the range of functionalities required for policy and regulation assessments, being based on a common infrastructure and an improved interconnectivity between models.

Aircraft Noise Exposure at and around Community Airports: Evaluation of the Effect of Measures to Reduce Noise (European Commission, DG MOVE, 2007) evaluated changes in noise levels at EU airports since the introduction of EU Directive 2002/30. The assessment included analysis of the planned and implemented noise mitigation measures around EU airports, and analysed measures in current and future legislation to reduce aircraft noise. The study took into account the endogenous (like the type of aircraft) as well as exogenous (like economic growth or EU population distribution) factors and policy changes since the introduction of the Directive 2002/30.

5. Sub-Theme: Ensuring Safety and Security

Air safety and security are essential for an efficient and trustworthy air transport system. However, safety and security challenges are mounting as a result of the growth in global traffic and of the threats evolving from the world instabilities. Facing such challenges requires a pro-active stance from the EU to ensure a capability to handle rather than to react to their aftermaths.

As the EU strives to be world leader in safety and security of air transport (EC, 2011a), there is a need to continuously improving safety and security technologies and processes. In the safety front, and in view to cope with the expected rise in air traffic, the EU is supporting innovation on safer air traffic operations and aircraft controlling technologies (ACARE, 2012) whilst addressing new human-centred technologies and processes to reduce the vulnerability of the human factor in air transport (EC, 2011b). In terms of security, since the threat of terrorism remains a major security issue at airports, the EU research has been oriented towards supporting the development of a set of common standards and rules to protect the civil aviation activity (EC, 2013c).

Research projects and studies are grouped as follows:

- **Expectations of society**: for increased safety and security levels.
- **Air vehicle operations and traffic management**: towards enhancing safety and security.
- **Design, manufacture and certification for safety and security**: aircraft and technologies to increase safety and security.
- **Human factors**: on reducing the vulnerability of the human factor in aviation operations.

Expectations of society

PROSPERO (PROactive Safety PERformance for Operations, FP7, 2012–2015) is delivering a common set of methods and tools to support the management of safety in air transport operations and traffic management – notably directed to improving anticipation of and response to emergencies leading to significant reductions in travel accident rates. Work focuses on a concept for performance indicators, a methodology for operational system analysis, a generic system-risk-management process and a software system to support operation and traffic management.

Implementing Regulation (EU) No 1082/2012 amending Commission Regulation (EU) No 185/2010 in respect of EU Aviation Security Validations (European Commission, DG MOVE, 2012) analysed the effects of the new Air Cargo and Mail Carrier regulation on flight security and cooperation. It was reported that the regulation has contributed to enhancing security of air cargo originating from countries external to the EU through a voluntary adherence to a flexible reporting framework that provides for a better acknowledgement of security strengths and vulnerabilities.

SVETLANA (Safety (and maintenance) improVEment Through automated fLight data ANAlysis, FP7, 2010–2012) developed a standardised, automated process to manage and perform analytics in large amounts of flight data. This enables airline operators to examine individual flight data with advanced and sophisticated algorithms in order to detect early-warning signs of the emergence of potential unsafe trends and to improve maintenance by predicting possible hardware failures.

Legal situation regarding security of flights from third countries to the EU (European Commission, DG MOVE, 2010) investigated the potential security risks associated with flights originating from countries outside the EU. A method was proposed to enhance the application of security standards that may contribute to heighten the security performance in those countries. The method included notably a "name and shame" policy and the sharing of safety audit information which have both proven to be rather effective in such a context.

Air vehicle operations and traffic management

In this section research projects are focussing and have concentrated on weather and environmental impact mitigations.

HAIC (High Altitude Ice Crystals, FP7, 2012–2016) is characterising mixed phase and glaciated icing conditions and is developing Acceptable Means of Compliance for test facilities and numerical tools. Appropriate detection and awareness technologies are being developed, including the upgrade of on-board weather radar. These activities are complemented with pre-operational space-borne remote detection and nowcasting, as well as with large-scale international flight test campaigns.

UFO (UltraFast wind sensOrs for wake-vortex hazards mitigation, FP7, 2012–2015) is evaluating a wide range of innovative new ultra-fast LIDAR and Eddy Dissipation Rate monitoring sensor technologies for study of wake-vortex, cross-winds, air turbulence and wind-shears. This includes two-dimensional electronic scanning technologies. In addition, new purpose-built design tools is being developed based on the use of multi-disciplinary simulators linking atmosphere models with electromagnetic, radar and LIDAR models.

DELICAT (DEmonstration of LIdar based Clear Air Turbulence detection, FP7, 2009–2012) validated a LIDAR-based medium range turbulence detection technique by comparing LIDAR sensor measurements with aircraft sensors measurements in a turbulent area. The purpose is to support the development of new approaches to heighten overall safety performance as well as comfort for passengers and crew during operations in turbulent conditions.

GREEN-WAKE (Demonstration of LIDAR-based Wake Vortex Detection System Incorporating an Atmospheric Hazard Map, FP7, 2008–2012) validated innovative technologies for detection of wake, wind-shear and other related environmental hazards. These techniques are used for enhancing both on-board and ground operations, with impact, notably, on the safety of passenger and crews and on the operating efficiency of airports, in terms of recovery speed from airport delays caused by environmental hazarding conditions.

Design, manufacturing and certification

JEDI ACE (Japanese-European De-Icing Aircraft Collaborative Exploration, FP7, 2012–2016) is investigating de-icing technologies for aircraft wings, through novel solutions that combine electro-thermal and/or mechanical actuation with passive anti-icing coatings and ice sensor and protection systems. These novel approaches, when integrated in aircraft design, are expected to improve ice assessment, and operational safety, whilst reducing energy consumption.

ASCOS (Aviation Safety and Certification of new Operations and Systems, FP7, 2012–2015) is developing adaptations to current certification processes to ease the consideration and the handling of safety enhancements. Updated safety assessment methods and supporting tools are being developed that fully incorporate the proposed certification adaptations.

FLY-BAG2 (Advanced technologies for bomb-proof cargo containers and blast containment units for the retrofitting of passenger airplanes, FP7, 2012–2015) is developing solutions for protecting wide-body aircraft from on-board blasts and is addressing the least risk bomb location required by aviation regulations. The aim is to exploit the knowledge gathered in the previous project FLY-BAG to develop new devices for both cabin and cargo environments, and to enlarge the experimental validation of the new concepts, including full-scale tests on retired aircraft.

IASS (Improving the Aircraft Safety by Self Healing Structure and Protecting Nano-fillers, FP7, 2012–2015) is investigating smart maintenance and self-repair capabilities in airframe designs. Nano-fillers are being used to produce self-healing structures and multi-functional systems with the potential for improving the structural performance, reducing weight and costs, limiting complexity, and enhancing the versatility of the airframe and its components. These will have direct benefits on lowering power consumption whilst increasing the efficiency and the safety of new aircraft designs.

RECONFIGURE (REconfiguration of CONtrol in Flight for Integral Global Upset RECovery, FP7, 2013–2015) is developing new aircraft guidance and control technologies that facilitate the automated handling of off-nominal events and the optimisation of aircraft status and flight, while improving safety. These new technologies will be implemented as an add-on to existing guidance and control functionalities with the purpose of better assisting pilots in controlling aircraft performances.

SAFUEL (The SAfer FUEL system, FP7, 2012–2015) is addressing the question of safety of fuel systems, and notably the requirements associated with the next generation of fuel systems – the latter encompassing composite and electric engines as well as the use of alternative fuels. Specific improvements to fuel systems are being tested, under simulated and experimental conditions, to ascertain compliance with prevailing safety requirements.

FLY-BAG (Blastworthy Textile-Based Luggage Containers for Aviation Safety, FP7, 2008–2010) developed a blast withstanding, textile-based container to protect narrow-body aircraft from on-board explosions in checked-in luggage. The luggage container counts with an internal high-strength layer made of ballistic textiles to stop the ejected debris, coupled with an external layer to deform in a controlled way during the explosion, thus mitigating the blast pressure. The new concept was validated in full-scale tests on the ground.

SMAES (Smart Aircraft in Emergency Situations, FP7, 2011–2014) is developing advanced methodologies and simulation tools to support the whole aircraft development cycle from the project phase through to certification. Innovation shall be facilitated in aircraft design and compliance be ensured with prevailing safety requirements. The development of more reliable and predictive loading models for aircraft design, including improved models for calculating ditching loads, are specifically addressed within the project.

AIRCRAFTFIRE (Fire risks assessment and increase of passenger survivability, FP7, 2011–2014) examined the problem of fire propagation in aircraft using advanced simulations and tests of material properties and fire behaviour. The aim was to allow for a better understanding of fire propagation phenomena and of its residual impact as a support to the design of next generation aircraft with respect to fire prevention and management – notably in what regards increases in passenger survivability in the event of an on-board fire.

ADDSAFE (Advanced fault diagnosis for safer flight guidance and control, FP7, 2009–2012) developed of a Fault Detection and Diagnosis system for aircraft applications. Based on the results of this development the project issue a set of recommendations to ensure acceptance and to promote use of these advanced safety-enhancement techniques in the aircraft industry.

ATOM (Airport detection and tracking of dangerous materials by passive and active sensors arrays, FP7, 2009–2012) designed a multi-sensor-based detection and surveillance system to track passengers carrying hazardous materials from the very entrance to the airport.

The system design is non-intrusive but pervasive to avoid interference with passenger flows. It is a further addition to a panoply of novel approaches for improved security in airport terminals.

ON-WINGS (ON Wing Ice DetectioN and MonitorinG System, FP7, 2009–2012) developed an autonomous, composite electro-thermal de-icing system for application in fixed wings, helicopter rotor blades and engine inlets. The system incorporates ice detection sensors that reliably detect the presence, thickness and type of ice accreted on such flight critical surfaces. These sensors in turn control the operation of electro-thermal heat blankets that ensure an optimum performance in the de-icing of those surfaces, with consequent benefits in terms of lowering power consumption.

DANIELA (Demonstration of ANemometry InstrumEnt Based on LAser, FP7, 2008–2011) prepared an improved Air Data System for operational aircraft use. The system consisted of three-axis doppler LIDAR functions, with its optical probes assessed through in-flight measurements. For purposes of qualification of its operational aptitude the system was subject to testing under a range of environmental conditions that included hailstones, icing, corrosion, bird collision and passenger stairs mishandling. Such testing has demonstrated that the technology has the capability for improving aircraft operational capacity and safety performance with may ultimately bring potential benefits to the whole of the air transportation system.

HISVESTA (High Stability Vertical Separation Altimeter Instruments, FP7, 2009–2011) increased the safety in degraded in-flight situations, such as those affected by low-visibility, through improvements to barometric altimetry transducers used in air data computers and to aircraft auto-pilot systems. The increased reliability in altitude information enabled by the improvements in the measuring accuracy of the transducers when coupled with the optimal response permitted by the manual and automatic flight modes, do lead to an enhanced environmental performance of the aircraft, with reduced CO_2 and NO_x emissions.

LAYSA (Multifunctional Layers for Safer Aircraft Composites Structures, FP7, 2008–2011) established the engineering guidelines, developed and tested multifunctional layers with thermal and electrical conductivity, for improved fire-barrier and anti-icing performance along with sensing capabilities to be incorporated in aircraft composite structures for ice and fire protection, as well as health monitoring.

Human factors

ACROSS (Advanced Cockpit for Reduction Of StreSs and workload, FP7, 2013–2016) is developing new tools and supporting guidelines for purposes of performing the monitoring of crews. Such new aids are notably geared for assessment of the global performance of crews when performing key operational tasks (navigate, communicate, manage), specifically during peak workload situations. Specific training aspects and evolution of functions are also tackled with a view to enable upgraded solutions that are implementable in the cockpit in the short-term.

A-PIMOD (Applying Pilot MODels for safer aircraft, FP7, 2013–2016) is improving flight safety, through a more efficient management of the ever more complex information flows on the flight deck. Towards this goal, several pilot and crew models (including a cognitive model) will be integrated into the flight automation system, to monitor crew activities and to understand the pilots' cognitive state, allowing the adaptation of the level of automation in accordance with an 'adaptive automation' philosophy. Adaptive multimodal cockpit concepts are evaluated to improve the latter. The project is expected to deliver a novel approach for design of adaptive crew-automation interactions.

I-VISION (Immersive Semantics-based Virtual Environments for the Design and Validation of Human-centred Aircraft Cockpits, FP7, 2013–2016) is studying new approaches for improving cockpit design – encompassing aspects such as human factors, semantics and virtual design – aimed at enabling significant costs reductions in the cockpit design and validation processes.

MAN4GEN (Manual Operation for 4th Generation Airliners, FP7, 2012–2015) is identifying deficiencies in situational awareness and manual control in modern flight decks and developing a set of recommendations regarding appropriate mitigations to such risks. The latter will include measures such as changes to operational procedures and training as well as new aircraft system technologies with special emphasis on those that can be implementable on the short-term. Overall, such studies enable a deeper understanding of the capability and behaviour of highly-augmented and automated aircraft system architectures.

ARISTOTEL (Aircraft and Rotorcraft Pilot Couplings Tools And Techniques For Alleviation And Detection, FP7, 2010–2013) designed tools and techniques for detection and alleviation of aircraft-pilot-couplings and rotorcraft-pilot-couplings in flight simulator training. Improved simulations, design guidelines and operational criteria to better handle such aircraft-pilot-couplings and rotorcraft-pilot-couplings were developed.

BEMOSA (Behavioral Modeling for Security in Airports, FP7, 2009–2012) improved the improvement of airport surveillance capabilities using feedback from experience for purposes of updating and revising safety and security skills and procedures. Within the project, a tailored training programme for airport staff was prepared to improve airport security while maintaining efficiency and costs.

HUMAN (Model-based Analysis of Human Errors During Aircraft Cockpit System Design, FP7, 2008–2011) produced a methodology and derived prototype tools to support the prediction of human error that is applicable to the design of human-centred systems. These tools included a cognitive model of crew behaviour that was validated within the project. This work resulted in better understanding of human error that was put into use in the improvement of the design of cockpit systems.

SUPRA (Simulation of upset recovery in aviation, FP7, 2009–2012) developed new simulator technologies to improve recovery training. These include extensions to current mathematical models of aircraft to cover out-of-the-envelope behaviour. Based on the evaluation of these root technologies a set of guidelines on the requirements for future simulators was produced.

ODICIS (One Display for a Cockpit Interactive Solution, FP7, 2009–2011) investigated a number of aircraft cockpit relevant issues, including flexible system architectures, surface optimisation and information continuity, with a view to enhance operational safety and efficiency, notably under critical circumstances, and reduce overall system development costs.

6. Sub-Theme: Prioritising Research, Testing Capabilities and Education

Innovation is crucial for maintaining the global leadership of the EU aviation industry. However, to be effective, innovation requires to be backed by a suitable pool of talent as well as an envelope of fit-for-purpose support instruments. This includes appropriate research and testing infrastructures that are able to respond to the evermore demanding business and operational and technological challenges that the aviation industry is confronted with.

To promote the emergence of a whole new and dynamic innovative environment that can support the quest of EU aviation, the EU and key aviation stakeholders – aviation industry, universities, research institutes and national governments (ACARE, 2012) – are jointly financing a number of enabling initiatives that include notably multidisciplinary technology clusters and education and training actions, all compounding to foster a highly motivated and skilled research workforce with the necessary facilities to deliver the essential innovation thrusts the air transport sector requires (EC, 2011a).

The research projects are grouped as follows:

- **Aeronautics research and innovation**: dealing with the optimisation of research and innovation life cycles in the air transport sector.
- **Modern infrastructure**: fostering high-quality R&D infrastructure as a fundamental pillar of efficient state-of-art research.
- **Skilled workforce**: supporting education and training measures to ensure a motivated and skilled workforce.

Aeronautics research and innovation

Research roadmaps

CAPADOCIA (Coordination Action Pro Production, Avionics, Design on Cost efficiency in Aeronautics, FP7, 2013–2017) is steering the elaboration of strategic research agenda of cost-efficiency in aeronautics and air transport. Key drivers include airframe design, production and maintenance, as well as aspects related to avionics and propulsion. The work will identify gaps and bottlenecks, and will issue recommendations on how best focus research work programmes for delivering the expected outcomes in time and on cost.

CATER (Coordinating Air transport Time-Efficiency Research, FP7, 2013–2017) is conducting annual reviews on the relevant research and innovation activities, assessing them against the prevailing state-of the art to identify potential gaps and bottlenecks, and finally to formulate strategic recommendations when such is deemed necessary. All these activities will be embodied in a knowledge base to be used as a reference source for the EU aviation industry.

FORUM-AE (FORUM on Aviation and Environment, FP7, 2013–2017) is monitoring and assessing the set of research and innovation activities geared to the reduction of environmental emissions in air transport. This includes an evaluation of their effective contribution to the fulfilment of the environmental targets set by ACARE. Relevant information on those activities will be compiled and structured to be exchanged with national and EU research projects.

CORE-JETFUEL (COordinatingREsearch and innovation of JET and other sustainable aviation FUELs, FP7, 2013–2016) is coordinating research initiatives and projects on sustainable aviation fuels carried out at EU and Member States level. The project acts as a focal point for the networking of public and private stakeholders – including competent authorities, research institutions, feedstock and fuel producers, distributors, aircraft and engine manufacturers, airlines and non-government organisations – with a view of exchanging information and fostering synergies between such research and development activities and additionally furthering market deployment of this type of fuels.

AERODAYSUK2015 (Aerodays 2015 – Aviation for Growth and Sustainability, FP7, 2013–2016) is a conference to be held in London designed as a showcase for aviation-related research activities financed under the EU Seventh Framework Programme. This specific project is committed with the task of organising the conference, in terms of its programme and specific contents as well as for rallying appropriate sponsorship for the event.

TIPS (Enhancing the Capacity of EU Transport Projects to Transform Research Results into Innovative Products and Services, FP7, 2012–2014) is improving the capability of EU-funded research projects in transport to better exploit their results into innovation of products and services. Best practice at European and national level is being identified and translated into operational templates that can support the transformation of the outcomes of R&D activities into a value generator for business or institutional advantage. A wider take up of R&D results is being promoted and action plans for achieving such a broader dissemination of research results are being developed.

AERA – PRO (Aeronautics and air transport European Research Agenda – Promotion, FP7, 2012–2013) worked on a vision for aeronautics and air transport at the horizon 2020 to 2050. This resulted in a new agenda for European research, which was object of a promotional campaign carried out on a global scale.

AERODAYS2011 (Innovation for a Sustainable Aviation in a Global Environment, FP7, 2011–2013) organised the AERODAYS conferences, as well as other relevant technical visits and project exhibitions in the framework of reparatory and dissemination actions relating to research and development in aviation. Such works were developed with regard to the needs of ensuring appropriate synergies with other relevant EU policies – e.g., environment, energy, climate change – and to attract the widest participation, notably from SMEs, and other participants from the civil society at large.

WEZARD (Weather hazards for aeronautics, FP7, 2011–2013) addressed the preparation of a research agenda on the capability of air transportation to withstand weather hazards, involving extreme events such as volcanic ash clouds as well as severe atmospheric conditions including icing. A R&D roadmap was developed delineating research gaps and establishing priorities, and recommendations regarding its implementation were released to the relevant stakeholders in the aeronautics sector.

INNOVATION PLATFORM (Innovation Management Platform for Aeronautics, FP7, 2010–2012) developed a software-based innovation management platform for assisting in the generation, assessment and scheduling processes of industrial innovation projects. Such tasks were facilitated when dealing with complex, multifaceted projects that embody the potential to lead to step-changes in the aeronautic sector.

NEARS (New European Aviation Research Strategy, FP7, 2011–2012) supported the development of a strategic research agenda for aviation in Europe for the horizon 2030 and beyond. The process involved a wide consultation of the key stakeholders who actively participated in the development of the agenda.

OPTI (Observatory Platform Technological and Institutional, FP7, 2011–2012) monitored the implementation of the European activities of the ACARE's Strategic Research Agenda. The project provided a wide platform for the networking of stakeholders – from academia, industry and public authorities alike – and for collecting up-to-date information on aeronautics research.

MONITOR (Monitoring System on the Development of Global Air Transport, FP7, 2009–2011) developed a monitoring system for global air transportation, including data on economics, environment, demography and technology aspects. The system which is designed to continuously monitor exogenous and endogenous factors of strategic importance to aviation, can be used for a manifold purpose: as a reporting or early-warning system, or otherwise as a discussion platform for stakeholders – public, private and academia alike.

AGAPE (ACARE Goals Progress Evaluation, FP7, 2008–2010) implemented a methodology for evaluation of the progress in research and technology as a contribution towards the fulfilment of the foresight Vision 2020 goals. The evaluation which was carried out in the course of 2008/09 assessed past, on-going and planned activities set against the global targets included in both the Vision 2020 document – initially drafted in 2000 – as well as the newer strategic roadmap for aviation research developed by ACARE. Some 150 experts were mobilised to perform such peer review of the projects undertaken since 2000.

CREATE (Creating Innovative Air Transport Technologies for Europe, FP7, 2008–2010) stimulated a foresight exercise to enable the emergence of creative ideas with the potential to generate stepwise changes in the sustainability of air transportation in the second half of the 21st century. A structured process for collecting and evaluating such novel ideas was designed and trialled. This process included notably a technology watch and an early-warning component, to alert specific interest groups on technology developments of particular relevance and broad applicability.

Communication

PROMO-AIR (PROMOting Aeronautic Innovations and Research, FP7, 2013–2015) is promoting scientific and technical studies in aeronautics and air transport to support career development in aviation research and industry. Special emphasis is given to the development of educational materials that incorporate state-of-the-art results from recent research initiatives.

AEROPLAN (Composites repairs and monitoring and validation – Dissemination of innovations and latest achievements to key players of the aeronautical industry, FP7, 2012–2014) is promoting an awareness campaign throughout the aeronautics industry centred on the theme "repair of composites in aeronautics". The consortium is established around a core group of institutions with a past track record of experience in the thematic area, acquired within a number of EU-funded research projects. This is the baseline that enables the integration of the best results from those individual projects into information packs tailored for training and application requirements within industry.

EUROTURBO 10 (Support to Tenth European Conference on Turbomachinery, FP7, 2011–2013) organised a scientific conference targeted on propulsion systems and energy conversion processes. Further to being a forum for promoting and disseminating the results of turbo-machinery research, the event acted as a platform for networking and knowledge transfer amongst the community of domain specialists across Europe.

E-CAERO (European collaborative dissemination of aeronautical research and applications, FP7, 2009–2012) harmonised the processes for dissemination of research results between the relevant European associations in the aeronautics and the turbo machinery sectors. In particular, core areas of interest were identified, and new concepts and guidelines for the organisation of European and international events were developed with a view to make those events more efficient and cost-effective as well as more attractive to the targeted audiences – from the research community and industry alike.

WAKENET3-EUROPE (European Coordination Action for Aircraft Wake Turbulence, FP7, 2008–2012) promoted exchange of information on wake vortex turbulence between research and operational specialists. Experiences between these two communities was contrasted with the objective of shaping a shared view on the influence of wake turbulence on capacity issues. Such common view was eventually translated into a set of guidelines and recommendations for potential take-up by the operations community at large.

EUROTURBO 9 (Support to Ninth European Conference on Turbomachinery, FP7, 2010–2011) organised a conference on turbo-machinery, focusing on technological development, competitiveness aspects and operational issues when integrated as part of propulsion systems and energy conversation processes. The conference was well attended by a mixed audience that included researchers, design engineers, users of turbo-machinery components and students.

International cooperation

BEWARE (Bridging East West for Aerospace Research, FP7, 2013–2015) is supporting collaboration between aerospace organisations in Western Europe with their rapidly evolving counterparts in Eastern Europe. The involvement of the latter is incentivised or incremented in EU research programmes matching the growing role they play nowadays in the European aerospace sector. Such collaboration activities revolve around workshops, meetings and factory tours to increase the mutual knowledge among the parties, to identify areas of common interest, and to discuss potential partnerships.

GRAIN 2 (GReener Aeronautics International Networking-2, FP7, 2013–2015) is evaluating on studies dealing with the greening of aviation and the reduction of its carbon footprint through the use of sustainable alternative fuels. Despite being a broad and manifold initiative the focus of the work is centred on a number of core subjects, notably: the improvement of the understanding of engine exhaust emission mechanisms; the coupling of fuel efficiency and environmental performance; the lowering of airframe noise; the take-up of multifunctional materials; and the development of aviation biofuels.

CANNAPE (Canadian Networking Aeronautics Project for Europe, FP7, 2012–2014) strengthens cooperation in aviation R&D between the EU and Canada, through bilateral initiatives developing mapping, networks and partnerships on specific research and technical themes of mutual interest. CANNAPE stimulates Canadian participation in aeronautics and air transport activities of FP7 and of European participants in Canadian initiatives, paving the way for a first EU-Canada coordinated call in Horizon 2020.

GRAIN (GReener Aeronautics International Networking, FP7, 2010–2014) addresses the theme of large-scale simulation methods and tools as a pivotal capability to support the achievement of the Vision 2020 goals regarding greener technologies. In particular, one of the objectives was to perform a screening and subsequent assessment of the capabilities of existing simulation methods and toolsets for purposes of predicting and minimising the impacts of aircraft/engines in terms of nuisances on the climate and noise. Novel extensions and gap-filling upgrades to current approaches have been proposed, which were designed to support emerging high-performance computer infrastructures in both Europe and China.

COOPERATEUS (Conditions of success for R&T Open options through a Platform of communications and for Expressing Recommendation Actions to Team-up Europe and USA, FP7, 2010–2012) enhanced cooperation in aviation research and technology between the USA and Europe. Several studies were conducted to analyse and overcome barriers to cooperation and to map R&D areas of mutual benefit in the respective research agendas and roadmaps, paving the way for concrete cooperation in certain domains related to safety and environmental issues.

SUNJET (SUstainable Network for Japan-Europe aerospace research and Technology cooperation, FP7, 2011–2012) established an infrastructure for enhancing cooperation in aviation research and technology between Europe and Japan. Such infrastructure facilitated the dialogue between the parties to reach fruition, resulting in the preparation of a common roadmap for cooperation around a set of themes of common interest that foresees linkages in calls for proposals in EU Framework Programmes with similar research mechanisms in Japan.

AEROAFRICA-EU (Promoting European – South African research cooperation in aeronautics and air transport, FP7, 2009–2011) created a multi-purpose infrastructure for enhancing cooperation between the EU and South Africa, addressing both aviation research and development and aviation policy. A range of networks and partnerships were developed between air industry players in both regions and between them and the research community that ultimately spilled over to participants from other African countries.

AERO-UKRAINE (Stimulating Ukraine EU aeronautics research cooperation, FP7, 2009–2011) facilitated cooperation in aviation-related research between the EU and Ukraine. This included activities geared to raise awareness of Ukrainian parties regarding EU-funded collaborative research programmes in view of supporting the participation of Ukrainian undertakings and institutions in collaborative research projects funded under FP7.

CEARES-NET (Central European Aeronautical Research Network Events, FP7, 2010–2011) fostered cooperation in research activities between Central European research institutions, universities and industrial/service companies from the aviation sector. Two workshops were held, respectively, in Vienna and Warsaw, to raise awareness of the core R&D supported by the Framework Programme, set against the context of the relevant EU policy initiatives in the aviation sector such as Single European Sky, SESAR and Clean Sky.

CEARES (Central European Aeronautical Research Initiative, FP7, 2008–2010) strengthened cooperation in aeronautics research between Central and Eastern European players through the organisation of meetings, information days and workshops designed to serve as catalysts for fostering such collaborative purposes. These manifold activities were complemented by the set-up of a network between regional research centres and universities.

COOPAIR-LA (Guidelines for Cooperation of Latin American Countries in European Aeronautics and Air Transport Research, FP7, 2009–2010) strengthened the R&D co-operation between Europe and Latin America, especially Brazil, Argentina, Mexico and Chile. As a result of a set of awareness and networking initiatives developed by the project a multi-national and multi-stakeholder community was established identifying research commonalities and opportunities for cooperation in co-funded regional aeronautics R&D programmes.

AEROCHINA2 (Prospecting and Promoting Scientific Co-operation between Europe and China in the Field of Multi-Physics Modelling, Simulation, Experimentation and Design Methods in Aeronautics, FP7, 2007–2009) fostered cooperation in aeronautics research between companies, universities and research organisations originating from Europe and China. The focus of the initiative was centred on applications of multi-physics techniques to problems of interest in aeronautics, including those issues linked to computer simulation and code validation, experimental testing and application of such techniques for purposes of engineering design.

Modern infrastructure

No research has been conducted in this area.

Skilled workforce

AIRTN-NEXTGEN (Air Transport Network – Next Generation, FP7, 2013–2015) extended in terms of both functionality and capacity the platform for networking and communication between European research institutions created by the project AIRTN. This platform stimulates an exchange of information between those parties regarding the preparation, implementation and dissemination of results from national aviation research programmes.

FLY HIGHER (FLY HIGHER – Shaping the New Evolving Generation of Aeronautic Professionals, FP7, 2012–2014) develops a suite of activities oriented to motivate young people to follow careers in aeronautics. These activities – which include actions such as the FLY HIGHER MISSION Pathway to Success – are designed and carried out to reach a broad audience of students, teachers, academic counsellors and career advisors.

IFARS (International Forum for Aviation Research Support Action, FP7, 2011–2014) is a support action to assist the International Forum for Aviation Research (IFAR) in fulfilling its mission. The latter focuses on facilitating non-competitive research and development on technological-oriented issues that underpin global challenges the aviation sector is confronted with. Reaching a shared understanding of these challenges is a first step for identifying potential novel, more ecologically and economically efficient approaches contributing to their solution. The role of student and information exchange promoted by IFAR is a pivotal contribution towards fulfilling such a goal.

X-NOISE EV (Aviation Noise Research Network and Coordination, FP7, 2010–2014) is a collaborative network in aero-acoustics to coordinate research, disseminate results and collect of information on aircraft generated noise. The project combines the skills and expertise of industry partners, SMEs, universities and research organisations in 21 countries. One of its key activities deals with the set-up of a knowledge-base on solutions to reduce the exposure to aircraft noise.

EDUCAIR (Assessing the EDUCational Gaps in Aeronautics and AIR Transport, FP7, 2011–2013) reviewed the requirements on education and training for professionals in aeronautics and air transport prevailing in Europe as well as in other regions of the world. A critical analysis of these requirements was performed to ascertain their coverage and adequacy to fulfil current market and operational needs. Moreover, extensions to these requirements to cater for operational and technological evolution up to 2020 were identified and analysed. These activities resulted in the issue of appropriate recommendations for improvements to the current educational and training systems to guarantee more robust and adequate curricula.

MASCA (MAnaging System Change in Aviation, FP7, 2010–2013) addressed the question of training for the management of organisational change in a broad range of undertakings within the air transportation sector, like airlines, airports, and maintenance companies. Novel concepts and training-based techniques were developed to facilitate the retention of skills and knowledge in change management and to foster the development and maintenance of new and updated skills for such a purpose.

SME-AERO-POWER (Empowering European Aeronautical SMEs to Participate in EU Research, FP7, 2011–2013) empowered SMEs in aerospace sector for participating in EU-funded research activities. Participating SMEs were given training for preparing research proposals for FP7 and Horizon 2020 while granted access to a European-wide network of SMEs and other small organisations as a means to search for potential partnerships. The training also addressed techniques for creative problem-solving and knowledge-sharing, including the participation of the SMEs in special interest groups on hot topics for the European aerospace sector.

AIRTN (Air Transport Net, FP7, 2010–2013) supported Europe's aviation industry to prepare for the continuous expansion and the growing competition within the sector notably by raising awareness on innovation through exposure to the research and development mechanisms already well-established in Europe. The work of the 24-strong consortium of universities, research institutes, manufacturers and airports from 18 different EU Member States provided ultimately a significant contribution to the preparatory activities for the establishment of the ERA as well as to the development of a well-reasoned European Research Policy tailored for the needs of aeronautics and air transport.

RESTARTS (Raising European Student Awareness in Aeronautical Research through School-labs FP7, 2009–2012) stimulating students for a career in R&D in aeronautics. Promotional and educational materials were developed centred on mainstream aeronautics subjects – such as aerodynamics – as well as on specific challenges in the aeronautical world that could appeal to students. In order to prepare and better disseminate this material a European network of Aeronautical School-Labs was created.

Social developments in the EU air transport sector (European Commission, DG MOVE, 2008) evaluated the development of air transport in the EU since the opening of the airline market in 1997 and its direct impact on employment, notably in terms of working conditions and remuneration. Representative developments and trends were analysed and set against the effects of increased competition, impinging external events and the growing number of agreements with third countries.

AEROPORTAL (Innovative Changes in Air transport Research for Universally designed Services, FP7, 2007–2010) supported SMEs in aeronautics sector to raise their technological baseline and capability through participation in EU-funded R&D projects. The work revolved around the creation of a multi-faceted single point of contact for purposes of disseminating the relevant information, for hailing project opportunities, and for providing direct support with a view of streamlining SME participation in those projects In order to heighten exposure cooperation was established with a range of interested groups supporting SMEs.

7. Future Challenges for Research Policy

Flightpath 2050 sets a new vision for air transportation based on an efficient, cost effective, more environmentally benign, safe and secure paradigm. Innovation is a catalyst to enable such paradigm shift to take place. Adhering to the research priorities set out in the Flightpath 2050, a first set of research projects under FP7 contributed with innovative solutions to the thrust of reducing environmental impacts, enhancing customer satisfaction, and contributing to a safer and more secure seamless mobility. The research challenges currently included within the new Framework Programme Horizon 2020 are a continuation of such innovation strategy, notably building upon the research outcomes already delivered.

Customer orientation

The primary focus of every travel company must be the customer – experience, convenience, quality and perceived value for money. To make air travel a better experience for the customer is essential for the whole of the aviation business. This entails a holistic perspective that considers those aspects linked with the whole door-to-door travel experience, including the integration of air leg with other complementary modes of transportation, as well as those factors that are intrinsic to air travel – such as cabin environment, passenger comfort, information aids and services. In this whole context, innovation plays an ever growing pivotal role to enable air transport to respond to the ever more demanding and broader expectations from its clientele. For instance, issues such as optimal seat size, sleep quality on long-haul flights, individual temperature regulation and reduced cabin noise, the availability of manifold types of information and communication services, all require novel technological and service concepts and solutions for which multidisciplinary research, crafted on unconventional partnerships between the air transportation and the service and retail sectors, is eventually instrumental. The emergence of a continuous stream of smartphone applications for purposes of travel planning, ticket reservation and customer requirement management, often from a door-to-door perspective, is an illustrative example of such reality.

Competitiveness

Strengthening the position of the air sector in Europe is crucial in the light of the fierce global competition in the air transport markets. Whilst incremental improvements in the performance of products and in the productivity of processes are still possible they are not conducive to sustain an industrial leadership in the long term. Breakthrough innovations in products and processes are essential for enabling an efficient and competitive European aviation industry. However, reducing time to market and stimulating the take-up of such innovations – such as unmanned aerial vehicles – is not only a technological or managerial feat but requires appropriate legislative and regulatory frameworks, the development of which have to progress hand-in-hand with the innovation cycle. In addition, and from a holistic perspective, the efficient provision and use of airport infrastructure is essential factor for maintaining the competitiveness of European air hubs and airlines. Innovative and competitive airport concepts and equipment solutions – such as for example offshore floating airports – will be deemed essential to cope with the continued growth in air traffic and the needs to interwoven such growth with the continuous urbanisation trends.

Environment

The greening of aviation will be a condition to ensure its sustainability set against the long-term growth forecast for air traffic and the growing demands from populations affected by the nuisances of the latter. The dimension and manifold complexity of the problem requires moving well beyond the palliative mitigation solutions of the past. Brand new concepts in terms of aircraft configurations, power technologies, air traffic management and land-use management will be essential to confront the challenge. The Clean Sky initiative, under FP7, has been a thrust in this direction notably through the progress it enabled in more efficient engines and novel aircraft concepts. Its successor, Clean Sky 2, boosts such research effort on engine, airframe and system technologies towards their holistic integration into vehicle platforms for demonstrating cleaner, quieter and more fuel efficient passenger aircraft and rotorcraft. This includes aspects such as the use of alternative fuels to reduce CO_2 emissions – e.g. synthetic fuels from coal and natural gas, and bio-kerosene from biomass – as well as more futuristic powering concepts such as full cells and electrical batteries.

Notwithstanding this fact, research will have to address whole new paths including notably a better integration of the novel aircraft into the traffic management system, the assessment of the social and health impacts of air transportation on populations – in particular on those living in the vicinity of major airports – and the implications all these will bring to land-use planning in large conurbations.

Research & Education

Aviation is a dynamic service and high-technology sector that is critically dependent on a well-trained and motivated workforce. The latter requires a top level education and training that are both fit-for-purpose and adaptable to the ever-changing operational and technological evolution. And such evolution is by nature ever more dictated by global factors which implies a growing need to contrasting European with other international cultures and practices. In this latter context, the EU is supporting international cooperation activities between EU Member States and developed countries such as the USA and Japan, which are powerhouses in air transportation. Those issues that are either global in nature – such as many of those linked to the environment or standardisation – or fundamental research will be addressed to enable step-changes in products or services in the longer-term. Cooperation with emerging countries, such as India and Brazil, should also be intensified to exploit untapped potential in terms of their scientific and technological capability and excellence. The evolution in products and services will require, in parallel, the development of an appropriate manning capability to operate, maintain and further develop the new facilities. The strong links being established between the research and the industrial/service sectors will eventually enable air transportation to make best use of the full potential of Europe's scientific community to better prepare future generations of the European aviation workforce for mastering change and new things to come.

Safety & Security

Air travel has become one of the safest forms of transportation. The industry has managed to sustain a continuous growth of its safety performance delivered against ever escalating traffic levels. In the last few years, fatal accident rates have decreased significantly worldwide.

While EU-funded research has substantially contributed to this success, further work is needed to ensure that such safety performance successes are delivered in the best efficient and cost-effective manner. This requires a whole range of new system concepts, products and operational practices to be brought in mainstream business operation, in turn entailing whole new challenges for the certification of aviation products and processes. Step-changes will be needed to accelerate lead-times, to cater for a wider acceptance of generic rather than aviation-only components, while guaranteeing the thoroughness and due diligence of the process.

Security is becoming a leitmotif of modern life, stepping-up within the aviation industry after the 9/11 events. Since the latter, the world of aviation security has changed beyond recognition. Recent international events have thrust security onto centre stage and what was already a complex problem involving terrorist threats, war zones, illegal immigration, awareness around restricted items, public health issues and forged documents now has even more gravity. Constant, vigilant and effective security solutions have never been so important and finding new ways of predicting and countering threats to aviation is even more of a priority. Sharing of information and data for risk assessments will become ever more pivotal in this context. Incremental variations on known security solutions are not adapted to accommodate the disparate panoply of emerging and fast evolving hazards. Whole new ideas are required combining state-of-art technologies with systematic hazard identification and handling processes that are efficient and effective and ultimately acceptable by all the relevant parties in the aviation value chain.

When talking about the regulatory environment and the adoption of new technologies, it is worth considering that technological advancements are often rushing ahead of social and political change. That is exactly what we see happening today in the aviation sector with UAVs. From a technological perspective, various use cases are already feasible, but general public acceptance is still lacking behind – due to concerns on safety and confidentiality for example. Whereas social change is occurring at a substantially slower pace than technological progress, they are still both positioned well ahead of relevant regulatory initiatives. Operation of UAVs in distinct EU Member States is nowadays either non-regulated or subject to rather disparate regulations.

In view of the increasing maturity of the technology and the business and job creation potential of the UAV sector, the EC decided to initiate the process for the elaboration of an EU-wide regulatory framework covering the relevant safety, security and privacy aspects. However, a stream of whole new operational and technical questions evolved from such a decision, pre-empting the necessity for novel solutions to existing and well-mature aviation practices.

Air Traffic Management

Modernisation of Air Traffic Management (ATM) is an enormously complex task but one that the aviation industry desperately requires. To safely and efficiently accommodate projected increases in air traffic demand – as well as to respond to the diversified needs of airline operators, the environment and other relevant socio-economic issues – it is crucial to evolve ATM concepts and systems to new technological and operational paradigms capable of delivering the required operational and performance benefits. Under the SES initiative, the EU has started a defragmentation of the European airspace, including the definition of the underpinning operational and technological evolution that is necessary to make it possible, the whole being embodied in the European ATM Master Plan. Within the latter, the need to reconcile ATM solutions tailored for local conditions within a coherent over-arching interoperable European-wide system architecture whilst ensuring the conditions for overcoming the concern of Member States to relinquish control of sovereignty of airspace above their territories – organising ATM according to air traffic flows in functional airspace blocks instead on the basis of national borders – will be major challenges that are to be confronted. Research has to give support on generating new ideas and solutions on how such endeavours can be effectively tackled to deliver in substance what is intended.

Conclusion

The travel industries are amongst the most vulnerable to global or local shocks with their onus in terms of contingencies, cash reserves, and hedging of major risks such as oil prices. Survival in such an environment is dependent on the agility and the boldness of leadership within the sector, who have to constantly think ahead on a multi-path strategy able to tune responses in accordance to how events unfold.

Aircraft manufacturers and airline operators will continue steadily on the avenue of reducing energy consumption and environmental impacts over the next decades, exploiting a broad range of possibilities, including notably novel aircraft configurations and engine designs, use of lighter composite and smarter materials, and more optimal aircraft routing. Operational efficiencies will also be gained from fuller planes, faster turnarounds, and other economies of scale.

Passengers will further fragment into additional segments, covering the whole spectrum from budget right up to premier business class, notably in long haul routes. This will imply the need for new services and value-added solutions that cater for such diversity. Despite energy price rises, more and more of the world's population will want to fly, and will sacrifice other spending to do so, cushioning the adjustment for the airline industry. Safety and security will be of paramount importance to maintain the trustworthiness of the public in the industry. However, the mounting impact of the increasing traffic on large communities will raise potential barriers to further expansions of the aviation industry.

Whilst the business environment is prone to so many contingencies, it is also the locus of plenty opportunities. To reap the latter it will be quintessential for the industry to provide a great experience to its clientele that is as imaginative as it is cost-effective. Innovation is a core DNA required to deliver such a goal.

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Glossary

ACARE	Advisory Council for Aeronautics Research in Europe
ATM	Air Traffic Management
ARINC 600	35-year old standard for packaging
CDM	Collaborative Decision Making
CFD	Computational Fluid Dynamics
CO_2	Carbon dioxide
CROR	counter-rotating open rotor
dB	Decibel
DEHSt	German Emissions Trading Authority
DG MOVE	Directorate-General for Mobility and Transport
DME	Distributed Modular Electronics
EASA	European Aviation Safety Agency
EC	European Commission
ECAA	European Common Aviation Area
EMA	Electro-Mechanical Actuators
ERA	European Research Area
EU	European Union
FAB	Functional Airspace Blocks
FP6	Sixth Framework Programme
FP7	Seventh Framework Programme
GDP	Gross Domestic Product
GLONASS	Global Navigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System

IFAR	International Forum for Aviation Research
LED	Light-Emitting Diode
LIDAR	Light Detection and Ranging
NDT	Non-Destructive Testing
NO_x	Nitrogen oxide
PIV	Particle Image Velocimetry
POD	Probability of Detection
RPAS	Remotely Piloted Aircraft Systems
RTM	Resin Transfer Moulding
R&D	Research and Development
R&T	Research and Technology
SES	Single European Sky
SESAR	Single European Sky ATM Research
SHM	Structural Health Monitoring
SME	Small and Medium Enterprises
SRIA	Strategic Research and Innovation Agenda
THz	Terahertz
TRIP	Transport Research and Innovation Portal
TRS	Thematic Research Summary
UAV	Unmanned Aerial Vehicles
UAS	Unmanned Aerial Systems
VTOL	Vertical Take-Off and Landing

ANNEX: Projects by Sub-Theme

Sub-Theme: Meeting Societal and Market Needs				
Acronym	**Title**	**Funding Programme**	**Project Website**	**Duration**
FANTASSY	Future Aircraft design following the carrier-pod concept as an eNabler for co-modal seamless Transport, pAssenger Safety and environmental SustainabilitY	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=44815	2012–2014
MODAIR	Co-modal Airport	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=45170	2012–2014
MYCOPTER	Enabling Technologies for Personal Air Transport Systems	FP7	http://www.mycopter.eu	2011–2014
CARGOMAP	Air Cargo Technology Road Map	FP7	http://www.cargomap.eu	2011–2013
ULTRA	Unmanned Aerial Systems in European Airspace	FP7	http://ultraconsortium.eu	2012–2013
PPLANE	Personal Plane: Assessment and Validation of Pioneering Concepts for Personal Air Transport Systems	FP7	http://www.pplane-project.org	2009–2012
SAT-RDMP	Small Air Transport Roadmap	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41586	2011–2012
FUSETRA	Future Seaplane Traffic – Transport Technologies for the Future	FP7	http://fusetra.eu	2009–2011

RESILIENCE 2050.EU	New Design Principles Fostering Safety, Agility and Resilience for ATM	FP7	http://resilience2050.innaxis.org	2012–2015
META-CDM	Multimodal, Efficient Transportation in Airports and Collaborative Decision Making	FP7	http://www.meta-cdm.org	2012–2014
ICARUS	Innovative Changes in Air transport Research for Universally designed Services		http://www.icarusproject.eu	2012–2014
	Study: Study on Consumer Protection against Aviation Bankruptcy	DG MOVE	http://ec.europa.eu/transport/modes/air/studies/doc/internal_market/2009_01_bankruptcy_study.pdf	2009
	Study: Review of Regulation 261/2004	DG MOVE	http://ec.europa.eu/transport/modes/air/studies/doc/passenger_rights/2007_02_passenger_rights.zip	2007
PULSARPLANE	PulsarPlane: Worldwide Air Transport Operations	FP7	http://www.pulsarplane.eu	2013–2015
AGEN	Atomic Gyroscope for Enhanced Navigation	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=45163	2012–2014
SANDRA	Seamless aeronautical networking through integration of data links, radios, and antennas	FP7	http://sandra.aero	2009–2013
GAGARIN	GAlileo-Glonass Advanced Receiver INtegration	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41399	2009–2011
GRAMMAR	Galileo Ready Advanced Mass MArket Receiver	FP7	http://www.kn-s.dlr.de/grammar/	2009–2011

ALICIA	All Condition Operations and Innovative Cockpit Infrastructure	FP7	http://www.alicia-project.eu	2009–2014
SAFAR	Small Aircraft Future Avionics Architecture	FP7	http://www.fp7-safar.de	2008–2012
INTERACTION	The INnovativeTEchnologies and Researches for a new Airport Concept towards Turnaround coordination	FP7	http://www.interaction-aero.eu	2013–2016
2050AP	The 2050+ Airport	FP7	http://www.2050airport.ineco.eu	2011–2014
ENDLESS RUNWAY	The Endless Runway	FP7	http://www.endlessrunway-project.eu	2012–2013
TITAN	Turnaround integration in trajectory and network	FP7	http://titan-project.eu	2009–2012
AAS	Integrated Airport Apron Safety Fleet Management	FP7	http://www.aas-project.eu	2008–2011
ASSET	Aeronautic Study on Seamless Transport	FP7	http://www.asset-project.eu	2008–2011
ICOA.10.09	International Conference on Airports, October 2009 Paris	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37956	2008–2010
METROPOLIS	Urban Design Airspace	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=46849	2013–2015
4DCO-GC	4 Dimension Contracts – Guidance and Control	FP7	http://www.4dcogc-project.org	2010–2013

	Study: Evaluation of Functional Airspace Block (FAB) initiatives and their contribution to performance Improvement	DG MOVE	http://ec.europa.eu/transport/modes/air/studies/doc/traffic_management/evaluation_of_fabs_final_report.pdf	2008
	Study: The European Common Aviation Area (ECAA) and the Western Balkans: Domestic Reforms and Regional Integration in Air Transport	DG MOVE	http://ec.europa.eu/transport/modes/air/studies/doc/international_aviation/2007_02_09_see_air_transport_en.pdf	2007

Sub-Theme: Maintaining and Extending Industrial Leadership				
Acronym	**Title**	**Funding Programme**	**Project Website**	**Duration**
ANULOID	Investigation of novel vertical take-off and landing aircraft concept, designed for operations in urban areas	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=46230	2013–2015
HYPMOCES	Hypersonic Morphing for a Cabin Escape System	FP7	http://www.transport-research.info/web/projects/project_details.cfm?ID=46819	2012–2015
CROP	Cycloidal Rotor Optimized for Propulsion	FP7	http://crop.ubi.pt	2013–2014
ESTOLAS	A novel concept of an extremely short take off and landing all-surface (ESTOLAS) hybrid aircraft: from a light passenger aircraft to a very high payload cargo/passenger version	FP7	http://www.estolas.eu	2012–2014
HEXAFLY	High-Speed Experimental Fly Vehicles	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=45360	2012–2014
HIKARI	High speed Key technologies for future Air transport – Research and Innovation cooperation scheme	FP7	http://www.hikari-project.eu	2012–2014
MAAT	Multibody Advanced Airship for Transport	FP7	http://www.eumaat.info	2011–2014
LAPCAT-II	Long-term Advanced Propulsion Concepts and Technologies II	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37390	2008–2012

ESPOSA	Efficient Systems and Propulsion for Small Aircraft	FP7	http://www.esposa-project.eu	2011–2015
RECREATE	REsearch on a CRuiser Enabled Air Transport Environment	FP7	http://www.cruiser-feeder.eu	2011–2015
ACHEON	Aerial Coanda High Efficiency Orienting-jet Nozzle	FP7	http://acheon.eu	2012–2014
ALASCA	Advanced Lattice Structures for Composite Airframes	FP7	http://cordis.europa.eu/projects/rcn/97744_en.html	2010–2013
COLTS	Casting of Large Ti Structures	FP7	http://www.colts-project.eu/	2010–2013
FAST20XX	Future high-altitude high-speed transport 20XX	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41317	2009–2012
BOPACS	Boltless assembling Of Primary Aerospace Composite Structures	FP7	http://www.bopacs.eu	2012–2016
BUTERFLI	BUffet and Transition delay control investigated with European-Russian cooperation for improved FLIght performance	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46783	2013–2016
RESEARCH	Reliability and Safety-enhanced Electrical Actuation System Architectures	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46827	2013–2016
STORM	Efficient ice-protection Systems and simulation Techniques Of ice Release on propulsive systeMs	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46812	2013–2016
TOICA	Thermal Overall Integrated Conception of Aircraft	FP7	http://www.toica-fp7.eu	2013–2016

ATLLAS II	Aero-Thermodynamic Loads on Lightweight Advanced Structures II	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41475	2011–2015
DISPURSAL	Distributed Propulsion and Ultra-high By-pass Rotor Study at Aircraft Level	FP7	http://dispursal.eu	2013–2015
FUTUREWINGS	Wings of the Future	FP7	http://www.futurewings.eu	2013–2015
GO4HYBRID	Grey-area mitigation for hybrid RANS-LES methods	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46810	2013–2015
IN-LIGHT	INnovativebifunctional aircraft window for LIGHTing control to enhance passenger comfort	FP7	http://inlight-project.eu	2012–2015
SARISTU	Smart Intelligent Aircraft Structures	FP7	http://www.saristu.eu	2011–2015
STARGATE	Sensors Towards Advanced monitoRing and control of GAs Turbine Engines	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=45111	2012–2015
TIDE	Tangential Impulse Detonation Engine	FP7	http://www.mf3.ro	2013–2015
ACTUATION 2015	ACTUATION 2015: Modular Electro Mechanical Actuators for ACARE 2020 Aircraft and Helicopters	FP7	http://www.actuation2015.eu	2011–2014
BRAINFLIGHT	Brain controlled aircraft flight using multiple feedback mechanisms	FP7	http://www.fp7-brainflight.eu	2012–2014
CERFAC	Cost Effective Reinforcement of Fastener Areas in Composites	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41580	2010–2014

NOVEMOR	Novel Air Vehicles Configurations: From Fluttering Wings to Morphing Flight	FP7	http://novemor.org	2011–2015
VR-HYPERSPACE	The innovative use of virtual and mixed reality to increase human comfort by changing the perception of self and space	FP7	http://www.vr-hyperspace.eu	2011–2014
WASIS	Composite fuselage section Wafer Design Approach for Safety Increasing in Worst Case Situations and Joints Minimizing	FP7	http://www.wasis.eu	2011–2014
CREAM	Innovative Technological Platform for Compact and Reliable Electronic integrated in Actuators and Motors	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=45120	2009-2013
DAPHNE	Developing aircraft photonic networks	FP7	http://www.fp7daphne.eu	2009–2013
ELECTRICAL	Novel Aeronautical Multifunctional Composite Structures With Bulk Electrical Conductivity And Self-Sensing Capabilities	FP7	http://www.electrical-project.eu	2010–2013
COALESCE2	Cost efficient advanced leading edge structure 2	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37913	2009–2012
ISPACE	Innovative Systems for Personalised Aircraft Cabin Environment	FP7	http://www.ispace-project.eu	2009–2012
SCARLETT	Scalable & Reconfigurable Electronics Platforms and Tools	FP7	http://www.scarlettproject.eu	2008–2012

TAUPE	Transmissions in Aircraft on Unique Path Wires	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37428	2008–2012
TRIADE	Development of Technology Building Blocks for Structural Health Monitoring Sensing Devices in Aeronautics	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37402	2008–2012
EUROTURBO 8	Support to Eighth European Conference on Turbomachinery Fluid Dynamics and Thermodynamics Graz, March 2009	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37953	2008–2009
ASHLEY	Avionics Systems Hosted on a distributed modular electronics Large scale dEmonstrator for multiple tYpe of aircraft	FP7	http://www.ashleyproject.eu	2013–2017
ALAMSA	A Life-cycle Autonomous Modular System for Aircraft Material State Evaluation and Restoring System	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=44786	2012–2016
CANAL	CreAting NonconventionAl Laminates	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46784	2013–2016
CORSAIR	COld spray Radical Solutions for Aeronautic Improved Repairs	FP7	http://corsair-project.eu	2013–2016
HIPOCRATES	Self-healing Polymers for Concepts on Self-repaired Aeronautical Composites	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46815	2013–2016
LOCOMACHS	LOw-COst Manufacturing and Assembly of Composite and Hybrid Structures	FP7	http://www.locomachs.eu	2012–2016

NIOPLEX	Non-Intrusive Optical Pressure and Loads EXtraction for aerodynamic analysis	FP7	http://nioplex.eu	2013–2016
POLARBEAR	Production and Analysis Evolution for Lattice-related Barrel Elements under Operations with Advanced Robustness	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46838	2013–2016
PUL-AERO	High-quality Curved Aerospace Composited using Pultrusion Manufacturing	FP7	http://www.pul-aero.eu	2013–2016
RBF4AERO	Innovative Benchmark Technology for Aircraft Engineering Design and Efficient Design-phase Optimisation	FP7	http://www.rbf4aero.eu	2013–2016
REPAIR	Future REPAIR and maintenance for the aerospace industry	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46828	2013–2016
UMRIDA	Uncertainty Management for Robust Industrial Design in Aeronautics	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46773	2013–2016
VIBRATION	Global in-flight health monitoring platform for composite aerostructures based on advanced VIBRATION-based methods	FP7	http://www.transport-research.info/web/projects/project_details.cfm?ID=46724	2013–2016
CHANGE	Combined Morphing Assessment Software using Flight Envelope Data and Mission Based Morphing Prototype Wing Development	FP7	http://change.tekever.com	2012–2015
QUICOM	Quantitative inspection of complex composite aeronautic parts using advanced X-ray techniques	FP7	http://www.quicom.eu	2012–2015

AIM2	Advanced In-flight Measurement Techniques 2	FP7	http://aim2.dlr.de	2010–2014
INMA	Innovative Manufacturing of complex Ti sheet aeronautical components	FP7	http://www.inmaproject.eu	2010–2014
PRIMAE	Packaging of futuRe Integrated ModulAr Electronics	FP7	http://www.primae.org	2010–2014
RECEPT	RECEPTivity and amplitude-based transition prediction	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41554	2011–2015
AFDAR	Advanced Flow Diagnostics for Aeronautical Research	FP7	http://www.afdar.eu	2010–2013
DAEDALOS	Dynamics in Aircraft Engineering Design and Analysis for Light Optimized Structures	FP7	http://www.daedalos-fp7.eu	2010–2013
DESIREH	Design, simulation and flight Reynolds number testing for advanced high-lift solutions	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37919	2009–2013
DOTNAC	Novel Aeronautical Multifunctional Composite Structures With Bulk Electrical Conductivity And Self-Sensing Capabilities	FP7	http://www.dotnac-project.eu	2010–2013
IDIHOM	Industrialisation of High-Order Methods – A Top-Down Approach	FP7	http://www.idihom.de	2010–2013
INFUCOMP	Simulation based solutions for industrial manufacture of large infusion composite parts	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41659	2009–2013

MAAXIMUS	More Affordable Aircraft Structure through Extended, Integrated, and Mature Numerical Sizing	FP7	http://www.maaximus.eu	2008–2013
ACCENT	Adaptive Control of Manufacturing Processes for a New Generation of Jet Engine Components	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37424	2008–2012
ADMAP-GAS	Unconventional (advanced) manufacturing processes for gas-engine turbine components	FP7	http://admapgas.com	2009–2012
ALEF	Aerodynamic loads estimation at extremes of the flight envelope	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37908	2009–2012
ATAAC	Advanced turbulence simulation for aerodynamic application challenges	FP7	http://www.ataac.cfdtm.org	2009–2012
ATOS2012	International Air Transport and Operations Symposium 2012	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=44789	2012
CRESCENDO	Collaborative & Robust Engineering using Simulation Capability Enabling Next Design Optimisation	FP7	http://crescendo-fp7.eu	2009–2012
ELUBSYS	Engine LUBrication SYStem technologies	FP7	http://www.elubsys.eu	2009–2012
EXTICE	EXTreme ICing Environement	FP7	http://extice.cira.it	2008–2012
FANTOM	Full-field Advanced Non Destructive Technique for On-line Thermo-mechanical Measurements on Aeronautical Structures	FP7	http://www.fantom-ndt.eu	2008–2012

FFAST	Future Fast Aeroelastic Simulation Technologies	FP7	http://www.bris.ac.uk/aerodynamics-research/ffast/	2010–2012
FLEXA	Advanced Flexible Automation Cell	FP7	http://www.transport-research.info/web/projects/project_details.cfm?ID=37422	2008–2012
GLFEM	Generic linking of finite element based models	FP7	http://www.smr.ch/projects/glfem/	2009–2012
HIRF SE	HIRF synthetic environment	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37322	2008–2012
IAPETUS	Innovative Repair of Aerospace Structures with Curing Optimisation and Life Cycle Monitoring Abilities	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37942	2009–2012
IMAC-PRO	Industrialisation of Manufacturing Technologies for Composite Profiles for Aerospace Applications	FP7	http://www.imac-pro.eu	2008–2012
MISSA	More Integrated Systems Safety Assessment	FP7	http://www.missa-fp7.eu	2008–2012
PICASSO	imProved reliabIlity inspection of Aeronautic structure through Simulation Supported POD	FP7	http://www.picasso-ndt.eu	2009–2012
AISHA II	Aircraft Integrated Structural Health Assessment II	FP7	http://sirius.mtm.kuleuven.be/Research/AISHA-II/	2008–2011
EVITA	Non-destructive EValuation, Inspection and Testing of primary Aeronautical composite structures using phase contrast X-ray imaging	FP7	http://www.evita-project.eu	2008–2011

VISION	Immersive Interface Technologies for Life-cycle Human-oriented Activities in Interactive Aircraft-related Virtual Products	FP7	http://www.project-vision.eu	2008–2011
	Study on the Impact of Directive 96/67/EC on Ground Handling Services	DG MOVE	http://ec.europa.eu/transport/modes/air/studies/doc/airports/2009_02_ground_handling_annex.pdf	2009

Sub-Theme: Protecting the Environment and the Energy Supply				
Acronym	**Title**	**Funding Programme**	**Project Website**	**Duration**
COBRA	Innovative Counter-Rotating Fan System for High Bypass-ratio Aircraft Engine	FP7	http://www.transport-research.info/web/projects/project_details.cfm?ID=46725	2013–2017
IDEALVENT	Integrated Design of Optimal Ventilation Systems for Low Cabin and Ramp Noise	FP7	https://www.idealvent.eu	2012–2016
JERONIMO	JEt noise of high bypass RatiO eNgine: Installation, advanced Modelling and mitigatiOn	FP7	http://www.fp7-jeronimo.eu	2012–2016
RECORD	Research on Core Noise Reduction	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=45101	2013–2015
ORINOCO	cOoperation with Russia in the field of advanced engIne NOise COntrol based on plasma actuators	FP7	http://www.orinoco-project.org	2010–2014
NINHA	Noise Impact of aircraft with Novel engine configurations in Mid- to High Altitude operations	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41574	2010–2013
OPENAIR	OPtimisation for low Environmental Noise impact AIRcraft	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37975	2009–2013
COSMA	Community Oriented Solutions to Minimise Aircraft Noise Annoyance	FP7	http://www.fp7-cosma.eu	2009–2012

FLOCON	Adaptive and Passive Flow Control for Fan Broadband Noise Reduction	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37068	2008–2012
TEENI	Turboshaft Engine Exhaust Noise Identification	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37092	2008–2012
VALIANT	VALidation and Improvement of Airframe Noise prediction Tools	FP7	http://www.cimne.com/websasp/valiant/	2009–2012
ENOVAL	ENginemOduleVALidators	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46794	2013–2017
E-BREAK	Engine Breakthrough Components and Subsystems	FP7	http://www.e-break.eu	2012–2016
IMPACT-AE	Intelligent Design Methodologies for Low Pollutant Combustors for Aero-Engines	FP7	http://www.impact-ae.eu	2011–2015
LEMCOTEC	Low Emissions Core-Engine Technologies	FP7	http://lemcotec.eu	2011–2015
AHEAD	Advanced Hybrid Engines for Aircraft Development	FP7	http://www.ahead-euproject.eu	2011–2014
FACTOR	Full Aero-thermal Combustor-Turbine interactiOn Research	FP7	http://www.factor-fp7.eu	2010–2014
ERICKA	Engine representative internal cooling knowledge and applications	FP7	http://www.ericka.eu	2009–2013
DREAM	Validation of radical engine architecture systems	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37071	2008–2010

SHEFAE	Surface Heat Exchangers for Aero-Engines	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=46228	2013–2016
ENCOMB	Extended Non-Destructive Testing of Composite Bonds	FP7	http://www.encomb.eu	2010–2014
HYSOP	Hybrid Silicide-Based Lightweight Components for Turbine and Energy Applications	FP7	http://hysop.onera.fr	2010–2014
ADVITAC	ADVance Integrated composite TailCone	FP7	http://www.advitac.eu	2009–2012
FUTURE	Flutter-free Turbomachinery Blades	FP7	http://www.future-project.eu	2008–2012
SADE	Smart High Lift Devices for Next Generation Wings	FP7	http://www.sade-project.eu	2008–2012
AFLONEXT	Active FLOw loads and noise control on NEXT generation wing	FP7	http://www.aflonext.eu	2013–2017
MORPHELLE	MORPHing enabling technologies for propulsion system nacELLEs	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46848	2013–2015
PEL-SKIN	PEL-SKIN: A novel kind of surface coatings in aeronautics	FP7	http://www.pelskin-fp7project.eu	2013–2015
SOAR	DiStributed Open-rotor AiRcraft	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46821	2013–2015
TFAST	Transition Location Effect on Shock Wave Boundary Layer Interaction	FP7	http://tfast.eu	2012–2016

MARS	Manipulation of Reynolds Stress for Separation Control and Drag Reduction	FP7	http://www.cimne.com/mars	2010–2013
PLASMAERO	Useful PLASMa for AEROdynamic control	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41677	2009–2012
ACFA 2020	Active Control for Flexible 2020 Aircraft	FP7	http://www.acfa2020.eu	2008–2011
DERPHOSA	Technology Development of Remote Phosphor for Avionic Cockpit Displays	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=44797	2012–2014
FIRST	Fuel Injector Research for Sustainable Transport	FP7	http://www.first-fp7project.eu	2010–2014
KIAI	Knowledge for ignition, acoustics and instabilities	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37945	2009–2013
TECC-AE	Technologies Enhancement for Clean Combustion in Aero-Engines	FP7	http://www.tecc-project.eu	2008–2012
AEROMUCO	AEROdynamic Surfaces by advanced MUltifunctional Coatings	FP7	http://www.aeromuco.eu	2011–2013
MERLIN	Development of Aero Engine Component Manufacture using Laser Additive Manufacturing	FP7	http://www.merlin-project.eu	2011–2014
REACT4C	Reducing Emissions from Aviation by Changing Trajectories for the Benefit of Climate	FP7	http://www.react4c.eu	2010–2012

HYPSTAIR	Development and Validation of Hybrid Propulsion System Components and Subsystems for Electrical Aircraft	FP7	http://www.hypstair.eu	2013–2016
CHATT	Cryogenic Hypersonic Advanced Tank Technologies	FP7	http://www.chatt.aero	2012–2015
ITAKA	Initiative Towards sustAinable Kerosene for Aviation	FP7	http://www.itaka-project.eu/default.aspx	2012–2015
SOLAR-JET	Solar chemical reactor demonstration and Optimization for Long-term Availability of Renewable JET fuel	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41424	2011–2015
GABRIEL	Integrated Ground and on-Board system for Support of the Aircraft Safe Take-off and Landing	FP7	http://www.gabriel-project.eu	2011–2014
ALFA-BIRD	Alternative Fuels and Biofuels for Aircraft Development	FP7	http://www.alfa-bird.eu-vri.eu	2008–2012
GREENAIR	Generation of Hydrogen by Kerosene Reforming via Efficient and Low Emission new Alternative, Innovative, Refined Technologies for Aircraft Application	FP7	http://www.greenair-fp7.eu	2009–2012
TOSCA	Technology Opportunities and Strategies towards Climate-friendly Transport	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37987	2009–2011
RETROFIT	Reduced Emissions of TRansport aircraft Operations by Fleetwise Implementation of new Technology	FP7	http://www.transport-research.info/web/projects/project_details.cfm?ID=41550	2010–2012

TEAM_PLAY	Tool Suite for Environmental and Economic Aviation Modelling for Policy Analysis	FP7	http://www.teamplay-project.eu	2010–2012
	Study: Aircraft Noise Exposure at and around Community Airports: Evaluation of the Effect of Measures to Reduce Noise	DG MOVE	http://ec.europa.eu/transport/modes/air/studies/doc/environment/2007_10_aircraft_noise_exposure_en.pdf	2007

Sub-Theme: Ensuring Safety and Security				
Acronym	**Title**	**Funding Programme**	**Project Website**	**Duration**
PROSPERO	PROactive Safety PERformance for Operations	FP7	http://www.prosperofp7.eu	2012–2015
	Study: Implementing Regulation (EU) No 1082/2012 amending Commission Regulation (EU) No 185/2010 in respect of EU Aviation Security Validations (European Commission	DG MOVE	http://ec.europa.eu/transport/modes/air/security/doc/new_acc3_regulation_final_report.pdf	2012
SVETLANA	Safety (and maintenance) improVEment Through automated fLight data ANAlysis	FP7	http://svetlanaproject.eu	2010–2012
	Study: Legal situation regarding security of flights from third countries to the EU	DG MOVE	http://ec.europa.eu/transport/modes/air/studies/doc/security/2010_11_security_flights_3rdcountries-eu.pdf	2010
HAIC	High Altitude Ice Crystals	FP7	http://www.transport-research.info/web/projects/project_details.cfm?ID=45003	2012–2016
UFO	UltraFast wind sensOrs for wake-vortex hazards mitigation	FP7	http://www.ufo-wind-sensors.eu	2012–2015
DELICAT	DEmonstration of LIdar based Clear Air Turbulence detection	FP7	http://delicat.inoe.ro	2009–2012
GREEN-WAKE	Demonstration of LIDAR-based Wake Vortex Detection System Incorporating an Atmospheric Hazard Map	FP7	http://www.greenwake.org	2008–2012

JEDI ACE	Japanese-European De-Icing Aircraft Collaborative Exploration	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=46229	2012–2016
ASCOS	Aviation Safety and Certification of new Operations and Systems	FP7	http://www.ascos-project.eu	2012–2015
FLY-BAG2	Advanced technologies for bomb-proof cargo containers and blast containment units for the retrofitting of passenger airplanes	FP7	http://www.fly-bag2.eu	2012–2015
IASS	Improving the Aircraft Safety by Self Healing Structure and Protecting Nanofillers	FP7	http://www.iass-project.eu	2012–2015
RECONFIGURE	REconfiguration of CONtrol in Flight for Integral Global Upset REcovery	FP7	http://reconfigure.deimos-space.com	2013–2015
SAFUEL	The SAfer FUEL system	FP7	http://www.safuel-fp7.eu	2012–2015
FLY-BAG	Blastworthy Textile-Based Luggage Containers for Aviation Safety	FP7	http://www.fly-bag2.eu	2008–2010
SMAES	Smart Aircraft in Emergency Situations	FP7	http://smaes.eu	2011–2014
AIRCRAFTFIRE	Fire risks assessment and increase of passenger survivability	FP7	http://www.aircraftfire.eu	2011–2014
ADDSAFE	Advanced fault diagnosis for safer flight guidance and control	FP7	http://addsafe.deimos-space.com	2009–2012
ATOM	Airport detection and tracking of dangerous materials by passive and active sensors arrays	FP7	http://atom-project.eu	2009–2012

ON-WINGS	ON Wing Ice DetectioN and MonitorinG System	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37946	2009–2012
DANIELA	Demonstration of ANemometry InstrumEnt Based on LAser	FP7	http://www.danielaproject.eu	2008–2011
HISVESTA	High Stability Vertical Separation Altimeter Instruments	FP7	http://www.sintef.no/hisvesta	2009–2011
LAYSA	Multifunctional Layers for Safer Aircraft Composites Structures	FP7	http://www.laysa.eu	2008–2011
ACROSS	Advanced Cockpit for Reduction Of StreSs and workload	FP7	http://www.across-fp7.eu	2013–2016
A-PIMOD	Applying Pilot MODels for safer aircraft	FP7	http://www.apimod.eu	2013–2016
I-VISION	Immersive Semantics-based Virtual Environments for the Design and Validation of Human-centred Aircraft Cockpits	FP7	http://www.ivision-project.eu	2013–2016
MAN4GEN	Manual Operation for 4th Generation Airliners	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=45028	2012–2015
ARISTOTEL	AIRCRAFT and ROTORCRAFT PILOT COUPLINGS TOOLS AND TECHNIQUES FOR ALLEVIATION and DETECTION	FP7	http://www.aristotel-project.eu	2010–2013
BEMOSA	Behavioral Modeling for Security in Airports	FP7	http://bemosa.technion.ac.il	2009–2012

HUMAN	Model-based Analysis of Human Errors During Aircraft Cockpit System Design	FP7	http://www.human.aero	2008–2011
SUPRA	Simulation of upset recovery in aviation	FP7	http://www.supra.aero	2009–2012
ODICIS	One Display for a Cockpit Interactive Solution	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=38395	2009–2011

Sub-Theme: Prioritising Research, Testing Capabilities and Education				
Acronym	**Title**	**Funding Programme**	**Project Website**	**Duration**
CAPADOCIA	Coordination Action Pro Production, Avionics, Design on Cost efficiency in Aeronautics	FP7	http://cappadocia-fp7.eu	2013–2017
CATER	Coordinating Air transport Time-Efficiency Research	FP7	http://www.cater-transport-time-efficiency.eu	2013–2017
FORUM-AE	FORUM on Aviation and Environment	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46803	2013–2017
CORE-JETFUEL	COordinatingREsearch and innovation of JET and other sustainable aviation FUELs	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46787	2013–2016
AERODAYSUK 2015	Aerodays 2015 – Aviation for Growth and Sustainability	FP7	http://cordis.europa.eu/projects/rcn/110022_en.html	2013–2016
TIPS	Enhancing the Capacity of EU Transport Projects to Transform Research Results into Innovative Products and Services	FP7	http://www.transport-tips.eu	2012–2014
AERA – PRO	Aeronautics and air transport Europe-an Research Agenda – Promotion	FP7	http://www.aera-pro-project.eu	2012–2013
AERODAYS2011	Innovation for a Sustainable Aviation in a Global Environment	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41564	2011–2013
WEZARD	Weather hazards for aeronautics	FP7	http://www.wezard.eu	2011–2013

INNOVATION PLATFORM	Innovation Management Platform for Aeronautics	FP7	http://www.transport-research.info/web/projects/project_details.cfm?ID=41481	2010–2012
NEARS	New European Aviation Research Strategy	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41469	2011–2012
OPTI	Observatory Platform Technological and Institutional	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41572	2011–2012
MONITOR	Monitoring System on the Development of Global Air Transport	FP7	http://www.monitor-project.eu	2009–2011
AGAPE	ACARE Goals Progress Evaluation	FP7	http://www.transport-research.info/web/projects/project_details.cfm?ID=37069	2008–2010
CREATE	Creating Innovative Air Transport Technologies for Europe	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37393	2008–2010
PROMO-AIR	PROMOting Aeronautic Innovations and Research	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46837	2013–2015
AEROPLAN	Composites repairs and monitoring and validation – Dissemination of innovations and latest achievements to key players of the aeronautical industry	FP7	http://www.aeroplanproject.eu	2012–2014
EUROTURBO 10	Support to Tenth European Conference on Turbomachinery	FP7	http://www.etc10.eu	2011–2013
E-CAERO	European collaborative dissemination of aeronautical research and applications	FP7	http://e-caero.com	2009–2012

WAKENET3-EUROPE	European Coordination Action for Aircraft Wake Turbulence	FP7	http://www.wakenet.eu	2008–2012
EUROTURBO 9	Support to Ninth European Conference on Turbomachinery	FP7	http://www.etc9.itu.edu.tr	2010–2011
BEWARE	Bridging East West for Aerospace Research	FP7	http://beaware-aero.eu	2013–2015
GRAIN 2	GReener Aeronautics International Networking-2	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46813	2013–2015
CANNAPE	Canadian Networking Aeronautics Project for Europe	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41347	2012–2014
GRAIN	GReener Aeronautics International Networking	FP7	http://www.cimne.com/websasp/grain/	2010–2014
COOPERATEUS	Conditions of success for R&T Open options through a Platform of communications and for Expressing Recommendation Actions to Team-up Europe and U.S.	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41289	2010–2012
SUNJET	SUstainable Network for Japan-Europe aerospace research and Technology cooperation	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41430	2011–2012
AEROAFRICA-EU	Promoting European – South African research cooperation in aeronautics and air transport	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37907	2009–2011
AERO-UKRAINE	Stimulating Ukraine EU aeronautics research cooperation	FP7	http://www.aero-ukraine.eu	2009–2011

CEARES-NET	Central European Aeronautical Research Network Events	FP7	http://www.ceares.eu	2010–2011
COOPAIR-LA	Guidelines for Cooperation of Latin American Countries in European Aeronautics and Air Transport Research	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37914	2009–2010
AEROCHINA2	Prospecting and Promoting Scientific Co-operation between Europe and China in the Field of Multi-Physics Modelling, Simulation, Experimentation and Design Methods in Aeronautics	FP7	http://www.cimne.com/aerochina2	2007–2009
AIRTN-NEXTGEN	Air Transport Network – Next Generation	FP7	http://www.transport-research.info/web/Projects/Project_details.cfm?ID=46777	2013–2015
FLY HIGHER	Shaping the New Evolving Generation of Aeronautic Professionals	FP7	http://www.flyhigher.eu	2012–2014
IFARS	International Forum for Aviation Research Support Action	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=41390	2011–2014
X-NOISE EV	Aviation Noise Research Network and Coordination	FP7	http://xnoise.eu	2010–2014
EDUCAIR	Assessing the EDUCational Gaps in Aeronautics and AIR Transport	FP7	http://www.educair.eu	2011–2013
MASCA	MAnaging System Change in Aviation	FP7	http://www.masca-project.eu	2010–2013
SME-AERO-POWER	Empowering European Aeronautical SMEs to Participate in EU Research	FP7	http://www.sme-aero-power.eu	2011–2013

AIRTN	Air Transport Net	FP7	http://airtn.eu	2010–2012
RESTARTS	Raising European Student Awareness in Aeronautical Research through School-labs	FP7	http://www.transport-research.info/web/projects/project_details.cfm?id=37955	2009–2013
AEROPORTAL	Innovative Changes in Air transport Research for Universally designed Services	FP7	http://www.aeroportal.eu/index.php?id=home	2007–2010
	Study: Social developments in the EU air transport sector	DG MOVE	http://ec.europa.eu/transport/modes/air/studies/doc/internal_market/2008_01_social_study_final_report.pdf	2008