D1.1 Common vision on the development of a Small Aircraft Transportation system

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D1.1 COMMON VISION ON THE DEVELOPMENT OF SMALL AIRCRAFT TRANSPORTATION SYSTEM

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COMMON VISION
on the development of
a Small Aircraft Transportation system

SAT-CommonVision-D1.1

Version - 6.0

by

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Executive Summary

Key Messages:

In the SAT-Rdmp Support Action a Vision and a Research Agenda on the development of a Small Aircraft Transportation system (SAT system) are being developed.

The **major goals** of the projects are:

- **Pave the way for the general acceptance** of the added value of small-size aircraft transport, operating on commercial scheduled or non-scheduled flights, as a component of the European (Air) Transport system.
- **Define a highly customer** (passenger and freight) **oriented service** able to achieve the strategic goal: 90% of travellers within Europe are able to complete their journey, door-to-door within 4 hours in Europe.
- **Identify the RTD needs** of the European transport service operators and manufacturing industry in order **to become the world leader** in operating, designing and producing small aircraft.

The **SAT system Vision and the Research Agenda** are aiming to **provide elements** to be included in the **SRIA** and also highlighting R&TD areas which should be developed within **Horizon 2020**, trans-national cooperation and national programmes.

In the short term (within 2020)**, it is recommended to perform dedicated research and dissemination activities to develop enabling technologies, increase trust in the approach, to support public acceptance and promote political leverage**. Small and regional airports are existing in a large number all over Europe even in remote areas, thus the basic infrastructure is available and eventually small upgrades are at low costs .

In the short term (within 2020) **an integrated system demonstration** should be launched in some Member States or Regions; this would allow building up a success story, to increase trust in the approach, to support public acceptance and increase political leverage.

History has shown that small aircraft are often at the forefront of technology. Modern small aircraft are in many respects more advanced that larger planes. (Laminar flow is already used in business jets, very advanced avionics including enhanced vision systems are already used in small aircraft).

A part of the cost reduction may come from setting up the enabling conditions and among these the proper business model and service operations. Another part of the needed cost reduction may come from technology improvements. Also in view of the goals of the Commission and the Transport Sector to achieve environmentally friendly multimodal trips door-to-door within 4 hours in Europe, the SAT-Rdmp (Small Aircraft Transport – Roadmap) Team proposes to continue research and technology development in Horizon 2020 and to **introduce in Clean Sky 2 demonstration and validation activities for innovative small commercial aircraft technologies and small aircraft operations**, as an option of the Green Regional Aircraft ITD extension.

Currently SESAR is focused on demonstrating technologies for large airliners and scheduled flights. At this point in time it does not take fully into account the introduction of a small aircraft transport mode and ATM costs reductions are important for SAT deployment**. SESAR should include the SAT system into the ATM concept of operations**. SESAR has to take into account the SAT system operations already in the employment phase in 2014, avoiding expensive late adjustments. The Small Aircraft community should be involved in SESAR and possible follow up. In SESAR 2 the concepts associated with more automation in the aircraft and in airspace management will have to be addressed.

Rationale:

- As it is envisaged in the Flight Path 2050 and the new SRIA, 4hour door to door challenge is a goal for the future multimodal transport system and an opportunity for new innovative air services in an intermodal transport environment; as a consequence a variety of transport services tailored to individual needs should be developed.
- A fully developed small aircraft transportation mode (for both passenger and freight) will be able to ensure 4 hour environmentally friendly trips on thin routes, to open up regions in Europe that have a bad surface transport infrastructure (including Mediterranean Sea areas) enabling accessibility to transport and economic growth.
- The SAT system will partially substitute car travel (for passengers) and small truck transport (for regional freight transport), and alleviate some of the serious European road congestion problems in the future; this transport mode substitution will ensure a much lower environmental impact.
- Small aircraft transport is a new component of the European Air Transport System and complementing existing ATS service and not a competing mode. It responds to further market segmentation by offering local and regional air transport services at a competitive price.
- The services will be provided by a family of small aircraft (e.g. from 4 to 19 seats) operating in appropriate business models (scheduled air transport services, per seat on demand (shared trips), per aircraft on demand (air-taxi)).
- Small aircraft transportation will enable the use of local and regional airfields in Europe (more than 2500 airfields) which are easily accessible to a large set of European population. New vertiports can be established. Also hydro planes can be built at a low costs to serve Europe's extensive shores.
- Small aircraft transportation will be a customer-oriented system fulfilling expectations of future travellers which include personalized travel, with individual tailoring of the travelling experience.
- The SAT -Rdmp project has shown that there is a substantial market for small aircraft operations in Europe. It has also identified in which areas integrated technology validation and demonstration needs to be done to allow the European industry to gain a world leading position. Demonstration projects are needed both in the area of aircraft technologies and X-planes as well as in the area of novel business models.
- Small aircraft need their own research and technology focus as these aircraft have a totally different spectrum of usage and operations with respect to large commercial aircraft.

Main Challenges for SAT deployment:

Small Aircraft Transport deployment faces big challenges:

- A key point is the capability for low cost solutions and this will be obtained by technology development and by a system approach.
- Interconnection of SAT system to other transport system (including cars and taxi) through a an interconnected booking system allowing also awareness of transport modes status and possible mode shift.
- Small aircraft should be designed taking into account the possible service flexibility foreseen: use of short runways, use of hydro-scales, passengers and freight mixed transport modes, etc.
- Families of aircraft should be designed with commonalities to reduce operative costs.
- Creation of well suited and easy to apply EASA rules for certification and operation of small aircraft transport commercial service and rules for pilot licensing.
- New rules are a determinant factor to support innovation into the sector and an enabling condition for realising the SAT mode. Rules with clear definition and easy to apply should be defined. The market has to be addressed with innovation. Innovation is expensive due to the needed R&TD, Know-how, and compliance to the rules. If rules are too rigid, not easy to apply, or not well suited for the specific application are against innovation increasing cost and time of development.
- Appropriate pilot training specifically taking into account small aircraft off-nominal situations (which are not the same of large aircraft).
- Distinguish rules for GA (leisure activities) and SAT mode (commercial activities) for pilot training, design, certification, operations.
- The SAT system has to be environmentally friendly and has to be perceived as such.
- Innovative power plant systems are mandatory (low cost and environmentally friendly)
- Aircraft configurations will be designed also to fulfil low noise foot print (e.g. QVTOL/QSTOL) and low emissions. In Europe there is not yet a settled capability for the development of engines for small aircraft. An effort has to be done in this direction.
- Fleet management and service operations are defined in order to ensure minimum number of empty flights and greater operating flexibility and effectiveness of the system; the transport of freight (e.g. parcels, small pallets) during night or mixed with passenger is an approach to increase the load factor.
- Fleet and transport services management will be net-centric and automated. New paradigms for maintenance specific for SAT, involving condition based maintenance.
- The key elements on board are the traffic and weather awareness, on board comfort, perceived level of safety. Advanced low cost, low weight and small volume avionics will ensure future small aircraft to fly with a total situation awareness. This will also allow to fly in adverse weather conditions, during night and in general in IMC, thus ensuring safety and reliability of service.
- Design innovation (adopted technology, tools for designing, and approaches) is an important element. R.A.M.S. approaches for the whole life cycle of the products/services, addressing dynamic risk modelling to support decision making at different stages.
- Innovative material and processes for low cost production and long term maintenance have to be developed. Introduction of technologies and materials from different sectors should be foreseen.
- Improvements of the production procedures of small aircraft to reduce cost have to be granted.
- The public support for developing (even if low cost) SAT infrastructures and service operators network is necessary. The same happened and it is still happening for HST, harbours etc.
- The development of SAT is also related to the trust of passengers into the system. Only with a high level of safety of all systems, operators (training and operating complex systems) and procedures the SAT can be really developed.

1 Foreword

Why a Vision Is Important?

- Is a catalyst
- Aligns involved people and organizations in joint activities
- Facilitates to set goals, priorities and planning
- Helps unifying efforts and funding
- Keeps the community inspired and facilitate people commitment
- Describes the shared future a community wants to create
- Reveals and announces the added values for the community of planned activities towards social needs, technological progress and innovation
- Visions can be short "we will have a man on the moon" or as long as a page or two. But, in either case, they must give a clear and compelling picture.

Some definitions to help the reader

- **Private aviation:** includes privately owned aircraft meant for recreational flight, business travelling etc.
- **Personalized ATS** (Air Transport System): user-friendly with IT support - includes aircraft owned by service providers (private and public) adopting different business models: air taxi, on demand seat, on scheduled or unscheduled flights, etc.

2 SAT-Rdmp Project – Summary

The project can be summarised in the following steps:

- Definition of a **common vision** of the small aircraft transport system for inter-regional mobility and personalized services focusing on aircraft with 4-19 seats.
- Design of a **business case** compliant with the identified requirements which describes the relations among all the system's components.
- Identification of the **SAT requirements** in terms of **technology needs** and **regulatory issues** to be addressed.
- Assessment of **current capabilities** versus the ATS demand.
- Definition of a **Research Agenda** to fill the **technology/regulatory/operational** gaps between current capabilities versus the requirements.
- **Risk Assessment** and **cost/benefit performance** of the identified new system's concept.
- **Dissemination** actions and establishment of a stable and well **recognised network of stakeholders**.

3 Acronyms

A/C	Aircraft
ADS-B	Automatic Dependent Surveillance Broadcast
AFR	Autonomous Flight Rules
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Transport System
DOC	Direct Operative Cost
EPATS	European Personal Air Transportation System
GHG	Green House Gas
GNSS	Global Navigation Satellite System
HUMS	Health and Usage Monitoring Systems
IFR	Instrumental Flight Rules
ILS	Instrumental Landing System
IT	Information Technology
IOC	Indirect Operative Cost
JTI	Joint Technology Initiative
MS	Member States
MTOW	Maximum Take Off Weight
PAX	Passenger
QSTOL	Quiet Short Take Off and Landing
QVTOL	Quiet Vertical Take Off and Landing
RAMS	Reliability Availability Maintainability Safety
RTD	Research and Technology Development
SAT	Small Aircraft Transportation
SES	Single European Sky
SESAR	Single European Sky ATM Research
SRIA	Strategic Research and Innovation Agenda
SWIM	System Wide Information Management
TEN-T	Trans European Transport Network
TMA	Terminal Management Area
VFR	Visual Flight Rules
VLJ	Very Light Jet

4 Introduction

In this report a Vision on the SAT system development is presented.

In order to have an appropriate consultation of the European General Aviation Community three workshops have been set up: “SAT Common Vision Workshop” and “SAT Research Agenda Workshop”.

On September 28th 2011 the Common Vision Workshop was held. As a preparation to this workshop a discussion paper “Common Vision on the Development of a Small Aircraft Transportation System (SAT system)” was elaborated, and sent to representatives of the SAT Community, EC, Regulators, Operators etc. The Discussion Paper was presenting also three Pivotal Questions to be debated at the Workshop. The outcome of the workshop is summarised in the deliverable “D1.5 - Report from the Common Vision for Small Aircraft Transport Mode Workshop”.

On 5th June 2012 a Workshop at CIRA dedicated to Vision and Roadmap for SAT deployment wad held. The outcome of the workshop are included in the current report. In Campania Region in Italy there is a high concentration of aircraft and equipment manufacturer (e.g. PiaggioAaero Industry, Tecnam, Vulcanair, OMA, Magnaghi), experienced University and Research Centres (CIRA, CNR) that contributed to this workshop.

The Vision further elaborates the outcome of the workshops setting the base for the Research Agenda development.

The structure of the report is as follows:

First the approach adopted in the SAT-Rdmp project to develop the SAT system Vision and Research Agenda is outlined.

The current European scene and perspectives (e.g. Flight Path 2050) is shortly described, providing a vision for the future ATS which comprises the SAT system, as a possible solution for the identified challenges and goals.

The Vision is described going through:

- challenges;
- high level objectives for product technologies and operations;
- systems concepts and technologies;
- enabling conditions.

The concept of SAT system is described looking to the different components.

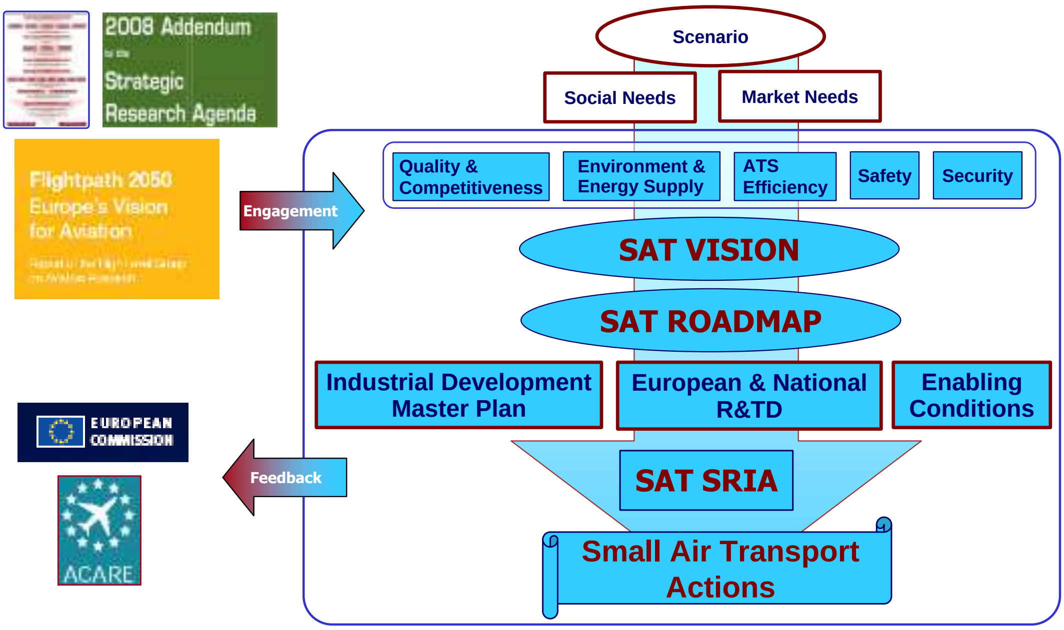
Some recommendations for the implementation are described with specific attention to the SRIA, currently under development and to the future FP Horizon 2020. A specific section is dedicated to state the need for the small aircraft community (e.g. Small Aircraft, business aviation, light rotorcraft) to be represented in ACARE.

5 The Overall Approach

In SAT-Rdmp project the top down approach has been adopted to define the Vision and the Research Agenda for the future implementation.

Thus, starting from the challenges defined by the social and market needs, taking into account the quickly evolving scenario, a Vision on the SAT system is defined. The Vision defines what a SAT system is, the steps on how to deploy the SAT system. In a follow on document the SAT will be developed to identify the RTD actions needed in the future.

A clear understanding of this new air transport mode and its enabling conditions need to be developed and accepted in the public and private domains; awareness of the social and economic benefits resulting from the implementation of SAT system has to be increased.



The key elements of the Vision are the essential input for developing the SAT system Strategic Research and Innovation Research Agenda.

In the Vision specific challenges, high level objectives (e.g. requirements) for product technologies and for operations, systems concepts and technologies, and the enabling condition are provided.

Furthermore, some recommendations for the implementation are described in the light of the SRIA, currently under development and to the future FP Horizon 2020.

In the short term (within 2020) it is essential to perform dedicated research and dissemination activities. Research should be dedicated to: develop, test and demonstrate new technologies necessary to meet the challenges; define appropriate business models and concepts for operations; **develop a model and software tool to simulate the SAT system performance**; perform surveys to collect data to be used as input for the SAT system simulation. **This approach would allow increasing: trust in the approach, political leverage, and public acceptance.**

In the short term (within 2020) an integrated system it should be launched in some Member States (MS) or regions; this would allow building up a success story, to increase trust in the approach, to support public acceptance and increase political leverage.

Furthermore, the **following actions are required to turn the SAT system into practice**.

- **The Small Aircraft community should improve their coordination and define an industrial development master plan.**
- **The enabling conditions to develop a SAT system should be improved at regional, national and EU level.**
- **Specific R&TD activities should be dedicated to develop the needed product technologies, the specific operations, systems concepts and related technologies.**

6 Flight Path 2050: a Vision for the ATS of the Future

The future European Transport System is depending on many factors (social needs, economy, fossil fuel price and availability, environmental concerns, climate change, political choices and stability). The future European Transport System should be based on an environmentally sustainable, cost efficient, safe, secure and co-modal, customer oriented system aiming to ensure seamless mobility and cohesion for the European citizens while enabling economic growth.

One future element of such an advanced transport system will be **transportation using small aircraft and local/regional airports**. This new transport mode will enable fast travel in areas of Europe where high speed trains or traditional airline connections are unavailable and will alleviate road congestion problems in a customer - and environmentally friendly way.

"general and business aviation complements regular air transport performed by commercial airlines and thus provides specific social and economic benefits such as increasing the mobility of citizens, the productivity of businesses and regional cohesion". [1]

In order to set the base for the updating of the Vision 2020, **ACARE** performed a large effort resulting in the document „**Beyond Vision 2020 (Towards 2050**)". In this document some elements relevant for the SAT system are provided:

The people-oriented system*: Today's traveller is sometimes treated not as an individual but as part of a herd. The experience of air travel often includes the invasion of privacy by security measures, discomfort during long transits, lengthy waiting times, inadequate information, and uncomfortable conditions - both on the ground and in the air."*

"In Europe, expectations of future travellers include: ***Personalized*** *travel, with individual tailoring of the travelling experience".*

In its White Paper on Transport the European Commission has advocated the substitution of car travel to rail travel. TEN-T funding is available to create more high speed rail connections. However High Speed rail infrastructure is expensive: about € 40 million per km. Extended (high speed) rail connections will not help access to regions outside the European Economic Banana, and anyhow only along certain graphical directives, to further develop their economics and welfare. These regions are mainly depending on road transport development. The European Commission does not yet fully recognizes the potential of the Small Aircraft Transport System. It is felt the potential impact of SAT System on future transport system should be more clearly recognized.

The **EC Commissioners Siim Kallas** and **Maire Geoghegan-Quinn** created a **High Level Group on Aviation Research** to **write Europe's Vision for Aviation Maintaining Global Leadership and Serving Society's Needs for 2050**.

This effort resulted in the document **„Flightpath 2050 Europe's Vision for Aviation".**

The Flight Path 2050 set the new Vision and will be a driver for the next EC Framework Programme for Research and Innovation 'Horizon 2020' starting in 2014.
The **challenges** identified in this report to develop the future ATS are:

- Meeting Societal and Market Needs

[1] European Parliament Resolution of 3 Feb 2009 on an Agenda for Sustainable Future in General and Business Aviation

- Maintaining and Extending Industrial Leadership
- Protecting the Environment and the Energy Supply
- Ensuring Safety and Security
- Prioritising Research, Testing Capabilities and Education

In Flight Path 2050 elements relevant for the SAT system are provided:

"European citizens are able to make informed mobility choices and have affordable access to one another taking into account: economy, speed, and tailored level of service".

Travellers can use continuous, secure and robust high-speed communications for added-value applications. 90% of travellers within Europe are able to complete their journey, door-to-door within 4 hours.

Passengers and freight are able to transfer seamlessly between transport modes to reach the final destination smoothly, predictably and on-time."

The Group recommended to establish a second Advisory Council for Aeronautics research and innovation in Europe (ACARE) to translate the high level goals into a European research and innovation agenda. This agenda will be published in the second half of 2012.

It is expected that the agenda will fully recognize the added value of transportation with small aircraft in the future to serve the European citizen as a customer of a seamless transportation system that ensures inter European journey time door to door of no longer than 4 hours maximum. Transport will be highly customer demand driven, tailored to the customer needs, green, affordable, dependable and seamless.

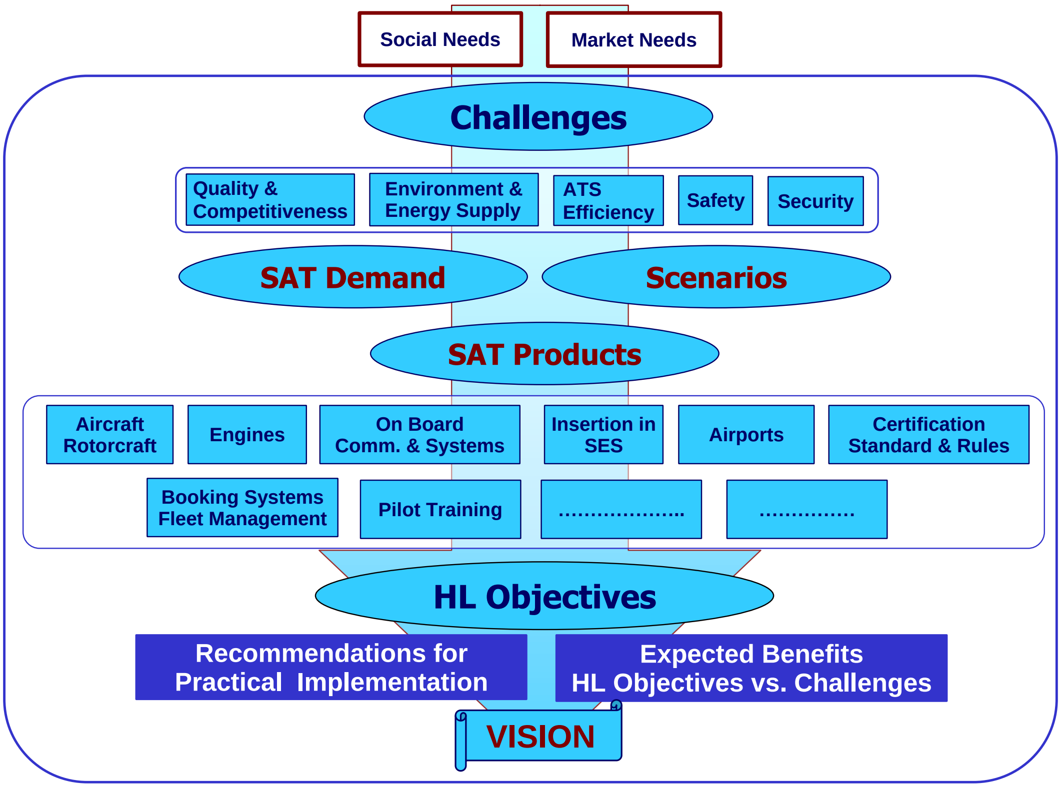
It is expected that by 2035 an important part (10 – 20%) of long distance travel by car will be shifted to Intelligent Personalized Air Transport System

7 SAT system VISION

Building a "Common" shared view on the development of a SAT System as a component of the European Integrated Transport is not an easy process; the community is rather fragmented and the perspective of a new transport mode need to be further disseminated across public and stakeholders themselves.

In the SAT-Rdmp project specific analysis were performed concerning building blocks (e.g. capabilities, demand models, regulations) together with both an internal consultation and a dedicated workshop to collect opinions.

The overall approach and the building blocks of the Vision are sketched in the following picture.



The SAT-Rdmp Workshop, dedicated to "Common Vision for Small Aircraft Transport Mode", gathered a satisfactory representative group of the General Aviation Community; there were attendants from 11 countries: manufactures, operators, regulators, academia, research, ACARE, EC. Before the workshop a Discussion Paper on "SAT System Common Vision", containing three Pivotal Questions was issued and distributed. Comments were collected in a written form and during the workshop. Two Parallel Sessions took place to openly collect views and opinions on key elements of the SAT Vision.

The first elements identified in the Vision are the Challenges.

Then, the following issues have been identified to build the Vision:

- Target Products and Technologies;
- Target Concepts and Operations, Systems and Technologies;
- High Level Objectives (requirements)
- Enablers.

7.1 The SAT Concept

- **SAT system will offer increased mobility** with a highly customer oriented approach.
- **The SAT system will add a new modality within the Air Transport System and complement international and regional transport.**
- The SAT System will be **highly customer oriented** (affordable, accessible, predictable, dependable and comfortable), **environmentally friendly, safe and secure, interconnected,**
- **SAT system will exploit enable the use of local and regional airfields in Europe (more than 2500 airfields).** Small airports, aerodromes, heliports, seaplane aerodromes are **easily accessible to a large set of European population.** New vertiports and hydroscales can be built at a low costs to serve Europe's extensive shores.
- **The system will be based on small aircraft and rotorcraft,** with 4 to 19 seats, including amphibious aircraft**, operating scheduled and unscheduled flights in an integrated and intelligent transport management system**.

Small Aircraft Transport System will serve:

- **the need for low-intensity intercity routes** (e.g. for west/east directives also in central Europe), which has been dependent so far on road transport;
- **regions with less developed infrastructures** (e.g. out of the central European "economic banana", sea costal regions and islands);
- **the needs of European personalized and business travel.**

Organization and operation of the system

SAT system will be a passenger transport system meant to provide public and private service. SAT System will be an element of the European development strategy for transport modalities and infrastructures, in particular air transport.

Organizational SAT system structure will comprise local, regional, national and EU organizations and entities, acting autonomously, but related through common regulations, infrastructure system elements and operating in a common central management system based on Intelligent Transport System Architecture scheme" as an initial concept to study the development of the business model. Aircraft operators will act both independently but also in corporations with agreements to provide transport services.

An IT based booking system that will allow timely bookings and on time and delay free flights, based on internet broker functions is needed.

Customers will have access to applications that provide door-to-door (departure to arrival) control & visibility with intelligent choices offered across a range of modes and services with options to optimise price, time, quality, comfort and flexibility with information being made available that allows for the choices made to be implemented while also delivering on going situational visibility

Depending on the adopted business model an ad-hoc Fleet Management system must developed.

Validated business models and IT systems will be operative to manage cost effectively transport services and to support flight operations, this will allow to achieve high load factors and lower service costs.

In the following figure the concept is sketched and some examples of possible applications are given.

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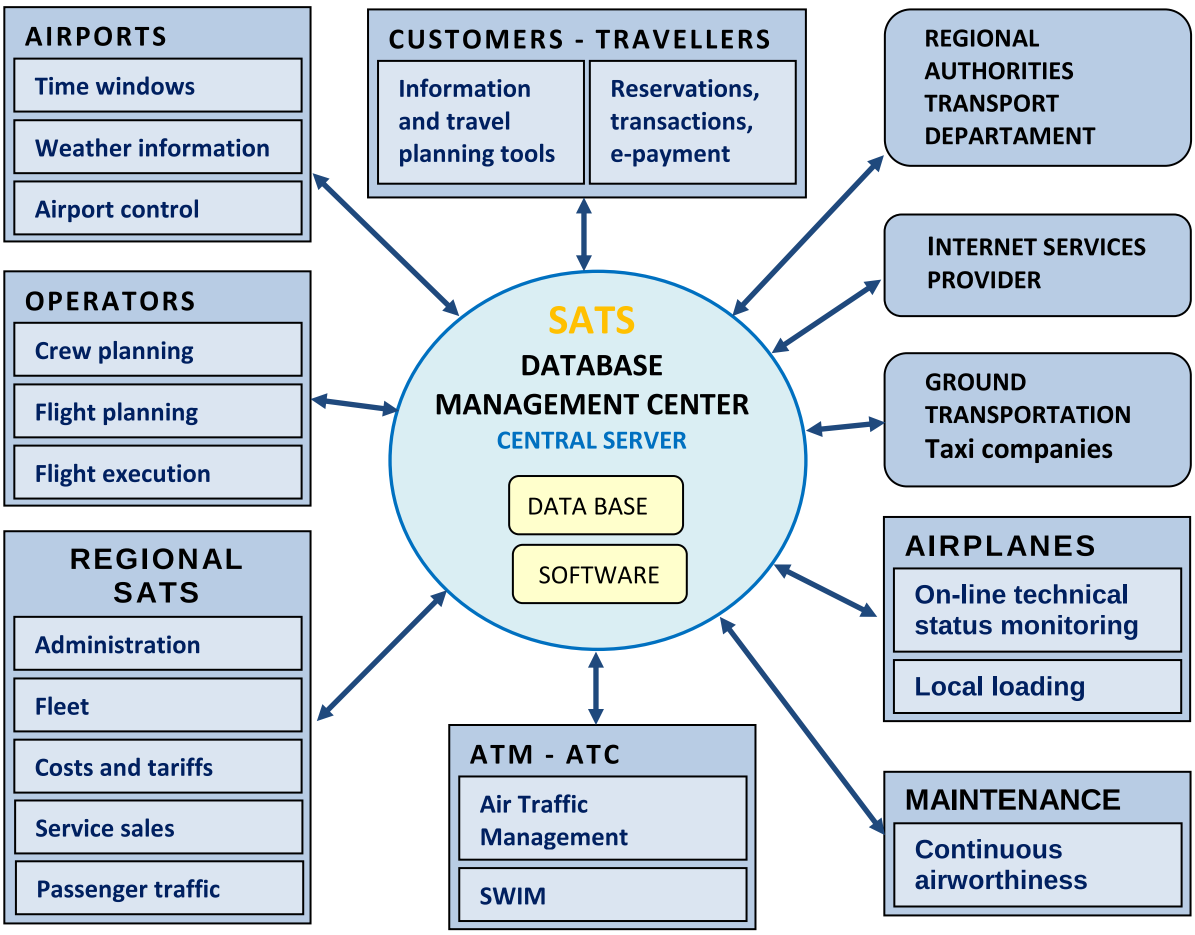
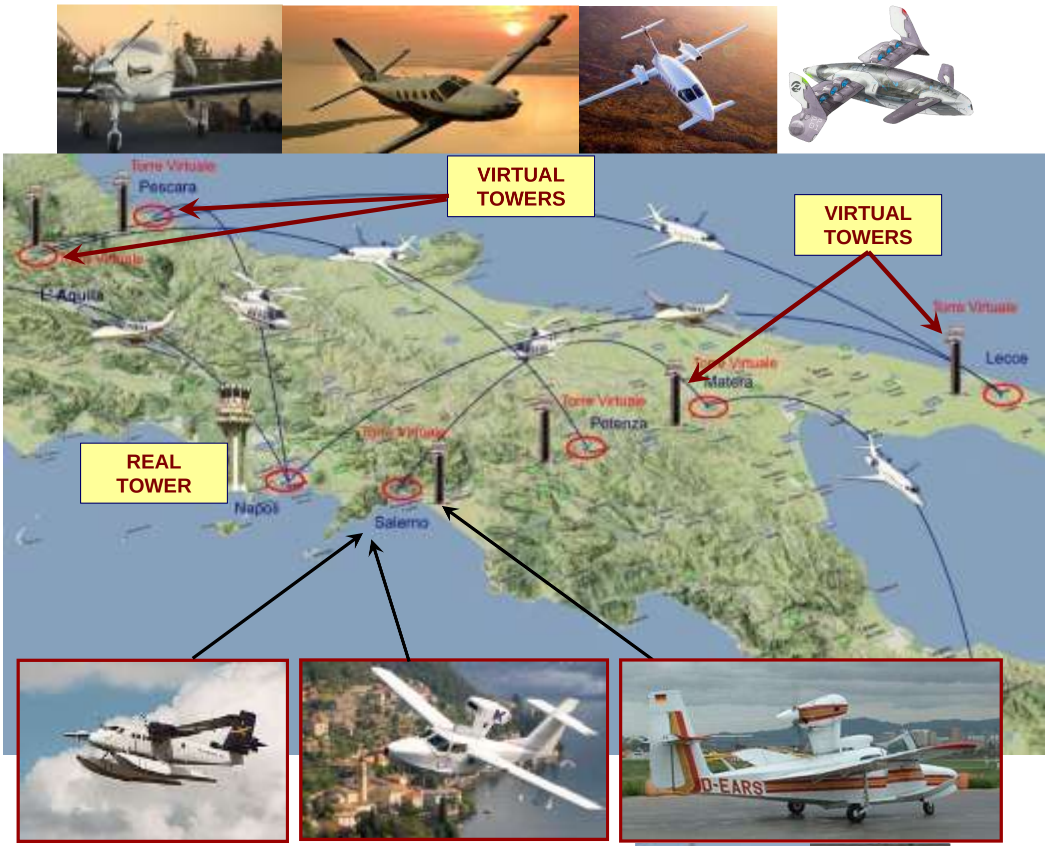
PROVISIONAL CONCEPT

Intelligent Small Aircraft Transportation System Concept



BASIC CENTRAL SERVER BLOCKS


VIRTUAL
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REAL
TOWER
Torre Virtuale
Pescara
L'Aquila
Napoli
Salerno
Potenza
Matera
Lecce
D-EARS


D-EARS

7.2 Expected Benefits for Europe

The SAT system will allow to answer to the flight Path 2050 challenges:

- meeting Societal and Market Needs
- maintaining and Extending Industrial Leadership
- protecting the Environment and the Energy Supply

respecting the constraint of ensuring Safety and Security

Meeting Societal and Market needs

- **SAT system will create additional mobility (door-to-door/point-to-point) for the European citizens as a component of an inter-modality transport system.**
- **SAT system will enable the strategic goal: "90% of travelers within Europe are able to complete their journey, door-to-door within 4 hours"**
- **SAT System will be interconnected, accessible, predictable, dependable and comfortable.**
- **SAT will be part of a variety of transport services tailored to individual needs.**
- **The SAT system will ensure access of small communities to air service.** In both the EU and U.S., scheduled air carrier service is declining for smaller markets. These markets are too thin, or small, to support daily scheduled service; the decline in scheduled service is resulting from airline industry responses to economic forces, include fuel costs. Over the last decade in the U.S. a reduction of more than 40% in passenger-miles for airline trips less than 250 miles and of more than 15% for trips between 251 and 500 miles[2] was experienced. The consequence is that smaller communities become more isolated from the economic mainstream loosing opportunities to contribute and to participate to economic growth and innovation; this results in a reduction of the quality of life. ***The small aircraft transport concept will ensure access of small communities to air service thus providing social and economic benefit.***

Maintaining and Extending Industrial Leadership

- **The deployment of the SAT system** will ensure the growth of European industry and of SME ensuring jobs and innovation.
- The SAT deployment will be **a stimulus for ensuring a level playing field between Europe and the rest of the world for small aircraft aviation**; this will have to be supported by the right policies, certification processes, funding and regulations, in close cooperation with the main stakeholders.
- The SAT system will **complement the traditional cargo system** allowing freight distribution in regions with less developed road/train infrastructures or among city pairs with less commercial volumes, partly substituting freight transport by tracks.
- **Export SAT products out of Europe covering emerging markets**.

Protecting the Environment and the Energy Supply

- **SAT System will be environmentally friendly**, affordable, safe and secure., The system will enable a reduction of emitted greenhouse gasses compared to other means of travel **by adopting more easily alternative fuel and alternative power sources.**
- **SAT System development will reduce road travel**. Highway modes are increasingly congested, with little prospect that more roads will be built to accommodate more car travel. Most of the demand for personal air mobility will likely be substitution for road travel, according to studies in EU and in U.S. **The benefits include the prospect for reduced emissions and energy consumption, in comparison with road transport.**

7.3 Stages of SAT system development

In order to get the full deployment of the SAT system according to the Vision, steps should be performed according to the following time frames:

- Short term 2020
- Medium term 2035
- Long Term 2050

Short term 2020

- **General acceptance of the added value of small-size aircraft and rotorcraft, operating on commercial scheduled or non-scheduled flights, as a component of the European (Air) Transport system.**
- **Perform RTD projects according to the needs of the European manufacturing industry, service operators and ATM in order to become the world leader in design and production of small aircraft and in operating a new transport mode.**
  - develop, test and demonstrate new technology, needed to meet the challenges;
  - define appropriate business models and concepts for operations;
  - develop a model and software tool to simulate the SAT system performance;
  - perform surveys to collect data to be used as input for the SAT system simulation;
  - perform additional studies on future means of individual air transport with time horizon reaching half of current century will be conducted during this phase with a special focus to cost reduction and green technologies and operations;
  - analyse interregional mobility demand in the EU to refine SAT system development planning.
- **Perform dissemination activities.**
- **SESAR ATM takes into account the SAT system operations already in the employment phase in 2014.**

  This approach would enable low cost SAT deployment and increasing: trust in the approach, political leverage, public acceptance.

- **New business models and IT systems** will be developed **to manage cost effective transport services and to support flight operations**, which should allow achieving high load factors and lower service costs.
- **The Small Aircraft community** should improve their **coordination** and define an industrial development master plan.
- **The enabling conditions to develop a SAT system should be improved at regional, national and EU level**; these enabling conditions include:
  - R&TD activities and infrastructure
  - Funding
  - Cost Models
  - Business Model
  - Certification, Standards and Rules
  - Flexible fleet and pilots are available
  - Small Aircraft community networking
  - Cooperative network of airports and small aircraft providers is created.
  - The needed logistics and related technical issues to set up a SAT system are identified.
  - Human issues related to a SAT System are studied
- **The system will start developing in MS or regions** (e.g. Poland, Italy, Sweden, Norway,…) most interested in low cost personal business travelling and in providing access to air transport; then, the SAT system will spread out gradually to other regions as its benefits will be recognised This would allow: collecting useful information to identify new problems and related solutions, refining business models; building up a success story, to increase trust in the approach, to support public acceptance and increase political leverage, and to stimulate a co-modal approach for the European transport system.

.***Medium term 2035***

In the medium term the main impact to be expected is here outlined.

- **Integration of small-size aircraft and rotorcraft**, operating on commercial scheduled or non-scheduled flights, within a **seamless inter-modality transport system.**
- **The European manufacturing industry** becoming the **world leader** in design and production of small aircraft.
- **Appropriate business models** for a full deployment of the SAT system available.
- **Full public acceptance and political support.**
- Small aircraft are **resilient to adverse weather.**
- **New advanced aircraft vehicles including clean and silent propulsion systems available.**
- **Situation Awareness by the availability of innovative cockpit, flight management systems, new communication and automation. The technology should allow single pilot operations and assist less trained pilots.**
- **New safety and certification regulations tailored to SAT are available.**
- **Innovative take-off and landing/launching techniques are adopted.**

<u>Long Term 2050</u>

- Innovative small aircraft and rotorcraft are developed in EU with **zero pollutant emissions, very small noise foot print,** and **low environmental impact all along the life cycle.**
- **The SAT system has the same safety and resilience level of the large aircraft ATS.**
- **Free flight and/or free** routing are the standard for operations.
- **Fully automated SAT aircraft** flying according to **autonomous flight rules.**

Thanks sister's PPlane Project for a picture.

7.4 The Current Capabilities

<u>The Current Capabilities</u>

The ***current capabilities*** have been described in the SAT-Rdmp report “D4.1 Assessment of existing capabilities in Europe”. In this report existing production, design and research capabilities of aviation industry focused on European Small Aircraft, including ATM systems and airport systems, capabilities of aircraft maintenance, training of people for operation and maintenance of aircraft, are described.

The information acquired within the scope of this activity will be used for ***the identification of missing capabilities*** in Europe (described in D4.2). Information about numbers of aircraft manufactures, engine and aircraft parts manufactures (fuselage, wing, etc.) focused on Small Aircraft are identified in this delivery. In the deliverable D4.1: Annex 1 contains information about capabilities of individual European countries; Annex 2 compares capabilities of individual European countries.

Four groups were created (Manufacturers (with or without Part 21), R&T / universities, Design organizations (with or without Part 21), Consulting service and others). The analysis of the capabilities was extended by international projects which are performed by some companies.

The analysis shows various European countries with many companies, universities and research institutes concentrating especially on manufacturing, design and development of aircraft parts and components.

In Europe there are aircraft manufacturers focused on production and sales of General Aviation aircraft designed for common commercial and non-commercial transport and helicopter manufacturers. These manufacturers are identified as the companies which are able to manufacture and sell fully certified aircraft (according to CS-23, CS-27, CS-29 regulations) and for operation of approved aircraft which would accomplish the idea of door-to-door transport intended within the scope of Small Air Transport project .

From the set of acquired data of individual European countries also the capabilities for ultra light aircraft production (the aircraft designed to transport 1 passenger only), airframes (wings) and engines of General Aviation airplanes usable within the scope of door-to-door transport are assessed.

The analysis shows:

- 17 manufacturers of small aircraft according to CS-23, CS-27 and CS-29 (5 manufacturers of helicopters),
- 16 manufacturers ultra-light aircraft (1 manufacture of UL helicopter),
- 17 manufacturers of piston engines (1 manufacture of Wankel engine),
- 5 manufacturers of turboprop engines,
- 6 manufacturers of jet engines,
- 11 manufacturers focused on production of airframe parts for GA aircraft,
- 2 manufacturers focused on production of engine parts for GA aircraft.

7.5 The Demand

The deliverable D2.1 defines four different operational scenarios for SAT-system. These are ranging from scheduled and non-scheduled commercial to personal operations with various operational costs, covering single and multi engine pistons, turboprops, jets up to 19 passengers.

These are not meant to be the final business models to be adopted but simply a base for the demand forecast.

Based on the assumptions on of the four scenarios, and by using the SAT-Rdmp demand model – as presented in “D1.2: Demand of small air transport aircraft analysis” **– the demand was assessed for 2030 for each scenario.**

In the following subsections a synthesis of these reports is given.

The major objective of the SAT-Rdmp project is to demonstrate and understand the role that small-size aircraft operating on scheduled or non-scheduled flights can play as a component of the Air Transport System to satisfy the needs of transportation in regions and city-pairs where transport networks are underdeveloped. In this context, the report “Business case subscriptions with operational characteristics” (e.g. SAT-Rdmp D2.1) aimed primarily in analysing the potential business cases and defining those being relevant for the European small air transport system.

The SAT system development is closely connected to the future interregional and intercity passenger traffic in Europe. An important element is to predict the demand of this type of traffic.

Data base and models of European transport network based on population mobility research are useful to this purpose. Such models and data were developed in the framework of many European projects, among others: DATELINE, TREMOVE I, TRANSTOOLS.

Internationally, the International Civil Aviation Organization (ICAO) has been compiling statistics on air travel since the start of commercial air travel. **Three basic descriptors of demand,** since air travel data started, **have been globally adopted** and recorded:

- annual flight hours per A/C,
- total passengers demand,
- total A/C movements,
- passenger-distance travelled,
- revenue passengers travelled, in terms of revenue passenger-kilometers,
- the required A/C.

Small amount of data are available for general aviation and air taxi. Moreover, these are not fully corresponding to the SAT system as defined in section “6.1 The SAT Concept”. The SAT system does not really exist, if not on a very small and local scale, thus demand forecast is even more difficult due to the lack of historical data. The potential SAT passenger demand can therefore be only obtained by estimating the level of traffic from other transport modes (and especially from the road transport mode) which would be transferred to the SAT transport mode.

The forecast analysis has been performed as follows: the number of annual flight hours per A/C, the origin destination passengers demand, the a/c movements and the number of required aircraft were assessed for 2030.

Specifically, the Origin Destination (OD) passenger demand has been evaluated. The Origin Destination passenger demand is the passenger trips originating or terminating at an airport. It represents the passenger demand directly associated with the airport/region local socioeconomic and “propensity to travel” characteristics.

Especially important for planning the SAT system, is the knowledge about those city-pair connections which, with existing transport modes, cannot be accomplished with a one day return trip. The choice of transport mode depends on many factors, but mainly on distance, time and cost of travel and on value of time spent in travel.

As numerous critical input records for the demand model are unfortunately publicly not available in certain cases, this model considers the following countries: Austria, Belgium, Switzerland, Germany, Denmark, Spain, Finland, France, Greece, Italy, Luxembourg, The Netherlands, Portugal, Sweden, the UK. Furthermore, 212 NUTS-2 regions, which is equal to 15 EU member states, could be included. These countries currently represent 80% of the total general aviation traffic in Europe. Updated estimations for 23 European countries should be provided in the Roadmap report. The total population of the countries included is 365 Million.

These routes will constitute the bulk of SAT system connections, the basis for calculating demand and setting mission requirements for aircraft. Door-to-door travel time on any interregional connection of up to 4 hours, is both a European transport requirement and an important SAT system requirements.

Current Air Transport System and potential mode shift

The air transport system in Europe currently accommodates about 10 million (IFR) flight movements to 450 airports (561 billion pas.km). Of the 10 million flights, 57,3% is operated by scheduled airlines, 22,1% by Low Cost airlines, 7,2% by business aviation , 5,7% by charters and 7,7% freight and military.150 scheduled airlines transport some 750 million passengers in Europe per year. Today about 30% of air travel is related to business travel and 70% to leisure. Thanks to economic growth, air travel demand increased by more than 4% per year. This resulted in mass transport. As a consequence numerous elements of the air transportation system, and more particularly the airports are getting more and more overloaded.

On long distance travel above 300 km, personal car transport some 2500 million passengers (992 billion pas.km) Highway modes are increasingly congested. Average speeds remain well below 100 km/h and do not change for many years. A large demand for SAT will be substitution for road travel.

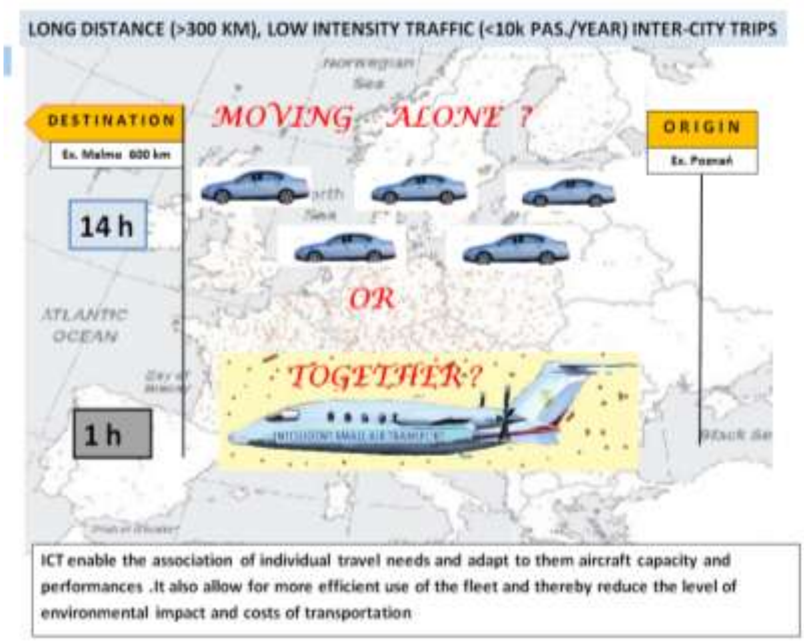
Existing mass transport systems – (high-speed) rail and airlines - serve intercity connections where passenger flows are thick and load factors are high (in aviation the load factor is nearly 80%). As a result cost-effectiveness is ensured. On connections where such passenger volumes are not achievable, mainly road transport modes are used (cars and busses).

In Europe a large scale high speed train network is being developed which involves the support by the European Commission. These high speed trains are seen as an attractive substitute for car travel and regional air traffic. Large sums of money are needed to establish the infrastructures (cost about € 40 million per KM of track) and this can be accomplished only on well identified routes mainly focussed on regions generating the biggest passenger traffic flows.

The EPATS study took into account that there are 2500 airports and aerodromes in Europe that might be used Small Aircraft Transport operations.

These airports are very near to regional towns. They make door to door travel possible in the shortest possible time. The maximum radius of action of a car trip is between 250 and 400 km per day (overall including the way back in one day this means up to 800 km), depending on road infrastructure. Even with a dense road network, distance that can be travelled by car during one day allowing a return trip does not exceed 400KM or 4 hours. A longer trip by car takes too much time. Apart from the cost of travel, these longer trips involve cost of accommodation. And there is the value of time: long car trips mean ineffective hours for business travellers which involve high opportunity cost.

Analyses performed in EPATS project, based on mobility requirements, indicate that 7% of travel by car on distance above 300 km can be shifted to SAT aircraft, this is 96 Bln pas.km and 183 M passengers for average travel distance 500 km. from cars to small aircraft, This will require a fleet of 28 thousands small 4 to 19 seat aircraft: both propeller driven aircraft and jets These projects show that in terms of safety, cost, time and energy efficiency as well as environmental impact, small aircraft transport is more advantageous than road transport.



All analysis of the market shows strong demand for aircraft operating in SATS, although the results differ.

Values differ as a consequence of the different models and input data., and particularly on:

- Passengers Origin-Destination flow data
- Income and Passengers Time Value distribution
- Vehicle transportation costs
- Components of generalized costs (monetary/non-monetary, internal / external, …)
- Transportation services model / business model

In future projects, the models and input data will have to be the subject of further studies and research both on Country and EU level

The fleet structure and allocation, the service model and resource management should be in line with the main goal specified in 7.5 The Challenges:

“The main goal of Small Aircraft Transportation System is to provide high-speed passenger transport to European Regions serving city-pairs with low-intensity traffic (below 10K pas./year for each route and more than 10K pas./year generated by region), currently connected mostly by personal cars or anyhow with a travel time from door to door (using available modes of transport) greater than 4 hours and without close perspectives for the introduction of high-speed train or scheduled airlines.”

Peripheral regions in Europe lack access to mass transport means and rely heavily on road transport. This hinders their economic development even more. It also adds to road congestion in Europe and its negative effects on the environment. Although airport facilities are available in those regions, the traffic flows do not allow regular airline operations using bigger aircraft. The SAT system could serve these regions as well and help to develop these

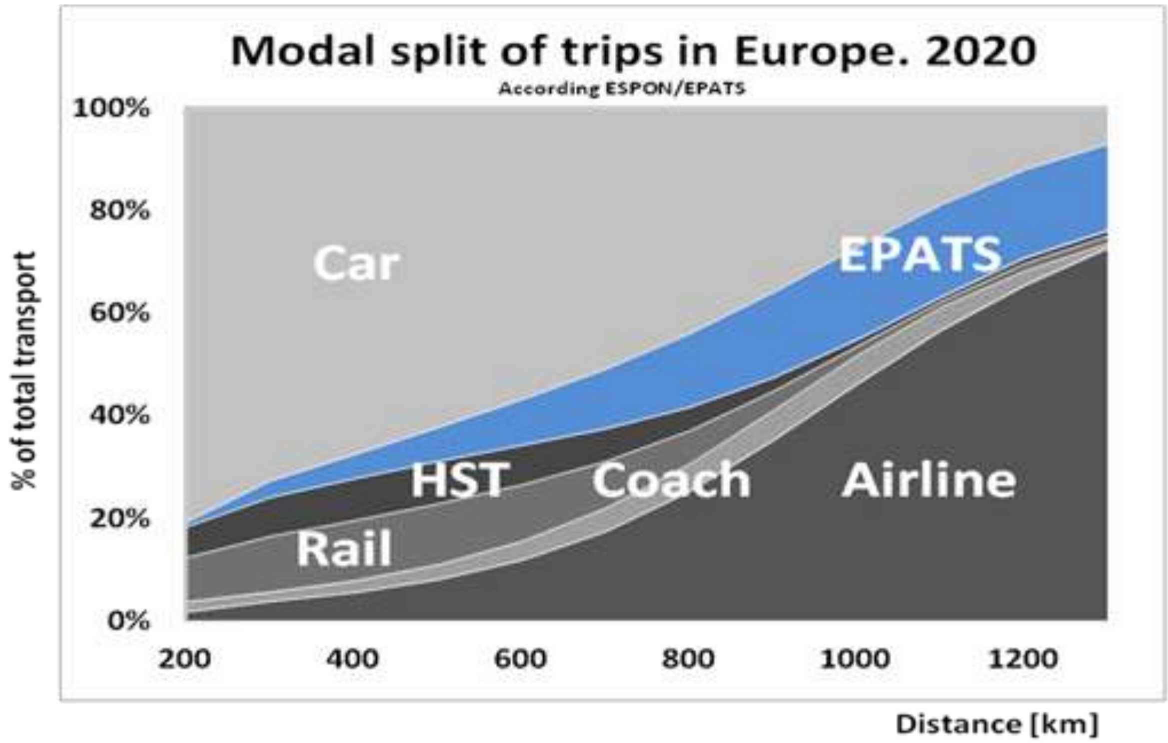
into stronger economic centres. In order to implement a balanced growth strategy it is important providing transport accessibility for cities and areas devoid of efficient and fast transport; this can only be realised through more intensive use of airspace and capabilities of air transport with an eco-sustainable approach.

The aim is to ensure a highly customer (passenger and freight) oriented service able to achieve the strategic goal: 90% of travellers within Europe are able to complete their journey, door-to-door within 4 hours in Europe.

Many countries are facing the Mediterranean Sea with very long costs and the market in the area should grow both in terms of passengers and freight transport. The connections along the coasts and with the islands are not very well served and a SAT system would improve transport accessibility and help the economic growth of the area. The infrastructure could partly exploit the existing harbours even though operations control has to be improved; resilience to adverse weather should be improved but it is worth saying the statistics of adverse meteorological and sea conditions show low occurrences of unfavourable status.

Thus, if the enabling conditions are fulfilled it is expected that a next step change in the development of the air transport system will be more personalized air transport. This form of transport will use relative small airplanes, dense network of small airports and new Information & Communication Technologies to provide quick services. In principle different types of operation to satisfy the needs of those requiring more personalized transport can be foreseen. It will complement existing travel modes and will be a substitute for road travel on highly congested roads in Europe for distances above 300 KM.

Picture below shows an example of such beneficial substitution



Modal split of trips in Europe. 2020. According to ESPON/EPATS

Scenarios

Scenarios are based on different costing methods.

In the scenario analysis (what if scenario) the fare is modified in order to see the effect on demand.

- ***Scenario nr.1*** defines small aircraft operations as conservative commercial air taxi operations with single and multi-engine pistons, turboprops and jets, up to 5 passengers. The total operational cost (TOC) of 2030 is therefore primarily based on the future evolution of the present real airfares of various air taxi companies.
- ***Scenario nr.2*** defines small aircraft movements as moderate (scheduled and non-scheduled) business flights performed by single and multi-engine pistons, turboprops and jets up to 19 passengers. The annual flight hours per aircraft are assumed to be 500.
- ***Scenario nr.3*** defines small aircraft movements as advanced (scheduled and non-scheduled) business operations performed by single and multi-engine pistons, turboprops and jets up to 19 passengers. The annual flight hours per aircraft are assumed to be 1000.
- ***Scenario nr.4*** defines small aircraft movements as advanced (scheduled and non-scheduled) business and personal operations performed by single and multi-engine pistons, turboprops and jets up to 19 passengers. The annual flight hours per aircraft are assumed to be 1500

For scenario 2, 3 and 4 the total operating cost is based on the SAT-Rdmp report, titled "Small Air Transport Aircraft characteristics". See the deliverable D2.1 for details concerning the operational scenarios for SAT-system,

Considered scenarios of future potential SAT operations

	Scenario n.1	Scenario n.2	Scenario n.3	Scenario n.4
operation	conservative commercial (scheduled and non-scheduled business)	moderate (scheduled and non-scheduled) business Annual flight hours per aircraft is 500	advanced (scheduled and non-scheduled) business Annual flight hours per aircraft is 1000	advanced (scheduled / non-scheduled) business and personal Annual flight hours per aircraft is 1500
cost	based on the future evolution of present real air taxi fares	based on advanced technologies and pioneering solutions in a/c design, manufacturing and operation	based on advanced technologies and pioneering solutions in a/c design, manufacturing and operation	based on advanced technologies and pioneering solutions in a/c design, manufacturing and operation
propulsion	piston, turboprop, jet	piston, turboprop, jet	piston, turboprop, jet	piston, turboprop, jet
a/c size	1-5 PAX	4-19 PAX	4-19 PAX	4-19 PAX

Considered scenarios of future potential SAT operations

	Scenario n.1	Scenario n.2	Scenario n.3	Scenario n.4
annual Flight Hours / aircraft	500-1000	500	1000	1500
TOTAL PAX demand	~ 955 000	~50 200 000	~61 900 000	~ 66 200 000
TOTAL a/c movements	~ 318 000	~35 100 000	~43 350 000	~ 46 300 000
TOTAL A/C	~ 720	~ 88 000	~54 000	~38 800

This estimate related to demand scenario 4 considers small aircraft movements including advanced scheduled and non-scheduled (business as well as personal) operations with relatively high annual flight hours and thus low total operating cost. This is based on the fact that for personalized air transport the sum of the fare and the cost of time is better than that of other transport modes like the car. It also incorporates regional scheduled air services to less developed regions.

More details on the forecast are given for the four scenarios in the following tables.

Preliminary estimated (SAT) PAX demand for 2030

	Scenario n.1	Scenario n.2	Scenario n.3	Scenario n.4
For pistons	~600 000	~ 48 670 000	~ 60 100 000	~ 65 000 000
For turboprops	~313 000	~ 1 300 000	~1 500 000	~ 226 000
For jets	~41 000	~222 000	~ 361 000	~950 000
TOTAL PAX demand	~ 955 000	~50 200 000	~ 61 930 000	~66 200 000

Preliminary estimated SAT a/c movements per year by 2030

	Scenario n.1	Scenario n.2	Scenario n.3	Scenario n.4
Pistons	~240 000	~34 000 000	~42 047 600	~45 500 000
Turboprops	~55 700	~917 900	~1 050 000	~158 000
Jets	~21 900	~155 568	~253 000	~665 000
TOTAL a/c movements	~317 000	~35 141 078	~43 353 000	~46 343 000

Required number of a/c to perform the preliminary estimated demand for 2030

	Scenario n.1	Scenario n.2	Scenario n.3	Scenario n.4
Pistons	~8690	~86 400	~53 340	~38 500
Turboprops	~610	~1 420	~810	~80
Jets	~25	~180	~150	~260
TOTAL A/C	**~720**	**~88 000**	**~54 300**	**~38 840**

The demand forecast

Based on the assumptions of the four scenarios the 2030 demand was forecasted for each scenario. The results for the four scenarios are presented in the following tables.

The highest yearly PAX demand is found to be that resulting from scenario 4 (1500 annual flight per A/C**)**:

- ~ 66 000 000 passengers travelling
- ~ 46 000 000 A/C movements

This would result in a fleet of ~ 39 000 A/C.

Scenario 2 (with 500 annual flight per A/C) **forecasts the larger aircraft fleet demand**:

- ~ 50 200 000 passengers travelling
- ~ 35 000 000 A/C movements

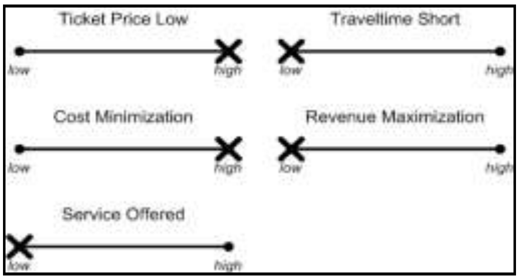
and a fleet of ~ 88 000 A/C.

Thus the demand forecast presented here has to be considered as a qualitative forecast useful for providing trends and the parameters affecting the demand.

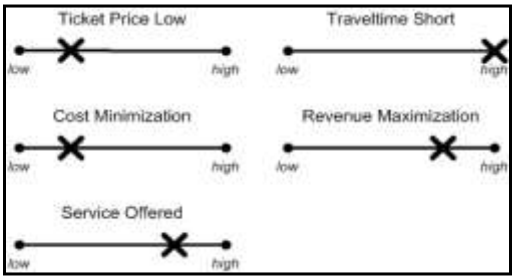
Business models

The project identified the most reasonable business models for the European Small Air Transportation System. The choice is based on the definition of five business models, which are characterised on the relative and absolute value of 5 key parameters including ticket price, travel time, cost minimization, revenue maximization and service offered.
For each of the five business models, the effects (e.g. fleet composition, targeted market, programs and ownership models offered) and the price sensitivity were given.

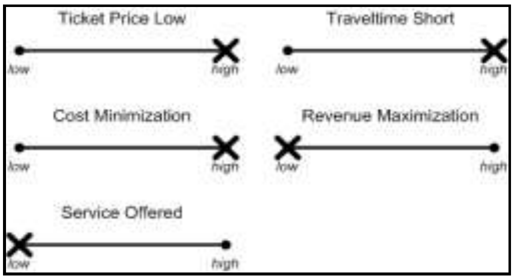
Business model nr.1 obtains a maximum profitability by minimizing the costs (to the SAT company and the passenger, while minimizing the ticket price too), in order to enlarge the market demand.



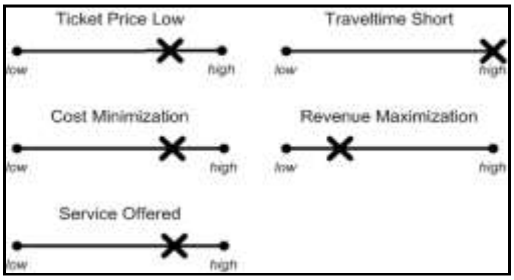
Business model nr.2 focuses on decreasing the travel time, at a higher price. It obtains a maximum profitability and undertakes a strategy to minimize the travel time while offering extra services to the customers.



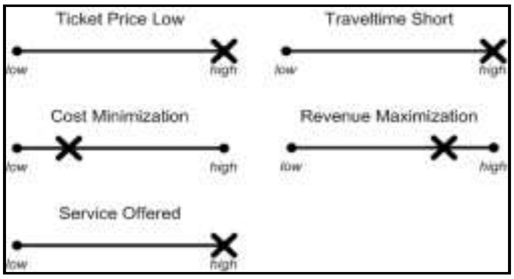
Business model nr.3 is a combination of the first and the second business model. Both the cost and ticket price minimization parameters and the travel time are important to increase demand (as a parameter to increase revenues) and decrease the costs. If the service parameter is less important, a lower ticket price and cost minimization can be effectuated. A variation of this business Model, where service is more important, will be studied in business model 4.



Business model nr.4 includes a cost minimization and travel time decrease strategy to increase the demand and revenues on the one hand, and decrease the cost on the other hand. If service is a more important parameter (in contradiction with business model 3), a low ticket price and cost minimization strategy can still be realized.



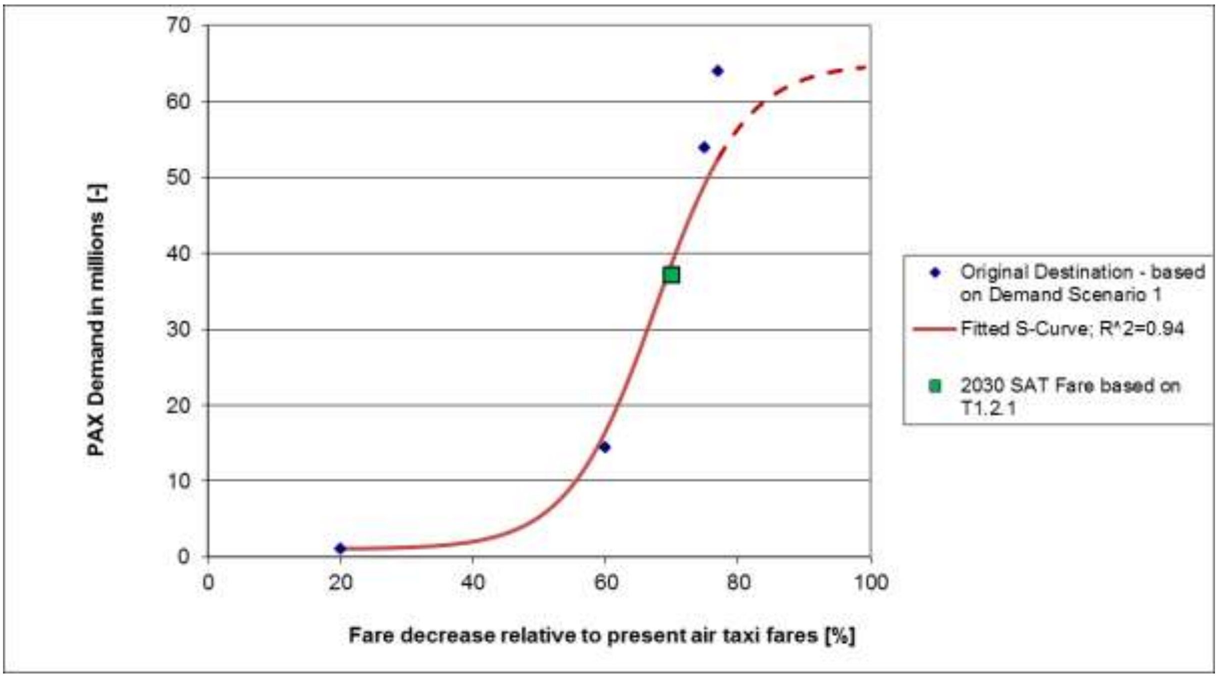
Business model nr.5 is a response to the entire market demand, thus fully differentiated with respect to other models. By supplying the ticket prices to a minimum, while offering different aircraft for different prices, the passenger can choose his own level of service (attracting a broad target market with a broad brand image). This model aims to increase the demand (and revenue) to a maximum while keeping the costs as low as possible without ignoring the demand of more affluent business travellers.



The adopted business models allow to perform a sensitivity analysis, which showed that the most significant influencing factor (on the passenger demand) is the SAT cost. This finding is fully in line with the expectations and the literature related to demand modelling.

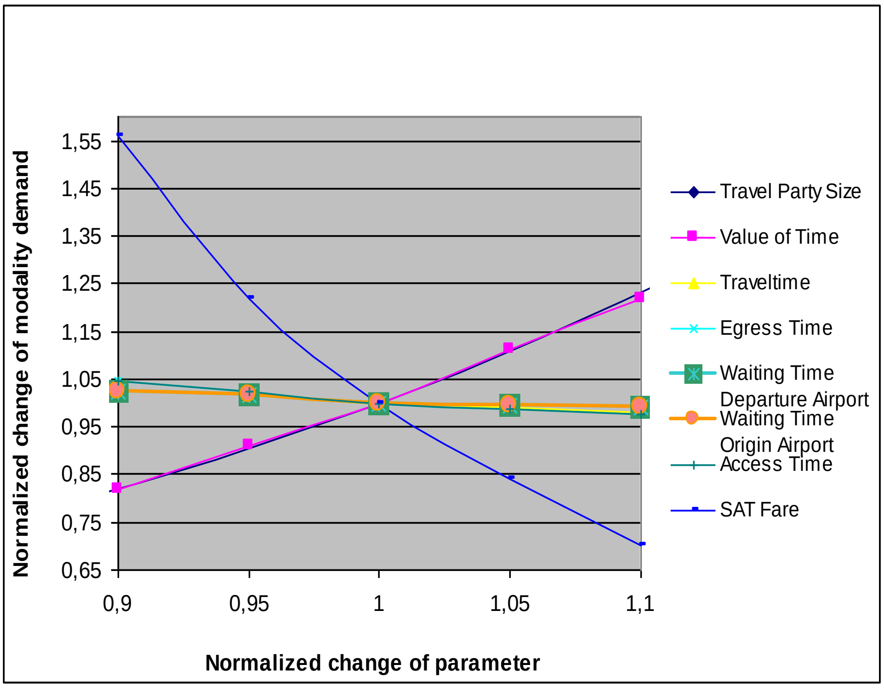
Major conclusions are :
- demand is highly cost sensitive,
- demand rises rapidly with cost decrease
- Key drivers of SAT demand: SAT fare, value of time, travel party size

Demand Sensitivity



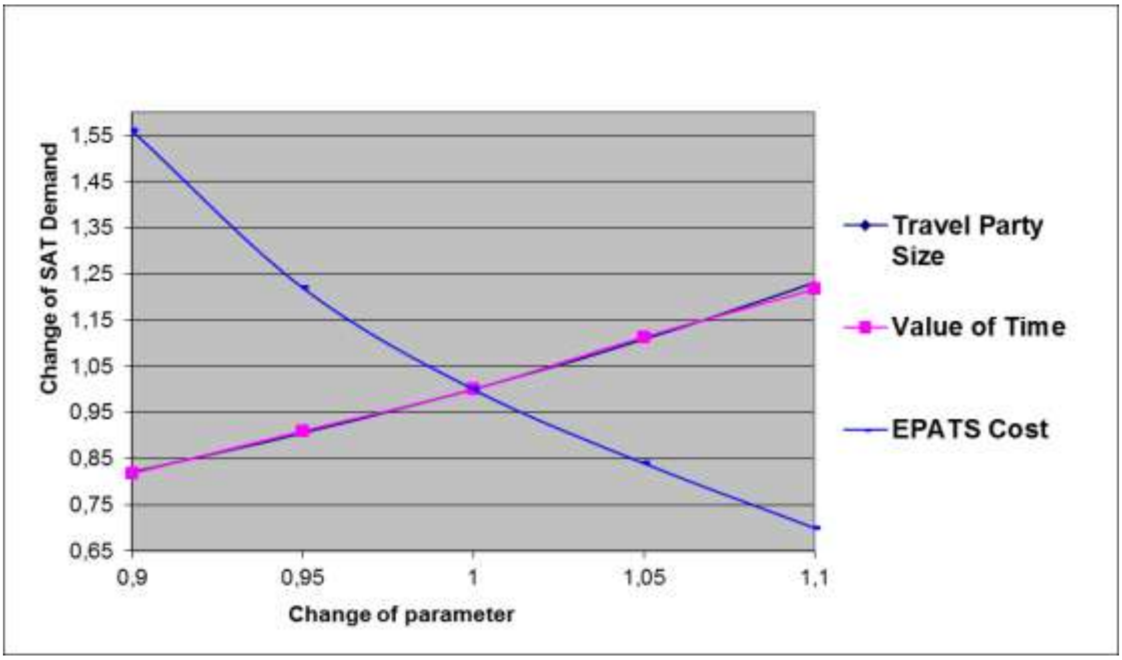
demand is highly cost sensitive
Example from Scenario-1 : demand rises with cost decrease

Demand Sensitivity



Key drivers of SAT demand: SAT fare, value of time, travel party size

Demand sensitivity to key drivers



Key drivers of SAT demand: SAT fare, value of time, travel party size

7.6 The Specific Challenges

Referring to Flight Path 2050 the SAT system will have to answer to the following challenges:

- Meeting Societal and Market Needs
- Maintaining and Extending Industrial Leadership
- Protecting the Environment and the Energy Supply
- Ensuring Safety and Security
- Prioritising Research, Testing Capabilities and Education

The Specific challenges are here highlighted.

The main goal of Small Aircraft Transportation System is to provide high-speed passenger transport to European Regions serving city-pairs with low-intensity traffic (below 10K pas./year for each route and more than 10K pas./year generated by region), currently connected mostly by personal cars or anyhow with a travel time from door to door (using available modes of transport) greater than 4 hours and without near term perspectives for the introduction of high-speed train or scheduled airlines.

The SAT System must be **highly customer (passenger/freight) oriented, environmentally friendly, affordable, safe and secure, interconnected, accessible, predictable, dependable and comfortable**.

- **Highly customer (passenger/freight) oriented service**
  - The system needs to be **dependable**. Through the use of IT and fleet allocation adapted to traffic, the passengers will have the opportunity to use flights which meet a personal schedule as much as possible or anyhow a lager choice for transportation through the increasing use of small aircraft serving small airports.
  - The system needs to be **comfortable** and client centred. Aircraft will offer the same comfort as cars. The reservation system will make use of electronic means to book flights.
  - The system has to be **affordable.** Cost of travel will be comparable with other means of fast transport.
  - The system has to be accessible. The high density of existing airports and the short distances between these airports and the final destination has to be exploited to facilitate the access to transport for a large number of communities in a cost effective way.
  - The system will offer a high level of reliability. The system needs to operate on time during 24 hours, seven days a week. Only in specific circumstances (extreme weather, volcanic ash) where safety might be compromised, the system may shut down.
  - The SAT system has to **create additional mobility ensuring door-to-door/point-to-point in 4 hours for the European citizens.**
- The system has to be **environmentally friendly and energy efficient.** SAT system should not raise the noise level at which people are exposed. Noise contours should stay within the airport boundaries and with a low societal impact. The system should also enable a reduction of emitted greenhouse gasses compared to other means of travel by adopting alternative fuel and alternative power sources.
- The system has to be **safe** not only by meeting appropriate aviation rules and regulations, but it should also be perceived as safe by the users. The operational system has to be **secure** as well.

It is generally accepted that the reduction of Cost is very relevant for SAT system development, and that this can be achieved through technology deployment, appropriate business models, and by logistical means (particularly by optimization of service route and network topology, aircraft fleet structure and resource allocation).

ACARE envisages implementing an intermodal travel management tool that will benefit the customers. This new system of operations should contain the following elements:

- intermodal; travel planning;
- pricing and total trip assessment, intermodal shopping;
- intermodal trip reservation and booking;
- intermodal ticketing (using social media);
- trip data storage;
- trip servicing (cancellations, rebooking etc);
- intermodal trip payment (only one single interface);
- notify customer of detected disruption;
- recommend alternative intermodal travel solutions;
- automated rebooking;
- install collaborative and joint mechanisms in case of disruptive events to enforce efforts to bring stranded passengers and cargo to their destination.
- IT systems to enable pre and in-journey customer decision making across all modes of transport through real time, high speed and secure data access, service tracking, notification and payment.

The seamless passenger service should be fully operational in 2035. The envisaged intermodal travel management toll might be partly tested on small aircraft operations.

The SAT system might be a forerunner of a future reservation system enabling seamless flow for both passenger and (small) freight.

7.7 SAT Target Products

In the following section the SAT target products will be described looking to: aircraft, concept of operations, and systems.

7.7.1 Aircraft

- New small aircraft will be developed according to mission requirements and system operational models.
- Aircraft will have to designed looking for operational flexibility and multipurpose applications.
- Both fixed wing aircraft and rotorcraft should service the SAT system market.
- Studies should be conducted on the aircraft types and performance requirements that best satisfy the SAT system needs.
- The aircraft will have to be environmentally friendly, energy efficient, safe, comfortable and allowing reliable operations.
- Product flexibility will have to be ensured: small aircraft should be designed taking into account the possible service flexibility foreseen: use of short runways, use of hydro-scales, passengers and freight mixed transport modes, etc.
- Families of aircraft should be designed with commonalities to reduce operative costs.
- Aircraft will have to be designed for greater autonomy and possibly speed.
- Innovative power plant systems (e.g. electric, based on alternative fuels,…) will be needed to reduce cost and environmental impact . In Europe there is not yet a settled capability for the development of engines for small aircraft. An effort has to be done in this direction.
- The new A/C requirements will pose new challenges for certification. Early engagement of the regulators is essential. New rules are felt as a determinant factor to bring innovation into the sector and an enabling condition for realising the SAT mode. Distinguish rules for GA (leisure activities) and SAT mode (commercial activities) for pilot training, design, certification, operations.
- New paradigms for maintenance specific for SAT, involving condition based maintenance, will have to be adopted.
- In the long term advanced configurations (e.g autogyro and amphibious planes) might become part of the SAT system
- New production procedures of small aircraft will have to be adopted to reduce cost.

- Introduction of technologies and materials from different sectors is expected to be beneficial.

- The fleet structure will be tailored to the requirements and business models; anyhow , the following products might be included in the SAT system:
  - Piston engine A/C - 9 seats or fewer – MTOW up to 5670 kg.
  - Turboprop A/C - 19 seats or less - MTOW up to 8618 kg.
  - In the long term Jet A/C – up to 19 seats - up to 7600 kg
  - Helicopters.
  - Novel aircraft configurations like QVTOL and QSTOL, autogyro's and amphibious aircraft

7.7.2 Concept of Operations, and Systems

- **Service flexibility** will have to be ensured for both operators and passengers cost/benefit trade-off.

- SAT system will provide **passenger/freight door-to-door transport on specific city-pairs** with a flexible range of service and tariffs (e.g. different business models for operations) including scheduled, unscheduled service. More specifically :
  - Aero-taxi service. (one way or return aircraft on demand)
  - Per aircraft on demand (aircraft charter)
  - Scheduled flight

- Different **business models** must identified for the overall cost/benefit balance:
  - the model for the **manufacturers** of Small Aircraft
  - the model for the **operator / owner** of the Small Aircraft (e.g. **fleet management**)
  - the model of **cost /benefits for the passengers** of SAT systems

- Within the adopted business models different class of service operators should be foreseen
  - **Passengers service** operators
  - **Freight transport service** operators
  - **Passengers/freight service** operators

- Service/Operations flexibility calls for
  - an appropriate **web based booking system** and SAT service management;
  - optimal SAT **service network topology** (e.g. airports network);
  - optimal SAT **aircraft fleet structure and management**;

- Remote operational support will be need to reduce cost and increase reliability.

- Interconnection of SAT system to other transport system (including cars and taxy) through an interconnected booking system allowing also awareness of transport modes status and possible mode shift.

- ❖ SAT system will operate in the standard SES air space that will have not to restrict SAT operations.

- ❖ SESAR ATM concept will have to take into account the SAT system operative requirements already in the employment phase in 2014, thus avoiding later expensive adjustments.

- ❖ Innovative cockpit, with integrate avionics, flight management system, and automation, improving situation awareness and possibly single pilot operations. The technology should also simplify piloting.

- ❖ Remote piloting, and automated aircraft (flying according to autonomous flight rules) will be in the medium/long term a target concept.

- ❖ In the long term, modifying ICAO regulation, full autonomous aircraft may become a reality.

1 The ICAO UAS manual, to be published in 2013, states : "UAS can be "autonomous" (i.e. they do not allow pilot intervention in the management of the flight) or Remotely-piloted aircraft (RPA, which are unmanned aircraft piloted from a Remote pilot station (RPS) . Only the latter are currently considered by ICAO suitable for standardised international civil operations, due to unclear responsibility for the autonomous portion of the flight."

7.8 High Level Objectives

In this section for each Challenge the High Level Objectives for the SAT system development are described.

HLOs for highly customer oriented service

- ❖ The system needs to be dependable, through the use of IT the passengers must have the opportunity to use flights which meet a personal schedule with a lager choice for interconnected transportation.
- ❖ The system needs to be comfortable and client centred, the reservation system will make use of electronic means to book flights.
- ❖ The system has to be affordable, cost of travel will be comparable with other means of fast transport.
- ❖ The system has to be accessible for a large number of communities in a cost effective way.
- ❖ The system will offer a high level of reliability. The system needs to operate on time during 24 hours, seven days a week. Only in specific circumstances (extreme weather, volcanic ash) where safety might be compromised, the system may shut down.
- ❖ The SAT system has to create additional mobility ensuring door-to-door/point-to-point in 4 hours for the European citizens.

HLOs for the Challenge COST

- Low cost operational aircraft is needed.
- Several cost issues need attention: production cost, maintenance, crew cost, off the shelf equipment and systems.
- The demand model analysis showed that DOC should be lowered by at least 20% compared to the current A/C generation
- Design for maintenance must become a good practice.
- Innovative material and processes for low cost production and long term maintenance.
- The development of an innovative low cost European piston engine is essential in the short term.
- In the medium/long term, engines with alternative fuels and electric engines have to be developed for the specific SAT application.
- Insurance cost should be lowered.
- Optimization of production techniques in view of high labour rates in Europe and increased competition from emerging countries.
- On board equipment requirements should be tailored to the needs of small aircraft for SAT system
- ATC costs should be reduced with respect to current figures and properly sized for SAT.
- Training cost for pilots and technicians should be reduced.
- Single pilot operation complemented by some automation should become a viable solution to reduce costs maintaining the needed level of safety.
- Improve fuel chain distribution at small airports to reduce fuel cost.

HLOs for the Challenge QUALITY AND COMPETITVENESS

- Improve on board comfort : noise, vibrations.
- A correct balance between cost and predictability of flights must be ensured.
- Good dispatch reliability is essential for both freight and passengers.
- The use of international airports for on-demand travel should be allowed
- R.A.M.S. approaches should be adopted for the whole life cycle of the products/services, addressing dynamic risk modelling to support decision making at different stages.
- Design innovation (adopted technology, tools for designing, and approaches) is an important element for new a/c.
- Innovative configurations should be investigated (e.g. VTOL, Tilt rotor, etc.).
- Improve social acceptance of a SAT system concept; positive impact should be advertises: employment, regional economy, etc.
- Persuade local authorities of positive impact: provide solid and reliable traffic/employment forecast, work together with neighbouring associations and habitants.
- The SAT marketing should be improved: the passengers do not know the real characteristics of the offer.

HLOs for the Challenge GREENING

- External noise is an important requirement; noise foot print will have to be very small to avoid an increase of noise impact at airports (community noise).
- Reduce emissions by improving aerodynamics efficiency
- Eco design concept must be adopted by SAT system (recyclable material, design criteria including maintenance and A/C decommissioning)
- Reliable, Clean and Silent engine must be developed. Engines with low emissions (CO_2, NOx) and fuel burn compared with currently available solutions (e.g in line with ACARE goals)
- Electric propulsion should be a viable solution in 2035.
- Alternative fuels with low emissions should be a viable solution in 2035.
- Appropriate flight profiles need to be adopted (e.g. steep approach, take off)

HLOs for the Challenge TIME EFFICIENCY

- Aircraft for SAT mode will have to be introduced and fit into the European airspace.
- The European ATM system will have to be able to ensure a high level of reliability including SAT
- Small Aircraft should be able to fly in poor weather (low visibility) by IFR in uncontrolled air space with low traffic density area.
- Current separation between controlled and uncontrolled space (G and C) should be kept valid.
- Implementing new communication, navigation and control systems (CNS) will lead to extend the SAT system network and capability
- Flight Levels issues in TMA (commercial vs. personal air traffic) should be solved.
- SESAR should recognize the importance of SAT system.
- New certified GNSS based equipment are needed both in the cockpit and at airports (no additional infrastructure cost) together with GNSS based operations.
- SAT system has to be integrated with large and small airports (non ILS airports vs. Aircraft fitted with the necessary systems)
- Low cost changes should be needed at regional airport infrastructures to enable IFR flights / IMC

HLOs for the Challenge SAFETY

- Small aircraft should have safety levels comparable to large commercial A/C.
- Early engagement of the regulators in new technology developments is essential.
- New rules for pilot training, certifications and operations are felt as a determinant factor to support innovation into the sector and an enabling condition for realising the SAT mode. Sat rules should be different from GA leisure activities rules.
- Rules with clear definition and easy to apply should be defined.

- Low cost certified operators for maintenance are needed.
- Post-crash survivability could be improved through new R&TD activities.
- Overcome small aircraft sensitivity to adverse weather
- Improved weather awareness without on-board weather radar.
- Affordable solutions in the detection and processing of atmospheric phenomenon must be adopted.
- Capability to operate with limited ATM services must be ensured
- Use of advanced technology (modern GPS, tablet, etc) for traffic and positioning awareness should be accepted.
- Low cost Traffic and Collision Avoidance Systems (TCAS) providing guidance to the pilot to restore safe separation (ACAS) must be adopted.
- GPS-based approaches on secondary airports allowing IFR flights in and out without expensive ground-based systems should be developed and adopted.
- Technologies that would prevent excursions out of the flight envelope on a permanent basis will have to be developed in a way similar to "fly-by-wire" technologies but at a much lower cost.
- On board monitoring via low cost HUMS.
- New cockpit design must be defined to lower the pilot workload and ensure situation awareness and possibly single pilot operations.
- Provision of effective/efficient pilot training for SAT system.
- Safety management system dedicated specifically to SAT (reporting improves safety).

HLOs for the Challenge SECURITY

- Security is recognised to be a relevant element at airports to secure the fleet and the passengers.
- Cyber attacks will have to be mitigated in due consideration of innovative adopted technology for communication, data links, avionics, etc.

7.9 Enabling Conditions

In order to deploy the SAT system in the time frame identified in section 6.2, the following enablers have been identified:

- Funding
- Cost models
- Business Models
- Certification, Standards and Rules
- R&TD activities and infrastructure
- Flexible fleet and pilots
- Small Aircraft community networking
- Cooperative network of airports
- The needed logistics and related technical issues to set up a SAT system must be fully identified.
- Human issues related to the SAT System are studied for improving public acceptance.

Here below some enablers are further discussed.

Funding

There is significant risk involved for industry in the design and development of aircraft for the on-demand and regional air carrier services as the market will only develop as soon as products are available.

There is a clear case of market failure: the industry will not develop and the market will not develop unless there are products available from other continents that will benefit from the European market.

Therefore, public support to mitigate technical and regulatory risks through public-private partnerships that target pre-competitive technology development will be needed.

In order to develop a SAT system EC and National policy decision makers should ensure the appropriate level of funding.

The public support for developing (even if low cost) SAT infrastructures and service operators network is necessary. The same happened and it is still happening for HST, harbours etc.

Cost Models

The demand model analysis showed that DOC should be lowered by at least 20% compared to the current A/C generation and in general costs are an enabling factor for the full deployment of SAT System.

The Cost issues are to be tackled by a structured approach which allows to consider all the elements which concur to the costs, constraints, evaluation of benefits and the actors who have to sustain/afford them.

Provided that there exists a common agreement on the needs for a SAT mode, rigorous paradigm are to be implemented to monitor and control the cost variables; according to the considerations made during the workshop some conclusions can be derived.

There are two main categories for cost evaluation:

- The costs related to the SAT system build up/set up.
- The costs related to SAT system operative life.

Cost Model for SAT SYSTEM BUILD UP

Such costs relate to the SAT build up phase. This should be a system to allow to analyse the cost impact of each item. The cost model could produce design options for the whole SAT system in terms of product components (vehicles, fleet, avionics, engines, hydro scales, ground infrastructures, ATS virtual towers, etc). The cost impact should be analysed versus benefits in terms of addressed challenges (environment, energy, competitiveness, safety, travel time…), and the cost model should consider the whole transport system linking with other transport infrastructures/modes.

SAT SYSTEM OPERATIVE SERVICE Cost Model

Such costs relate to the operative life of the SAT system; it is a system of systems whose end users are: passengers, transport service providers, MRO etc.
A dynamic, multi-layered system for service operations has to be adopted on the basis of real numbers coming from various operators (cost numbers, available routes, weather conditions, time constraints,…)

1. The cost model has to include the door to door transport: buy a ticket from Paris to Stromboli - Paris-Naples with a standard ATS service, and SAT from Naples to Stromboli. The same concept should apply to freight for regional freight distribution.
2. The cost model has to take into account the cost benefit of operating ensuring service flexibility, product flexibility, adaptability of service.

According to these considerations a concept for the system architecture can be derived. It has to be a network centric system allowing the specific user (passenger, service providers, …..) to obtain the answer which fits his specific needs. The network system contains all the following ingredients: network topology dynamic definition; flexible travel options,….

The Business Model

Reliable and affordable business model have to be adopted. The business model to be adopted is an essential element (influencing transportation costs) for the success of a SAT System.

Business models will have to take into account the needed service flexibility. SAT system will provide passenger and small freight door-to-door transport on specific city-pairs with a flexible range of service and tariffs including scheduled, unscheduled service.

Studies on different business models must be identified for the overall cost/benefit balance:

- the business model for the manufacturers of Small Aircraft
- the business model for the operator / owner of the Small Aircraft
- the cost /benefits for the passengers of SAT systems

Certification, Standards and Rules

In the report "D1.4 Identification of existing regulation requirements, regulatory difficulties and innovative approach" this enabling condition is analysed in details.
Certification of aircraft, engine, aircraft unit, aviation personnel or organization is for most of companies quite a demanding activity from time, finances and administration point of view.

Reduction of these costs will enable a larger development of Small Aircraft Transport segment (SAT) in Europe and it will open the way to the development of new airplanes for small aircraft.

The market has to be addressed with innovation. Innovation is expensive due to the needed R&TD, Know-how, and compliance to the rules. If rules are too rigid, not easy to apply, or not well suited for the specific application are against innovation increasing cost and time of development. Rules for GA (leisure activities) and SAT mode (commercial activities) for pilot training, design, certification, operations have to be distinguished.

The regulatory community for General Aviation aircraft in the U.S. is highly interested in supporting the advancements considered in both the EU and the U.S. on-demand mobility studies. Collaboration between the EU and US in technology advancement for SAT/On-Demand Mobility would logically include the regulators of both EU and USA.

The current European regulation for certification and operations is complex and does not allow a simple and cost effective implementation of the SAT system. In fact, SAT system is not foreseen but only commercial or non-commercial operations are distinguished in EASA regulation.

To comply all the requirements (HLOs) expressed in section 6.6, studies for defining a new class of operations (SAT system) should be performed in cooperation with EASA.

R&TD activities and Infrastructures

R&TD activities and relevant infrastructures have to be ensured to grant:

- development of specific simulation tool for multidisciplinary simulation and optimisation,
- step changes in small aircraft technology,
- development of new small engine technology,
- development of an ATM concept suitable for SAT system and fitting SES,

Small Aircraft Community Networking

The Small Aircraft community is rather fragmented in a high number of small SME and local operators. This situation does not allow an appropriate coordination and networking among stakeholders; furthermore, the community in such fragmentation is not able to have sufficient political leverage at both national and EU level.

The Small Aircraft community should improve coordination and networking.

Currently, the Small Aircraft community is not officially represented in ACARE; this situation should be overcome in order to ensure the appropriate visibility to this component of Aviation.

Airport network

In Europe there are 2126 airports and aerodromes, 1336 of which have concrete runways and 737 are already equipped with ILS systems. In most cities with more than 100.000 citizens there are airports available with concrete runways in the proximity (e.g. within 30 minutes).

These airports will have to be exploited taking into account environmental limitation. Central and local governments and private companies will have to exploit the SAT system service potential and benefits.

An “Airport Improvement Program” (AIP) will be defined and implemented in a coordinated way between EU, MS and local governments.

Airport concept, must be driven by enhancement of capacity and assurance of efficiency; efficiency requires that the organisation of all activities must be optimised for all processes.

Airports network should be created exploiting existing small airports, or creating new infrastructures where strictly necessary; depending on required ATM equipment existing airports should be upgraded.

8 Recommendations for the Implementation

8.1 Main Recommendations

- **The deployment of a SAT system should be considered as an answer to the social need for additional mobility** specifically in some regions and city-pairs; these areas would increase their access to transport.

- **The Small Aircraft Transport System should be part of the European Integrated Transport System;** this is a challenging objective but in Europe there is the knowledge and market potential to achieve it.

- **A part of the cost reduction may come from setting up the enabling conditions and among these the proper business model and service operations. Another part of the needed cost reduction may come from technology improvements. In order to bring the technologies up to the highest level of maturity and allow, validation and demonstration activities are needed in Clean Sky 2.**

- **SESAR should recognize the importance of SAT system**. **SES ATM has to take into account the SAT system operations already in the employment phase in 2014, avoiding expensive late adjustments. ATM costs reductions are important for SAT deployment: SAT should be considered in both SESAR and SESAR2.**

- **The market has to be addressed with innovation**. Innovation is expensive due to the needed R&TD, Know-how, and compliance to the rules**. If rules for pilot training, design, certification and operation are too rigid, not easy to apply, or not well suited for the specific application are against innovation increasing cost and time of development.**

- **A proper dissemination and political leverage is needed** to improve awareness of sustainability and possible social benefits of a SAT system. Currently the enabling conditions are in a poor status. European manufacturer are suffering from this situation.

- **In the short term (within 2020) it is essential to perform dedicated research and dissemination activities.** Research should be dedicated to: develop, test and demonstrate new technology, needed to meet the challenges; define appropriate business models and concepts for operations; to develop a model and software tool to simulate the SAT system performance; to perform surveys to collect data to be used as input for the SAT system simulation. **This approach would allow increasing: trust in the approach, political leverage, public acceptance.**

- **The system should start developing in MS or regions (e.g. Poland, Italy, Sweden, Norway, etc) most interested in low cost personal business travelling and in providing access to air transport.** The SAT system will spread out gradually to other regions as its benefits will be recognised. This would allow: collecting useful information to identify new problems and related solutions, refining business models; building up a success story, to increase trust in the approach, to support public acceptance and increase political leverage, and to stimulate a co-modal approach for the European transport system.
- **SATRdmap Vision and Research Agenda outcomes should be considered as elements of ACARE SRIA. Research, Testing Capabilities and Education will have to be prioritised taking into account the need for the SAT System deployment.**
- **Horizon 2020 should foresee R&I activities dedicated to the full deployment of the SAT system as an element of Future European Transport System.**

8.2 SAT system R&TD Roadmap

Starting from the SAT Vision, having agreed on specific challenges and high level objectives for class of products, the SAT roadmap will identify technologies, systems, procedures and actions to enable the successful implementation of small aircraft operations in commercial aviation. The SAT roadmap adopts a top-down approach and identifies the solutions for future products, operations and enablers first. Then the analysis shows the technology areas that need to be addressed to enable the SAT system.

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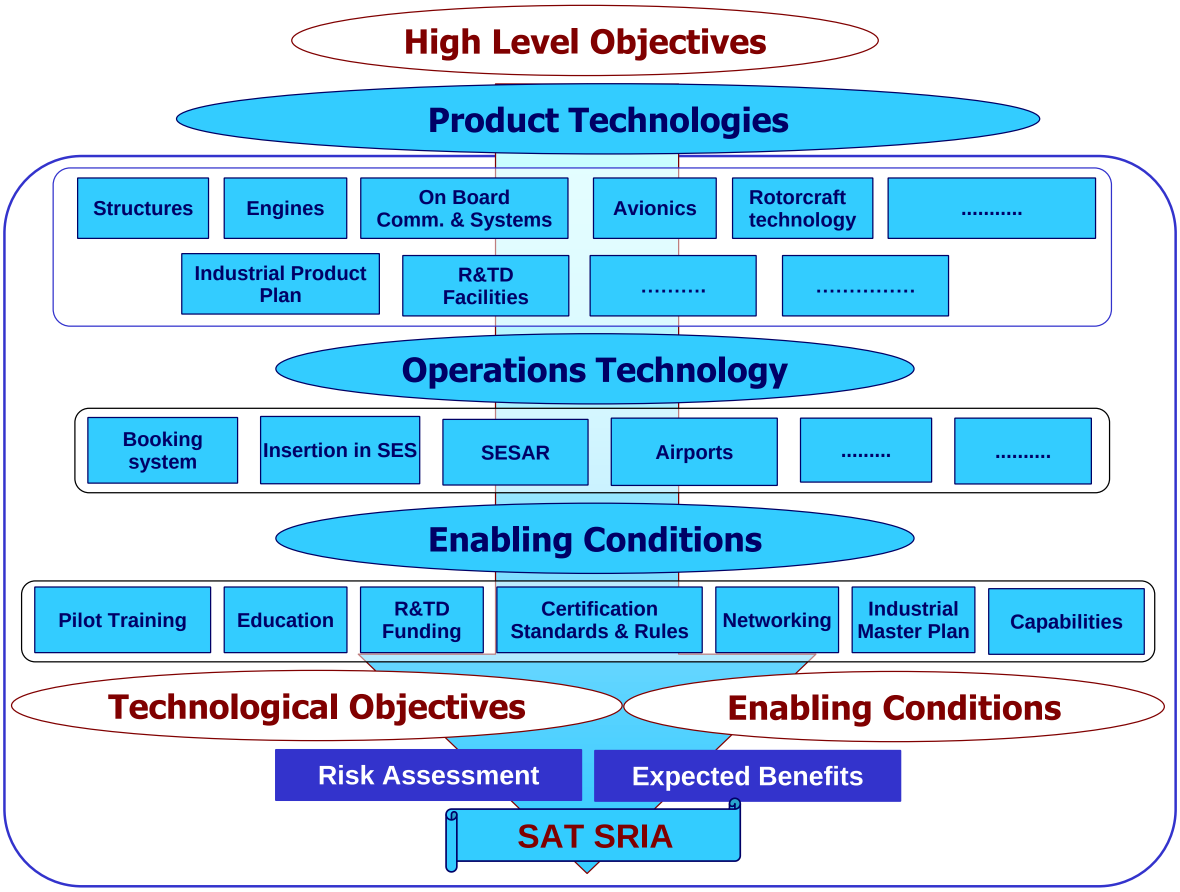

The RTD roadmap will be based on the requirements coming from the demand estimates. The type of demand determines the type of aircraft needed and the tools required to develop the SAT business. New demands are translated into RTD needs.

The Research Agenda identifies solutions needed in the 2020 and 2035 time frame. These solutions require additional research. However the new research topics identified will be matched with already on-going and planned research to avoid overlaps. The resulting list of potential research topics will be provided to the European Commission and ACARE. The SAT Research Agenda project will also investigate if new capabilities are needed in Europe to enable the new research and technology development.

The SAT Research Agenda outcomes should be considered as input elements of ACARE SRIA.

8.3 SAT system and Horizon 2020

The Horizon 2020 programme, as proposed by the European Commission on November 30th, 2011, encompasses different high-level areas; within the "Societal Challenges", the smart, green and integrated transport is identified with the objective of achieving a European transport system that is resource-efficient, environmentally-friendly, safe and seamless for the benefit of citizens, the economy and society. These objectives will need to embrace both medium-term outcomes, which can be implemented in the next generation of aircraft and ATM, and far-reaching breakthrough innovations including novel aircraft configurations, radical design options, new business models and operations.

Horizon 2020 should foresee R&I activities dedicated to the full deployment of the SAT system as an element of Future European Transport System.

8.3.1 Collaborative Research

The 7th Framework Coordination and Support Actions SAT-Rdmp (Small Air Transport – Roadmap) and earlier FP6 SSA EPATS (European Personal Air Transportation System) show, that there are promising opportunities to create a new mode of transport in Europe, for travel in areas where high speed trains or traditional airline connections are unavailable. As travel in, to and from those regions will depend on car travel, the wider use of small aircraft and rotorcraft will enable environmentally friendly access to more European communities in less time and will alleviate local road congestion. Furthermore by adopting seaplanes also Mediterranean regions with long costal lines and small islands accessibility might be increasing served.

This goal is in line with the goals set out in Flight Path 2050 especially "90% of travellers within Europe are able to complete their journey door-to-door within 4 hours".

In the short term (within 2020) it is essential to perform dedicated research and dissemination activities.

Research should be dedicated to:

- develop, test and demonstrate new technologies necessary to meet the challenges;
- define appropriate business models and concepts for operations;
- **develop a model and software tool to simulate the SAT system performance**;
- perform surveys to collect data to be used as input for the SAT system simulation.
  - *have a complete understanding and reliable data on intercity (interregional) origin-destination passengers traffic (road, rail, air).*
  - *have complete knowledge about social welfare and reliable socio-economic data for each EU Countries (income per capita, households income, value of time, …)*
  - *have complete knowledge and reliable data about vehicles operational transportation costs and the impact of technology on these costs.*
  - *understand and model the role of non-monetary costs in travel*
  - *understand the role and impact of external costs of transport on the assessment of vehicles global effectiveness – to develop a comparative method*

This approach would allow increasing: trust in the approach, political leverage, and public acceptance.

8.3.2 "Clean Sky 2" and "SESAR 2" for the ATS of the future

Clean Sky 2

Through a continuous research and innovation chain, the role of technology maturation, up to the highest level of integrated demonstration, is essential to reduce the risks of new products development. This is ever more essential when technologies become more complex and when non-evolutionary step changes are necessary. For very long-cycle, high capital cost and technology-intensive sectors like aviation technology demonstration is even more important.

Public Private Partnerships initiated in FP7 for transport, such as the Clean Sky Joint Technology Initiative, have proven to be and important and efficient instruments for demonstration and to bring forward innovation when there is a market failure; this instrument should be continued.

A part of the cost reduction may come from setting up the enabling conditions and among these the proper business model and service operations. Another part of the needed cost reduction may come from technology improvements. In order to bring the technologies up to the highest level of maturity and allow, ***validation and demonstration activities are needed***.

A "Clean Sky 2" in Horizon 2020 should cover these steps for the various market sub-sectors including Small Aircraft.

It is recommended to introduce in Clean Sky 2 demonstration and validation activities for innovative small commercial aircraft technologies and small aircraft operations, as an option of the Green Regional Aircraft ITD extension.

SESAR 2

Current SESAR implementation program focus on the largest of airports and related airspace and airline users; this is a similar situation to that in the US with NextGen. The result is that the pace of implementation and the realization of benefits for Small Aircraft are somewhat delayed compared to a situation in which the small aircraft community were more fully engaged.

SESAR should include the SAT system into the **ATM concept of operations.**

Cost reduction of ATM are important and SESAR needs to consider SAT already in employment phase in 2014 in order to avoid later cost intensive adjustments.

The Small Aircraft community should be involved in SESAR and possible follow up.

In SESAR 2 the concepts associated with more automation in the aircraft, safety, and in airspace management will have to be addressed.

8.4 The Role of the Small Aircraft Community in ACARE

The Small Aircraft community is rather fragmented in a high number of small SME and local operators. This situation does not allow an appropriate coordination and networking among stakeholders; furthermore, the community in such fragmentation is not able to have sufficient political leverage at both national and EU level.

Currently, two important actions are active:

- EGAMA - European General Aviation Manufactures Group
- EGAST - European General Aviation Safety Team

EGAMA was founded in 2007and is a high-level group of the AeroSpace and Defence Industries Association of Europe (ASD). EGAMA represents 13 of the European leading general aviation manufacturers ranging from complex business jets to helicopters and small leisure aircraft.
EGAMA has the purpose to be a common forum for dialogue with the EU institutions and aims at fostering common coordinated industrial views on strategic areas such airworthiness, safety, environment, ATM, security and R&T.

EGAST (European General Aviation Safety Team) is the General Aviation branch of the ESSI. ESSI is a 10 year EASA programme (2006- 2016) aimed at improving aviation safety in Europe, and for the European citizen worldwide.
EGAST is a partnership between EASA, other authorities, the industry and Small Aircraft Associations Addressing European General Aviation focusing on Safety promotion, education and training Partnership approach has proven successful and EGAST made recommendations of research topics to EASA

Future innovative research programmes have to consider Small Aircraft. The Small Aircraft community should improve coordination and networking; **many more stakeholders should join initiatives like EGAMA and EGAST increasing their importance in the large aviation community.**

Currently, the Small Aircraft community is not officially represented in ACARE; this situation should be overcome in order to ensure the appropriate visibility to this component of Aviation.

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