COMMON VISION

ON THE DEVELOPMENT OF

A SMALL AIRCRAFT TRANSPORTATION SYSTEM (SATS)

PAPER FOR DISCUSSION

with Three Pivotal Questions

Version v0, Sept 6, 2011

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1 Small Aircraft Transportation System (SATS) concept

The air transport system in Europe has been constantly adapted to new demand and requirements.

In the 1960ties, economy class was introduced in airline operations which made air travel more affordable. The introduction of Low Cost Carriers was another step change. It allows leisure travel to further develop. The HUB and spoke airport system allowed access to those destinations where direct routing for large (intercontinental) aircraft was not economic.

The air transport system in Europe currently accommodates about 10 million flight movements to 450 airports. 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 the airport systems is getting more and more overloaded. New security rules are in place that are time consuming for the passenger.

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 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.

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).

The EU development strategy is mainly focussed on regions generating the biggest passenger traffic flows. Most high speed train connections run North/South. The FP6 project “European Personal Transportation System” - EPATS showed that East /West business travel is still very much depending on road transport. The analysis showed that the biggest demand for personal transport operations may be in the southern part of France despite the fact that France has the best high speed rail network of all European countries.

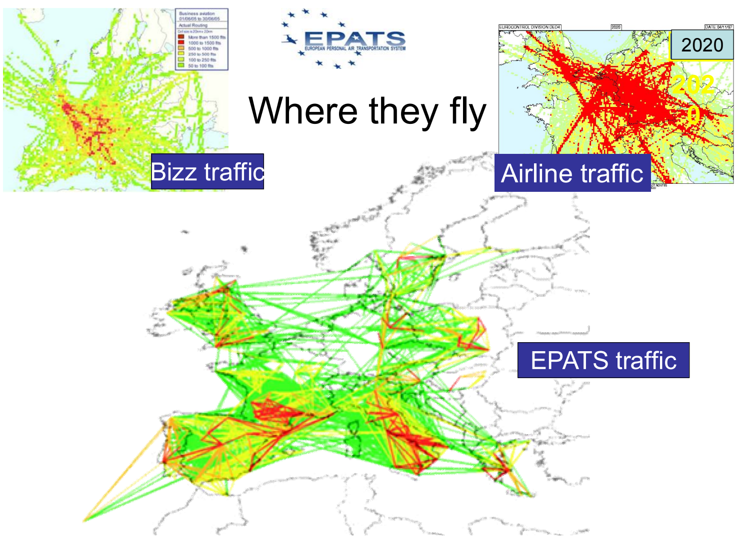

Fig 1. One typical 2020 day of flights. According to EUROCONTROL, D3.1 “EPATS impact on ATM”

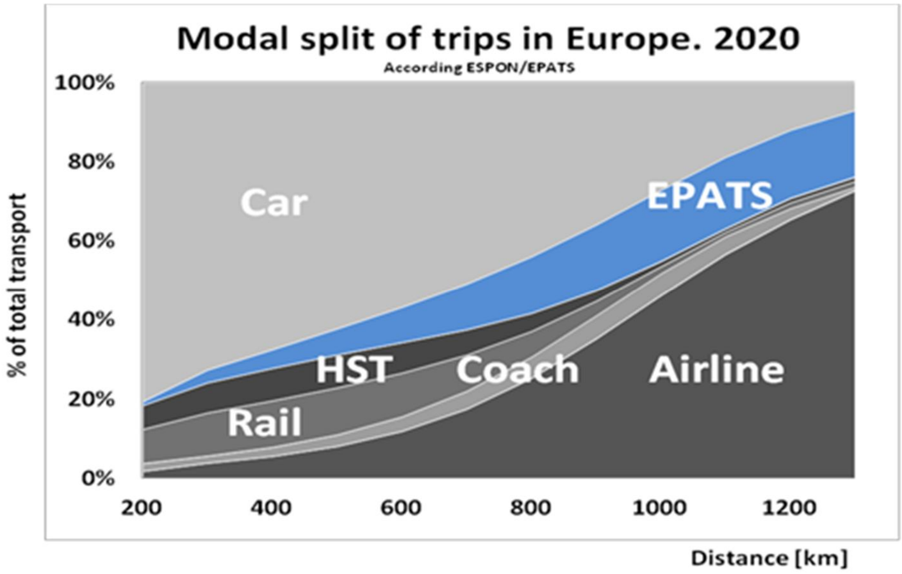

Fig 2. Modal split of trips in Europe. 2020. According to ESPON/EPATS

Travelling to high-speed rail stations and airports may also take considerable time. The total cost of travel for the business passenger using mass transport means can be substantial (actual cost of travel and time used for the total trip).

And even if good mass transport options exist, the business traveller will lose time in transit from railway stations or airports if the final destination is not located near the transfer point. The EPATS study took into account that there are 2500 airports and aerodromes in Europe that can 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, 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. Peripheral regions in Europe outside the European "Economic Banana" 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 SATS 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 SATS approach will add a new modality within air transport and complement international and regional transport. Small Aircraft Transport will serve:

- the needs of European business travel;
- 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;
- SATS approach will also be useful in regions out of the central European “economic banana” with less developed infrastructures.

The system is based on small aircraft, 4 to 19 seats, operating in an integrated and intelligent transport management system.

Thus it is advised that the Small Aircraft Transportation System development and implementation might be included in the EU mobility strategy and transport network development.

The High Level Group on Aviation Research chaired by the European Commission published its „Flightpath 2050 Europe's Vision for Aviation" in March this year.

It advocates tailored travel services that are seamless and cost/time efficient.

The SATS system can contribute to this goal.

Research and development

So far, the research and technology development activities (R&TD) for civil transport aircraft has been focused on larger aircraft along high-intensity and long range routes. To some extent this is logical as the industrial profit margins on large aircraft is much larger than for small aircraft.

Substantial profits adopting SAT system are only possible if small aircraft are intensively used and produced in large series. Only large markets will attract the interest of the manufacturing industry.

The same holds true for RTD focusing on airports and new Air Traffic Management systems. Currently, the actions are focused on large airports and SESAR is essentially concerned with scheduled airline operations using large aircraft.

If a new SAT system has to be developed, RTD actives need also to focus on the development of related systems and its major components.

SATS approach will add a new modality within air transport and complement international and regional air transport.

Small Aircraft Transport will serve the European business travel, the need of passengers along low-intensity traffic intercity routes, as well as the needs of remotes regions with less developed infrastructures.

The system is based on small aircraft, 4 to 19 seats, operating in an integrated and intelligent transport management system.

SATS cannot be developed overnight.

Therefore urgent action is needed today to prepare for the future.

In „Flightpath 2050 Europe's Vision for Aviation":

"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."

In „Beyond Vision 2020 (Towards 2050)":

"Business air transport is also what symbolically drives social demand. ***Personalized*** *air transport that is clean - the key element is pollution; air before noise - could be a driver for future aviation.*

In a multipolar world, such a model could envisage the position of the air transport sector (particularly in the EU) within a world that has the means to offer itself air transportation with lower standards. Potential policies aiming to regionalize leisure could create specific niches for ***personalized*** *air transport solutions. The social image of future air transport could therefore be articulated around both big mass transport and* ***light personal transport****."*

*"****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 travelers include: ***Personalized*** *travel, with individual tailoring of the travelling experience".*

2 Small Aircraft Transportation System (SATS) main goals

The Goal of Small Aircraft Transportation System is to provide fast passenger transport service for European business travel, the need of passengers along city pairs with low-intensity traffic (also in central Europe), as well as the needs of remotes regions with underdeveloped transport infrastructure thus enabling door-to-door travel between EU regions/city pairs at a flying distance of around 4 hours.

The System must be **environmentally friendly, affordable, safe and secure, interconnected, accessible, predictable, dependable and comfortable**.

- The system has to be **environmentally friendly.** SAT system should not increase noise levels around (regional) airports. 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.
- The system has to be **affordable.** Cost of travel will be comparable with other means of fast transport.
- The system has to be **safe** not only by meeting appropriate EU aviation rules and regulations, but it should also be perceived as safe by the users. The operational system has to be **secure** as well.
- The system has to be **interconnected** so that it will be part of a multi modal seamless transport system.
- The system has to be **accessible** thanks to the high density of existing airports and the short distances between these airports and the final destination.
- The system will offer a high level of **predictability**. 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 system needs to be **dependable**, so that the passenger will be assured of flights that meet his or her time schedule.
- The system needs to be **comfortable** and client centred. Aircraft will offer the same comfort as cars. The reservation system will make use of social media to book flights.

Meeting these goals will depend on many factors: volume of traffic has to be attractive, new aircraft are needed to meet the stringent requirements, regional airports may need to be adapted, Air Traffic Control needs to be able to handle a large volume of additional flight movements in a safe way, a new booking system needs to be developed, regulations may need to be adapted etc.

Meeting thess goals will depend on many actors: EU, member states, regions, cities, as well as the industry, social partners and citizens. Hence, a clear vision of development needs and broad awareness of the social benefits resulting from implementation of SATS is crucial for future developments.

A clear vision for the development of this new air transport mode needs to be developed and accepted in the public and private domains based on the awareness of the social and economic benefits resulting from the implementation of SATS.

3 Vision on system development.

a. Mobility and demand

Vision of SATS development is closely connected to prediction of interregional (intercity) passenger traffic in Europe. The choice of transport mode depends on many factors, but mainly on distance, time and cost of travel and on value of time spend in travel.

Planning a new transport investment it is necessary to have a full knowledge on the needs it has to meet and tasks it has to fulfil. Data base and models of European transport network based on population mobility research will serve this purpose. Such models and data were developed in the framework of many European projects, among others: DATELINE, TREMOVE I TRANSTOOLS.

Especially important for planning the SATS system is knowledge about those intercity connections which, with existing transport modes, cannot be accomplished with a one day return trip.

<u>These routes will constitute the bulk of SATS connections, the basis for calculating demand and setting mission requirements for aircraft.</u> <u>Door-to-door travel time on any interregional connection of up to 4 hours, is one of the main SATS requirements.</u>

Preliminary analyses so far, in EPATS project, that was based on mobility requirements indicate that substituting business trips above 300 km from cars to small aircraft, would require a fleet of 89.000 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.

b. Airspace and air traffic management.

Introducing large quantity of small IFR aircraft into the European airspace requires an adaptation of the ATM system in Europe. These small aircraft will make use of modern satellite based CNS systems and will be connected to the new SWIM network. They will use new GNSS based systems to navigate, separate, take-off and land. Therefore only small low cost changes will be needed at regional airport infrastructures. These costs are affordable for local governments interested in their development.

c. 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.

These airports are not exploited up to their potential. There is a need is to inform both central and local governments about the SATS service potential and benefits. Hence, a broad information action and setting up contacts and collaboration is needed to introduce the system.

It is reasonable to take action for: “Initiating stocktaking of all existing and planned airport and landing facilities in the EU Member States and Strategic Plan of European Airport Modernization”. An European program - similar to the US “National Plan of integrated Airports Systems” (NPIAS) and “Airport Improvement Program” (AIP) - should be defined and implemented. The new Airport Package proposal by the European Commission (DG Move) should also include the development of these regional airports.

d. Small aircraft market

The market of small aircraft for passenger transport meeting FAA Part 91 requirements for non-commercial transport (private and corporate) and FAA Part 135 for commercial transport (charters, aero-taxi, commuters) include the same range of aircraft as business aircraft market. The fleet of these aircraft comprises pistons, turboprops and jets, 4 to 19 seaters. Number of these aircraft in EU is roughly 5000, of which there are 2294 jets and 1148 turboprops. Most of these aircraft are American built. The most commonly types used in EU are:

- Jets: Citation 525 (7 seats), Citation Mustang (5 seats)
- Turboprops: Beechcraft King Air 200 (14 seats), Piaggio P180 (7 seats)
- Pistons: PA-31 (5 seats)

Currently, aircraft with highest annual production numbers and mostly purchased in recent years are:

- Jets (meeting affordability criterion): Eclipse (161), Phenom 100 (100), Citation Mustang (73)
- Turboprops: Cessna Grand Caravan (87), Beechcraft King Air (90), Socata TBM 850 (38), Pilatus PC-12 (79)
- Pistons: Cirrus (264), Diamond (129), Piper (135)

In the class of business aircraft these aircraft now represent the highest technical level.

The annual world production of business class aircraft in 2010 was 2015 airplanes, which is made up by 889 pistons, 363 turboprops and 763 jets. EU share was about 18%, while US share was 66%. It is worth to remind to be aware of potential production capabilities that in the US in 1976 annual production reached 17000 units, while in Poland Mielec manufacturing plant produced 660 AN-2 in 1972. Currently manufactured business aircraft, as new CNS are developed and propulsion modernized, will be periodically retrofitted, which will enable their adaptation to new regulation requirements.

Designing new aircraft types should be based on mission requirements resulting from intercity mobility research, transport models (e.g. TRANSPOOLS) and SATS operation model.

New aircraft designs to be introduced after year 2020 should take into account relevant results of SESAR, Clean-Sky, ESPOSA projects and should be based on regulations requirements in force on the day the design process is started. Mission requirements for designs carried out in the framework of EU projects should include socio-economic requirements and be supplemented by operational cost limits approved by the European Commission.

Increasing demand for air transport services induced by introduction of SATS will create the need for dynamical increase of small aircraft fleet size; currently existing aircraft types deliveries will increase and new aircraft types will be designed and introduced into market.

e. Organization and operation of the system

SATS is a personal passenger transport system meant to provide public service. Local and central government should supervise the system, and are responsible for sustainable transport and regions development. SAT System development should be an element of the European development strategy for transport modalities and infrastructures, in particular air transport. The basis for creating SATS in a region is a transport development plan, based on intercity mobility needs and transport models, coordinated and consistent with national and EU programs.

Organizational SATS structure comprises 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 technologies – see "Appendix 1 - System Architecture scheme" which must be treated as an initial concept to study the development of the business model. Aircraft operators should be concentrated in corporations which sign agreements with organizer to provide transport services. Transport organizer might be public, private-public or private entity, and should sign an agreement with governments.

Common maintenance base will be created and continuous airworthiness planning coordinated. (topic to study in the business model).

The current White paper on transport by the European Commission does not yet fully recognises the potential of the SATS system. It is felt the potential impact of SATS on future transport system should be more clearly recognized.

f. Service range and tariffs.

SATS services should provide passenger door-to-door transport on any route in the network at a convenient time for passengers and include:

- Per-seat on demand (aircraft sharing).
- Aero-taxi service.
- Seat reservation on a scheduled flight
- Transport services information system, including a tool for choice of best available transport to carry out the travel planned by customer.

During reservation the system should allow to organize transport to and from the airport as part of the service and as part of a single transaction. Appropriate agreements should be signed with taxi companies, which should be included in the IT system.

Service tariffs should be published and updated on the SATS webpage. Tariffs should be set centrally, (we assume the most of routes will operate as PSO routes (Public Service Obligation for remote regions) according to Regulation (EEC) No 1008/2008 which define a system of public service obligations (but finally it should be the subject of studies in the framework of business model) based on model of Dynamic SATS Yield Management, which maximizing yield of the system (in limited scope) will take into account a variety of services and customers, time windows, regularity of service use, purchase of service pack, etc.

g. Intelligent Small Air Transportation System

Meeting the condition of SATS affordability requires creating Intelligent Small Air Transportation System. Affordability can be achieved, provided that the price of services will be affordable for a wide number of people, i.e. total cost of travel will be comparable to that of a personal car. Nowadays, cost of transport using business airplanes and air taxi service prices are far higher. It is mainly a result of high indirect costs, which are several times higher than direct operating cost. This is caused by: too few annual flight hours, low load factor, high cost of idle flights, high customer handling cost and high DOC resulting from small fleet size.

Analyses show that there is the possibility to significantly reduce these costs to a level close to affordability for a significant part of the population. To achieve this goal, the following conditions must be met:

- Annual flight hours over 1000 hours.
- Load factor 0,75 or more.
- Allocation of airplane bases adapted to serviced network and lowering idle flights of 5%.
- Introduction of full and automatic internet customer handling.
- Interactive connection between customer needs and service provider capabilities.
- Centralized customer services management.
- Common aircraft maintenance bases.

Above requirements are possible to achieve using advanced management techniques and various ICT thus creating Intelligent Transportation System.

Definition and introduction of such ITS requires the involvement of many institutions and specialists from different disciplines and its evaluation requires extensive investigations.

Implementation and verification of ISATS operations may take place in several regions of UE countries, chosen on the base of mobility research and transport models.

These regions would play the role of forerunners in creating SATS in Europe and would start a new impulse in European personal transport strategy.

4 Vision on Small Transport Airplanes development

A “Vision” on SATS should be agreed for two time frames:

- **Current and near term social needs and mostly existing technologies (until 2020),**
- **Future needs and new technologies (after 2020).**

Development of small airplanes is driven by demand for fast transport services. A measure of the demand is the number of passengers which are willing to choose air transport as optimal transport mode for travelling between regions.

The choice depends mainly on time and travel cost, passenger wealth and their assessment of time value. Cost and time of air transport depend on airplanes parameters and business model used. Setting the parameters and model is the scope of transport market analyses. In passenger transport such analysis are mainly done by airlines which, under agreement with manufacturers, set mission requirements for new aircraft types and order them.

In case of introduction of a new transport system, such as SATS, the lack of an existing operational airline means that other entities must take up the task of analyzing market demand and setting mission requirements. As it is a public service transport, local government and institutions are responsible for balanced transport development and thus they should carry out the task or endorsing such an analysis looking for competent stakeholders.

Mission requirements include the following main airplane characteristics:

- number of passenger seats,
- cruise speed,
- operative range,
- takeoff and landing distance,
- typical flight profile,
- propulsion,
- avionics,
- economic and operational parameters.

Operational, safety and environmental requirements are common for a given aircraft category.

Extended mission requirements describe airplane that meets customer requirements. The formulation of extended requirements define future aircraft performance and characteristics and thus to technical solutions that will be chosen in the design process.

Elaborating mission requirements for SATS airplanes must be based on:

- interregional mobility research and social demand,
- real technical and infrastructural rationale,
- specific business model and reliable socio-economical and cost data.

a. Current and near term social needs and mostly existing technologies (until 2020)

Let’s assume that during next years currently produced aircraft will continue to operate, and in nearest years (2020) new designs will be developed based on safety, environment and design requirements currently in force. Operational requirements, on the other hand, might change.

Based on these assumptions, in the EPATS project expected mission requirements, comprising SATS fleet, have been determined. These are shown in Appendix-2. These requirements are based on the results analysis of interregional mobility research carried out in DATELINE and ESPON EU projects and on available technologies used in passenger aviation. Because of gaps in the above mentioned

mobility research and not thoroughly elaborated cost models and choice of transport mode models, the presented SATS fleet structure should be considered as an updated guideline.
Aiming to minimize energy use and detrimental effects on environment and seeking to optimize aircraft type and route on particular network connections, it should be expected that number of aircraft types should increase and many models should be introduced. Specifically, it should be expected that a category should emerge to fill a gap between 19 seater commuter and 40 seater regional aircraft.

Determining what new small passenger aircraft types should, in a few years (until 2020), be developed from private and public funds and enter EU market should be done after having gained a clear picture of interregional mobility and reliable transport model. The SAT-Roadmap project will provide business model, cost models and collect available results on mobility research and transport models.

Investment return period for design, starting production and introducing into market of a new passenger aircraft, reaching hundreds of millions of Euros, is about 15 years. Only the biggest aircraft manufacturers can afford such decisions. Similar cycle for small passenger aircraft will be below 10 years and the investment might be 50 – 150 million Euros. For small aircraft manufacturers these are huge sums and the risk is very high if there is not a reasonable expected return due to a foreseen market.

b. Future needs and new technologies (after 2020)

Further development of small passenger aircraft is constrained by the adoption of the SATS as a new transport mode by EC and MS and by starting new R&TD projects.

So far, only few research projects have been directly associated with R&TD for small aircraft. Planning to introduce SATS requires supplying the market with more advanced aircraft; clearly the goal is to have EU industry lead in manufacturing this class of aircraft and related systems for operations.

SATS aircraft to be operational after 2020 will differ from business aircraft currently in the market; hereafter, a non-exhaustive list of potentially relevant technologies.

- **Innovative Concepts and Configurations**
  - New configurations may be introduced.
  - Modular aircraft design will increase product adaptively to market requirements (among others, easy replacement of constantly modernized avionics). Base version should ensure development of derivative versions (e.g. with lengthened fuselage and number of passenger seats with the same wing and its nodes, tail, cockpit and propulsion).

- **Propulsion:**
  - Environmental friendly, lighter and more efficient small turbine engines with significantly lower manufacturing and operation costs.
  - Introduction of diesel engines powered by Jet-A or Bio-Fuel.
  - Higher efficiency propellers (above 0,85)
  - Innovative propulsion engines with low environmental footprint (e.g. electric, hydrogen)

- **Structure:**
  - Using new technologies and materials for structure to decrease weight and manufacturing costs.

- **Aerodynamics and Aeroacoustics:**
  - Increased lift to weight ratio and decreased stall velocity (through wing with innovative high lift devices).
  - Drag reduction technologies.
  - Noise reduction technologies.

- **Airplane control:**
  - All Electric Aircraft – airplane with fly by wire and electrical systems superseding other currently used designs (e.g. hydraulics). All Electric Aircraft will ensure effective use of IT during flight on for maintenance.
  - Easier and more intuitive flying,

- Automatic flight control (allowing single pilot operation)

- **Flight management:**
  - Integrated flight management (flight plan, restricted airspace warning, air traffic intensity, terrain configuration and fuel level, loading, weather and other information). Easy gathering information on flight and position on PFD ((Primary Flight Display) and MFD (Multi-Function Display) instruments. Integration of electronic flight bag/ i-pad technology.

- **Standardisation:**
  - Introducing higher level of Standardisation of avionics, equipment and structure components.

- **Flight safety:**
  - Reduction of human error
  - Increased crash survivability - higher resistance of overloading caused by impact.
  - Ensure flight safety by more restrictive design regulations of SATS aircraft (CS-23 - through including chosen CS-25 regulations).

- **Comfort:**
  - Decreased noise and vibration level, smoother flight through use active abatement system, more roomy and ergonomic cabin (especially for single engined aircraft),

- **Costs:**
  - Lower purchase price – achieved through new technology solutions used appropriately to cycle of use, and through increased manufacturing scale and taking advantage of cooperation possibilities in EU.
  - Lower operational costs – achieved through lower fuel consumption, purchase price and service cost.

R&TD projects will have to address specific category of aircraft or transport system elements.

Testing in real environment of innovative technologies and concepts has to be performed.

5 Stages of SATS vision development.

Two main Small Aircraft Transport System development phases are assumed:

- **First phase – years 2010 – 2020,**
- **Second phase – years 2020 – 2030 and further**

a. First phase – years 2010 – 2020

The main impact to be expected is here outlined.

- **General acceptance of the added value of small-size aircraft, operating on commercial scheduled or non-scheduled flights, as a component of the European (Air) Transport system.**

- **Satisfying the RTD needs of the European manufacturing industry in order to become the world leader in design and production of small aircraft.**

During this first phase the new transport system should be accepted and developed on the basis of currently existing aircraft equipped with modern avionics and being compliant with current safety and environmental regulations.

The system should use existing airport and aerodrome network and operate as a part of current air traffic management and control system.

New business models and IT systems will be created to manage transport services and flight operations, this will allow to achieving high load factors and lower service costs. The system will be developed in regions most interested in low cost personal business travelling and in providing access to air transport; then, the SATS will spread gradually to other regions as its benefits are recognised.

Parallel to implementation, further research and development should be carried out in the framework of European FP7 and of National programmes; further projects, regarding SATS issues, should be carried out in Horizon 2020 Framework Programme. Further analysis of interregional mobility demand in the EU should be performed to refine SATS development planning.

Also studies on future means of individual air transport with time horizon reaching half of current century will be conducted during this phase. Currently, the „P-Plane" project is investigating these issues, although with a specific view that is the Autonomous Personal Transport. Complementary approaches should be analysed as well.

b. Second phase – years 2020 – 2030 and further

Results of „SESAR", and other projects within FP7 and Horizon 2020 Framework Programme will be implemented.

New safety regulations will be valid for aircraft operating in SATS. New aircraft and their propulsion systems developed in the EU will hit the market and benefit SATS. Implementing new communication, navigation and control systems (CNS) will lead to extend the SATS network and capability to perform free flights. Expanding IT networks managing services and flight operations will extend collaboration and expand SATS operational area.

The SAT-Roadmap project is going to develop a SAT technology roadmap that will be delivered by September 2012. Some examples of needed technology have been mentioned in section 4.b and have to be further debated in the next "SAT Common Vision Workshop" and in a dedicated "SAT Technology Roadmap Workshop" that will be organised in 2012.

6 Three Pivotal Questions

1. **Do you agree with the following statement: "A Small Aircraft Transport System, based on small-size aircraft, operating on commercial scheduled or non-scheduled flights from standard airports and small airfield network, should be accepted as a component of the European (Air) Transport System"?**
2. **Do you agree with the formulated goal: "The main goal of Small Aircraft Transportation System is to provide fast passenger transport service for European business travel, the need of passengers along city pairs with low-intensity traffic (also in central Europe), as well as the needs of remotes regions with underdeveloped transport infrastructure thus enabling door-to-door travel between EU regions/city pairs at a flying distance of around 4 hours?**
3. **Do you agree that this goals might be met by 2020 using mostly currently existing aircraft, infrastructure and available ICT?**

If you answered **„yes"**:

- highlight in the present SATS Vision discussion paper the text you do not agree (please mark with yellow the text and possibly provide some comments)?
- eventually include in the text additional requirements (for aircraft or operational) or enabling conditions to implement SAT

If you answered **„no"**, please submit your own view to prepare discussion at the workshop.

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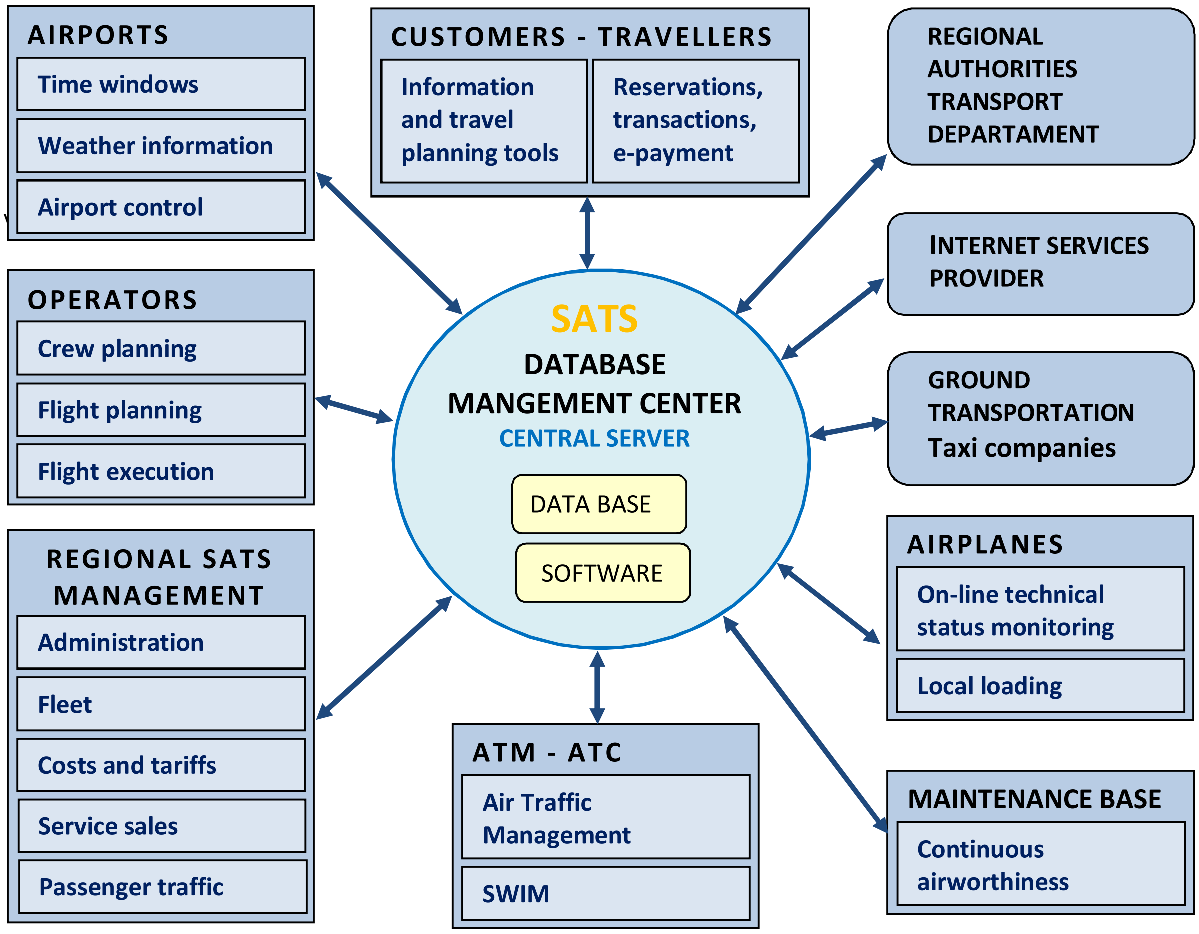
Appendix – 1 INTELLIGENT SMALL AIRCRAFT TRANSPORTATION SYSTEM ARCHITECTURE

PROVISIONAL CONCEPT FOR DISCUSSION



BASIC CENTRAL SERVER BLOCKS (General concept for discussion)

a) Static Data Base

1. Airplanes (technical characteristics, Registry data, Manuals, overhaul plans).
2. Airports (serviced airports network, bases and fleet of aircraft).
3. Distances from city centre to airport.
4. Socio-economic data of serviced regions (including population mobility and travel costs outside transport).
5. Prices of supplies (fuel, services, airport fees, insurance, salaries of crews and personnel etc.).

b) Dynamic Data Base:

1. On-line localization of every airplane, its loading and operational flight plan.
2. On-line data on transport process events record (engine start, takeoff and landing, boarding, flight time, aircraft load etc.).
3. On-line data on seat reservation and acceptance of orders, airplane loading and routing.
4. On-line data on yield and costs.

c) Information:

1. For transport process participants (business activity area, conditions to participate, terms of signing an agreement, legal regulations, range, mode and terms of access to network data.)
2. For customers (transport service range, range of network data use, service tariff, terms and conditions of service.).
3. For Aviation Industry and Research Institutions representatives active in SATS development (development needs, collaboration areas, range and conditions of access to network data).
4. For broad audience (Educating of SATS role in personal transport system and its influence on safety, ecology and economy).

d) Advertising and marketing

1. Through respective SATS local logistic centres.
2. Through organizations and private companies interested in SATS development.

e) Application software

1. Application calculating SATS transportation cost.
2. Application calculating travel costs – tool for individual choice of optimal mean of transport.
3. Application optimizing use of private and fractionally-owned aircraft.
4. Application for tariff and service prices management.
5. Application for routing, fleet, services and flight plan management (annual, monthly).
6. Application for seat reservation and service orders management.
7. Application for flight operation record analyses.
8. Application for logistic reports management.
9. Financial Application (analyses, cost balancing, yield consolidation, settlements)

f) Device Drivers

1. External communication
2. Aircraft localization.
3. Internet communication.
4. GSM communication.
5. Application for central SATS server data access

g) Connection to cooperating Systems and organizations

1. Airspace Traffic Management and Control.
2. Meteorological information System.
3. Airlines.
4. Ground transport organizations.
5. Hotels and catering network.
6. Other

h) SWIM functions

In later development stages, aircraft localization and other management and control functions will be taken over by complex information management system - SWIM = System Wide Information Management that is planned for introduction in the framework of SESAR program in 2020 r

The system will cover the following scope of information and ATM:

1. Weather
2. Terminal data
3. Inter Agency
4. Aeronautical Information
5. Traffic flow management
6. Radar data
7. Surveillance
8. EnRoute data
9. Positioning – 4D
10. Traffic Awareness and Avoidance
11. Traffic Management
12. Flight Guidance and Control

Appendix - 2 SMALL AIRCRAFT TRANSPORTATION SYSTEM MISSION REQUIREMENTS

Class *	Pistons		Turboprops		Jets	
Class name	**ACP-1**	**ACP-2**	**ACT-1**	**ACT-2**	**ACJ-1**	**ACJ-2**
Main mission	Private and business travel, air-taxi service available on request, a short distance, middle class of service,	Air-taxi on demand, a short distance, middle class of service,	Business and private travel, air-taxi service on demand; available to the majority of the population,	Commuter according to flight schedules and on demand, for small passenger flows and a variety of routes; available for most of the poplation,	Corporate travel, business and private travel, air-taxi service on demand; for passengers with significant time value,	Commuter on request and according to flight schedules, corporate, business and private travel, high class service for passengers with a very high value of time.
Seats**	**1+3**	**1+5**	**1+9**	**1+19**	**1+5**	**1+9**
Cabin – Width [m]	**>1,30**	**>1,40**	**>1,80**	**>1,85**	**>1,50**	**>1,60**
Cabin – Height [m]	**>1,30**	**>1,40**	**>1,70**	**>1,75**	**>1,50**	**>1,60**
Toilet	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Pressurised	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**
All weather capability	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
MTOW [kg]	**<1300**	**<2000**	**<5600**	**<8600**	**<5600**	**<7600**
Cruise speed[km/h]	**>300**	**>350**	**>550**	**>550**	**>700**	**>750**
Cruise altitude [FL]	**80-200**	**80-200**	**150-250**	**150-250**	**250-300**	**250-300**
Takeoff distance [m]	**<600**	**<600**	**<1000**	**<1000**	**<1000**	**<1000**
Range fully loaded [km]	**>600**	**>750**	**>900**	**>1200**	**>1500**	**>1800**
Cruise fuel consumption [l/pas.km]	**<0,035**	**<0,035**	**<0,04**	**<0,03**	**<0,08**	**<0,07**
DOC [Euro/pas.km]	**<0,15**	**<0,12**	**<0,20**	**<0,l5**	**<0,35**	**<0,30**
Price [k Euro}	**<200**	**<400**	**<2000**	**<4000**	**<2000**	**<5000**
Requirements***	**CS-23 A**	**CS-23 A**	**CS-23 A**	**CS-23 A**	**CS-23 A**	**CS-23 A**

*) Single engined MTL aircraft should be characterized by similar safety level as multi engined aircraft – which should be the main condition to allow commercial transport (air-taxi).

**) The first number denotes crew, the second one certified number of passenger seats.

***) Letter 'A' denotes amendment of existing CS-23 regulations with increased safety and environmental requirements in SMTL category.

LIST OF SATS AVIONICS. (*on the basis of „D4.1 EPATS aircraft missions specification")*

Aircraft class	ACP-1	ACP-2	ACT-1	ACT-2	ACJ-1	ACJ-2
Communications						
Dual 8.33 kHz VHF radio	✓	✓	✓	✓	✓	✓
SWIM dual data link	✓	✓	✓	✓	✓	✓
WiMax			✓	✓	✓	✓
Broadband services					O	O
Navigation						
Dual GNSS /w SBAS	✓	✓	✓	✓	✓	✓
Dual DME	✓	✓	✓	✓	✓	✓
RVSM					✓	✓
P-RNAV FMS	✓	✓				
4D RNAV FMS			✓	✓	✓	✓
ILS receiver(s)	✓	✓	✓	✓	✓	✓
Surveillance						
ADS-B in/Out 1090 ES	✓	✓				
Enhanced ADS-B			✓	✓	✓	✓
TAS	✓	✓	✓		✓	
TCAS II				✓		✓
ELT 406 MHz	✓	✓	✓	✓	✓	✓
FDR & CVR				✓		✓
TAWS-B	✓	✓	✓		✓	
TAWS-A				✓		✓
Lighting detection (sferics)	✓	✓				
Weather radar			✓	✓	✓	✓
Human machine interface						
IFD (PFD/ MFD / audio / AP)	✓	✓	✓	✓	✓	✓
HUD / SVS / EVS					O	O
EFB	✓	✓	✓	✓	✓	✓

O - OPTIONAL

ROUGH TIME OF FIXED OPERATIONS OF SATS AIRCRAFT [min]

Aircraft class	ACP-1	ACP-2	ACT-1	ACT-2	ACJ-1	ACJ-2
Check-list before flight, engine ignition and warm up	5	8	8	12	12	12
Boarding	1	2	1	4	1	3
Ingress to cruise altitude	10	20	20	20	20	20
Engine stop	1	2	1	2	2	2
Unloading	1	2	1	4	1	3

DISTRIBUTION OF PROJECTED RANGE OF SERVICE FOR THE CLASSES OF AIRPLANES