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LIST OF ABBREVIATION:

ACJ	Aircraft class jet
ACT	Aircraft class turboprop
ACP	Aircraft class piston
ADOA	Alternative Design Organization Approvals
ATC	Air traffic control
ATM	Air Traffic Management
CS	Certification specification
CVE	Certified verification engineer
DOA	Design Organization Approvals
DOC	Direct Operating Cost
EASA	European Aviation Safety Agency
EC	European Commission
EU	European Union
FAR	Federal Acquisition Regulation
GA	General Aviation
GPS	Global positioning system
HST	High speed train
IFR	Instrument flight rules
IMC	Instrument meteorological conditions
IOC	Indirect Operating Cost
MTE	Multi engine
MTOW	Maximum Take Off Weight
POA	Production Organization Approvals
SAT	Small aircraft in the air transport system
SESAR	Single European Sky ATM Research
STOL	Short take-off and landing
TOC	Total Operating Cost
VFR	Visual flight rules
VLJ	Very light jet
VMC	Visual meteorological conditions
VTOL	Vertical take-off and landing
WP	Work package
UL	Ultra-light
US	United state of America

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EXECUTIVE SUMMARY

The main purpose of ”Master Plan for Development of Aircraft for Small Air Transport“ document is an overview of information from individual reports of this project, so that the reader can get an idea about possibilities of new SAT system creation within the EU.
At the same time this document will serve as the so-called “plan“ according to which SAT system development in the EU should proceed in order to meet all the ideas and visions to the full extent.

The report is divided into several parts:

1. Introduction
2. Existing and vice versa missing possibilities of GA and development of new technologies for SAT transport system in the EU.
3. Regulation requirements and their biggest obstacles for manufacturers of GA technologies.
4. Design of a new business model for SAT transport system
5. Conclusion

1. Description of Task T4.3 Master Plan for industrial development of aircraft for Small Air Transport System

This task will wrap up the results from WP1, 2 and 3. A Small Air Transport Master Plan will be prepared that will be the guide to the future development of small aircraft air transport in Europe. This master plan will be published as a brochure (WP5) and offered to the Commission, the European parliament, SESAR, Eurocontrol, EASA as well as the Member States / Associated States and the partners in the SAT-Rdmp network set up under T3.4.

2. Introduction

The basis idea of SAT transport system is creation of a new mode of transport, the so-called door-to-door using small aircraft of GA type (airplanes with standard takeoff and landing, helicopters, VTOL, STOL airplanes, etc.) with capacity of 4 to 19 seats for providing regular or irregular air transport of passengers or cargo. New technologies are developed within the framework of fulfillment of individual phases of SAT transport system. These technologies will be used for design and production of such airplanes and the whole SAT system and will be directed to minimization of environmental impact (emissions, noise), while safety and utility properties will be with the emphasis on the minimum operation and service costs.
The airplanes with the above mentioned assumptions will have a positive influence on minimization of direct operation costs, thus enhancing attractiveness of this mode of aircraft transport for the final user (passengers, air carriers, etc.).

Why SAT? Some studies suggest that the number of cars in the world will increase from around 700 million today to more than 3 billion in 2050, creating serious sustainability problems unless a different concept of mobility is introduced in an environmentally friendly way.

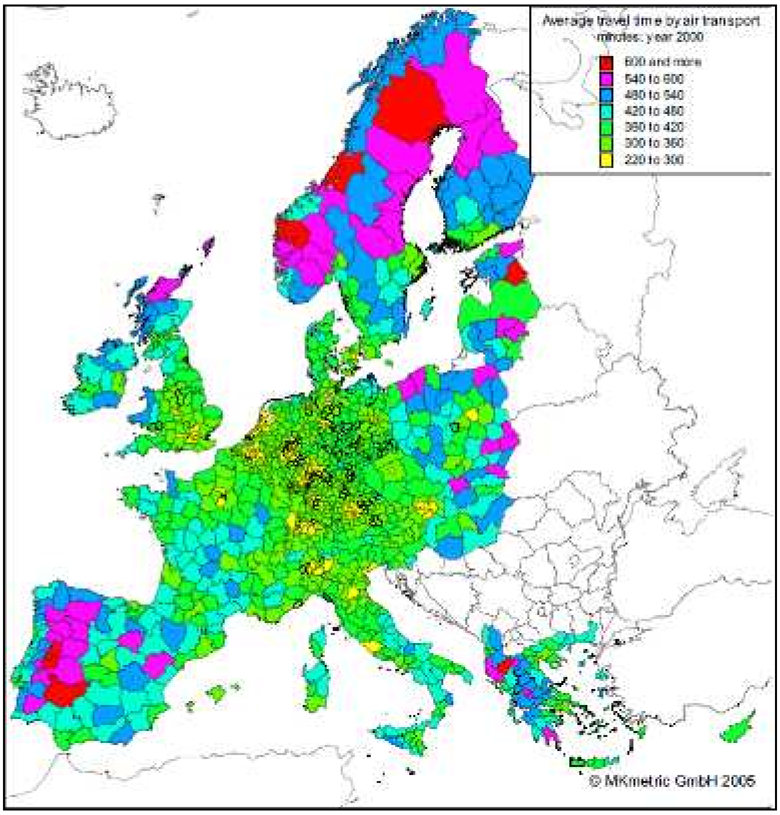


Fig. 2.1 Average travel time by air transport in minutes – year 2005.
From 220 min. (3,7 h) – yellow color to more than 600 min (10 h) – red color

90% of travelers within Europe are able to complete their journey, door-to-door within 4 hours see Fig.2.1 *Average travel time by air transport in minute*. In Europe, expectations of future travelers include: Personalized travel, with individual tailoring of the travelling experience. Passengers and freight are able to transfer seamlessly between transport modes to reach the final destination smoothly, predictably and on-time.

SAT mode is a segment of high-speed transport market that serves local and interregional **low traffic** connections. The SAT mode can fill a gap which exists between regular surface transport and regular mass air transport. Scheduled and unscheduled transport of GA aircraft has increase access of communities with poor transport infrastructure with using of local airports acceptable for this mean of transport. The SAT system will be supported by modern and new aircraft and technologies.

It consists of the three main parts:

1. **Aircraft** - small 4 to 19 seater (piston, turboprop, jet) as mentioned above
2. **Infrastructure** on the ground and in the air - Regional Airports + ATM/ATC
3. **Net – Centric Management & Acquisition** – Informative logistic network

Main aircraft characteristics for future SAT system:

ACP - Piston engine powered airplanes with a passenger seating 9 or fewer and a maximum weight up to 5670 kg,

ACT - Turboprop airplanes with a passenger seating of 19 or less and a maximum weight up to 8618 kg,

ACJ - Jet airplanes with a passenger seating 11 or less and a maximum weight up to 7600 kg.

Cruising speed from 300 to 800 km/h

Range from 900 to 2500 km

Light helicopters, Novel aircraft configurations like **QVTOL** and **QSTOL**, **autogyro's** and **amphibious aircraft.**

As mentioned above, one of the main objectives of SAT transport system is the development of new technologies and used materials developed within the scope of SAT system for reduction of aircraft empty weight, reduction of structure resistance and increase of lift, improvement of operation parameters of engines (reduction of weight, consumption, noise, emissions – electromotors, engines using alternative fuels, ...) and assurance of maximum safety and reliability. An effective way of maintenance (extension of service intervals, monitoring systems, etc.) should be a part of the new airplane design.

Such airplanes should be able to operate under VFR and IFR (VMC, IMC) conditions, in operation mode 24/7.

The phases of gradual fulfillment of SAT project visions are as follows:

Short term 2020 (an integrated system demonstration)

- General comprehension (political, public) of added value of the new transport system SAT within the scope of EU transport system
- Research and development of new technologies leading to gradual fulfillment of SAT project visions

Medium term 2035

- Integration of new technologies into the SAT transport system (enabling single pilot operation of airplanes)
- Adaptation of European ATM and certification regulations also for the needs of SAT transport system

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

Long term 2050

- Minimization of impact on the environment in all phases of development (manufacturing, operation, maintenance of aviation technology)
- New certification regulations and seamless integration of SAT into inter-modality transport system
- Introduction of free flights, autonomous flying by SAT aircraft
- The people-oriented system

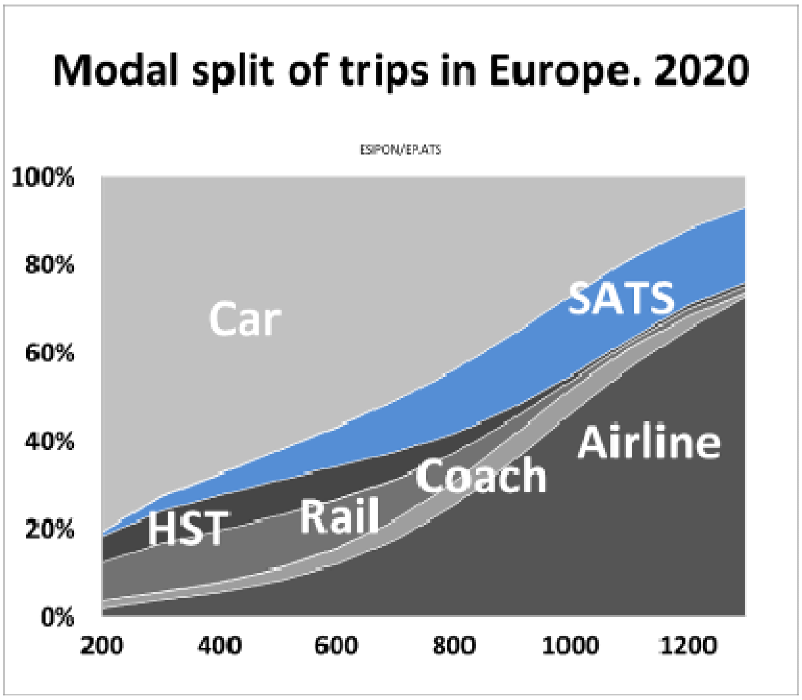


Fig. 2.2 Modal split of trips in Europe 2020. According to ESPON/EPATS

Subsequently fulfilment of the SAT visions of individual phases (short term 2020, medium term 2035 and long term 2050) has increase access of communities with poor transport infrastructure as mentioned above thereby support economy and employment of SAT area in EU.

Figure 2.2 shows the „Modal split of trip in Europe forecasted by ESPON Project in 2020". We are interested in „short haul gap" with distances from 200 km up to 1300 km. *Y axis is % of total transport.*

Main modes in Europe are:

- car transport - it is 48 % *on showed diapason of distance*,
- next will be Airline 40%,
- Rail 6%,
- High Speed Train 4%,
- and Coach 2%.

The SAT system will complement existing travel modes and will be a substitute for road travel on highly congested roads in Europe for distances above 300 km. The SAT will be part of new intermodal transport systems for passengers and freight.
Our IDEA is to shift part of long distance trips **from cars to small aircraft.**

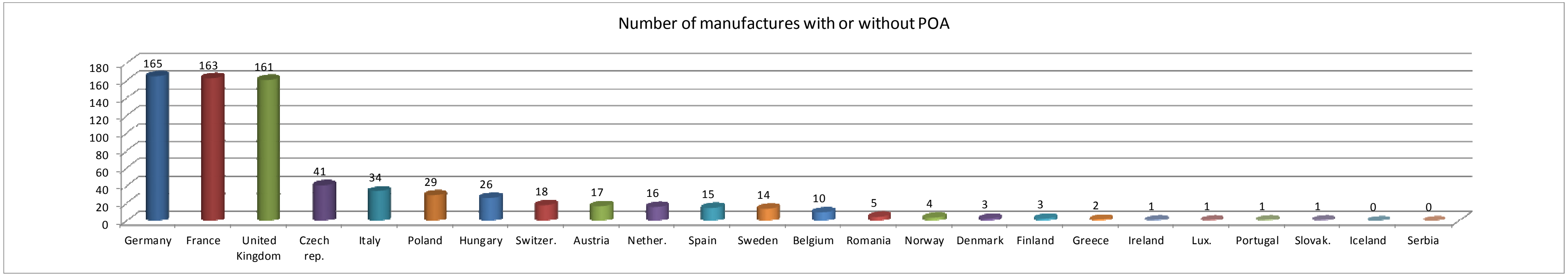
3. Capabilities and new potential technological requirements

3.1 Current capabilities for GA industry

The following diagrams (Fig. 3.1 up to 3.4) show manufacturing, development, research and other possibilities available currently in the EU for the aircraft industry. If we compare these diagrams (particularly the number of organizations which are holders of POA, DOA and ADOA) with Table 3.1 which contains options of production of aircraft (helicopters), engines and various aircraft parts for GA in the EU we can see a considerable disproportion between the GA technology manufacturers and the manufacturers focusing on the production of large commercial aircraft. In addition, Table 3.1 is supplemented with manufacturers of ultralight, training and experimental aircraft.

It follows from this overview that the major part of technologies, which are developed within the scope of the aircraft industry in Europe, is rather concentrated on large commercial aircraft the activities of which are oriented beyond the area of GA.

Ensuring R&TD, validation and demonstration activities for small aircraft and business aircraft design and production (both fixed wing and rotorcraft as well as advanced novel configurations) will stimulate the revitalization of the relevant European manufacturing industry and will help to improve the European trade balance, creating a level playing field with US industry which is able to capture large part of the European market.


Number of manufactures with or without POA
180
160
140
120
100
80
60
40
20
0
165
163
161
41
34
29
26
18
17
16
15
14
10
5
4
3
3
2
1
1
1
1
0
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Czech rep.
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Poland
Hungary
Switzer.
Austria
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Spain
Sweden
Belgium
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Finland
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Portugal
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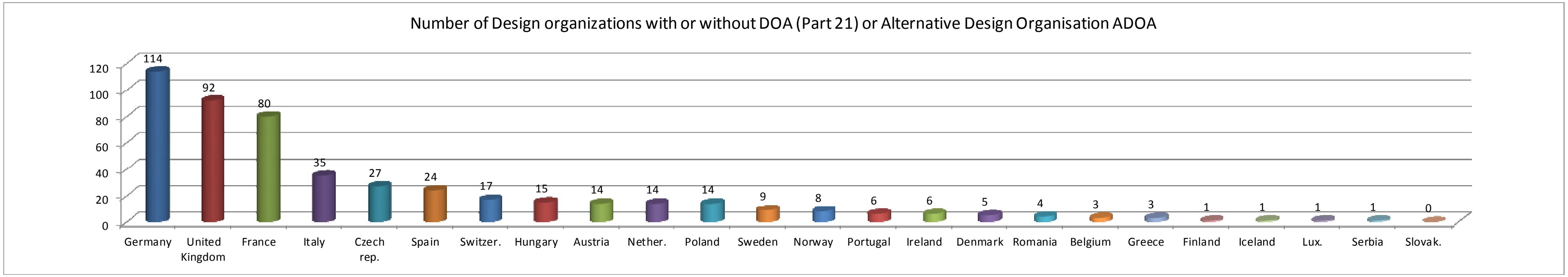
Iceland
Serbia

Fig. 3.1


Number of Design organizations with or without DOA (Part 21) or Alternative Design Organisation ADOA
120
100
80
60
40
20
0
114
92
80
35
27
24
17
15
14
14
14
9
8
6
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Slovak.

Fig. 3.2

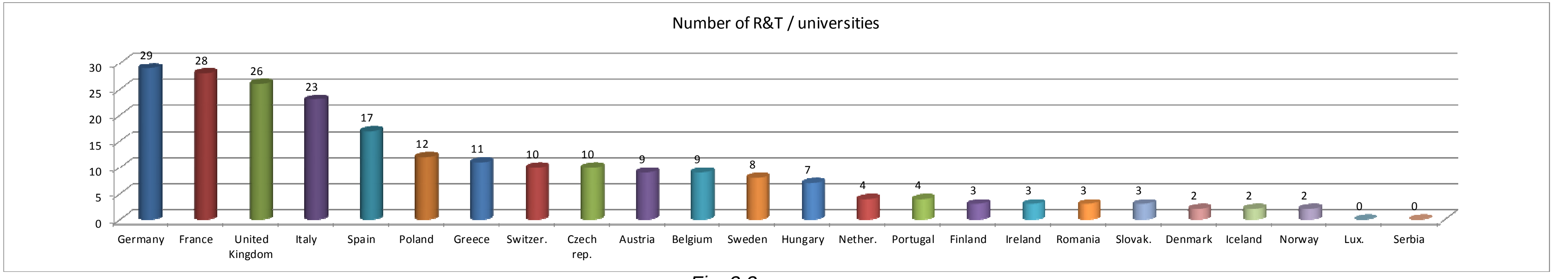
Number of R&T / universities
0
5
10
15
20
25
30
29
28
26
23
17
12
11
10
10
9
9
8
7
4
4
3
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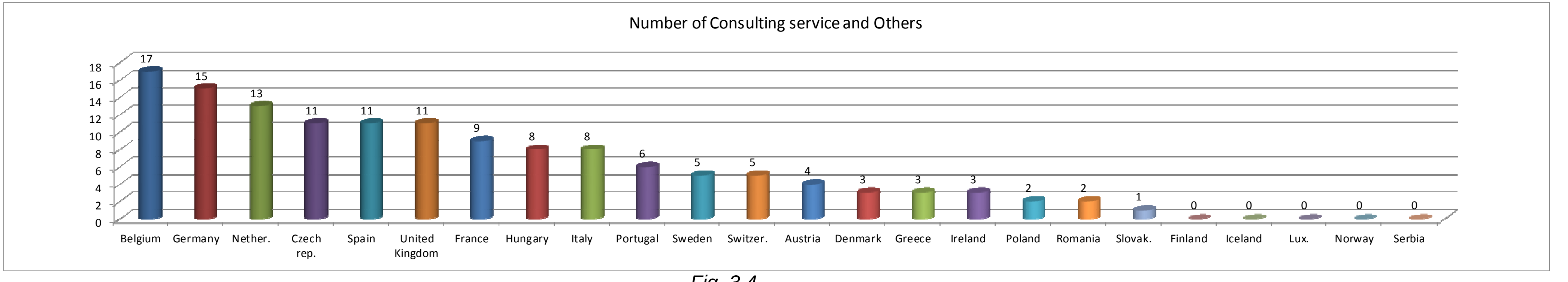
Fig. 3.3


Number of Consulting service and Others
0
2
4
6
8
10
12
14
16
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17
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13
11
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9
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Belgium
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Nether.
Czech rep.
Spain
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Serbia

Fig. 3.4

Tab.3.1

Capabilities of production General aviation airplanes (airframe, wing) and engines (piston, turboprop, jet)								
Countries	**Airplanes**				**Engines**			**Parts of airframe (wing), engine**
	CS-23 (CS-27, CS-29)	UL	Training	Experimental	Piston	Turboprop	Jet	
Austria	1	0	0	0	2	0	0	0
Belgium	0	0	0	0	2	0	0	5
Czech rep.	2	4	1	1	2	2	1	1
France	3 (2 helicopters – Eurocopter, Guimbal)	0	0	0	2	1	0	0
Germany	1 (1 helicopter - Eurocopter)	4 (1 helicopter)	2	0	5	1	1	0
Hungary	0	4	0	0	0	0	0	0
Italy	4 (1 helicopter - AgustaWestland)	2	0	0	0	0	0	1
Poland	4 (3 helicopter – Black Hawk; SW-4; W-3A Sokol	1	1	0	2	0	0	1
Romania	0	0	0	0	0	0	0	2
Slovakia	0	1	0	0	0	0	0	0
Spain	(1 helicopter - Eurocopter)	0	0	0	0	0	2	0
Sweden	0	0	0	0	0	0	1	0
Switzerland	1	0	0	0	1 (Wankel engine)	0	0	0
United Kingdom	1 (1 helicopter – AgustaWestland)	0	0	0	1	1	1	1
Total	**17 (5 helicopters)**	**16 (1 helicop.)**	**4**	**1**	**17**	**5**	**6**	**11**

3.2 Missing capabilities for GA industry

Missing capabilities are necessary for development and integration of new technologies suitable for effective activity of aircraft or GA used in SAT-Rdmp. The technologies which are not currently available or suitable for effective development and operation of aircraft applicable for the SAT transport system in the EU follow from the identification of missing capabilities. The challenge for future products is to achieve:

- Reduction in the Operational Cost (use less energy)
- Improve Environmental Impact (noise, pollution)
- High Time Efficient
- Customer Oriented Design (increase seamless connectivity)
- increase Safety and Security

Most of the technologies are available, but to deliver higher performance aircraft with reduced pilot workload and improved safety, dedicated efforts are needed **not scalable from big aircraft.**

Most of the avionic technology is available and it allows delivering higher performance with reduced pilot workload:

- GPS navigation
- Display large screen man machine interface
- Air traffic, weather condition, aerospace border easily displayed
- Flight envelope protection

But as in the past, today we are living in an engine-centric world so the economic performance of future Small Aircraft product are depending on **efficient, less expensive aircraft power plant.**

Besides the mentioned technologies the mutual interaction between the manufacturer of aircraft technology (airplanes) and the operator is also important. Although there are currently systems of maintenance monitoring, the missing element of these activities is a complex interconnection of the manufacturer and the operator of small aircraft and especially sharing joint data in a tailor-made system of small entities participating in design, manufacture, operation, repairs and airworthiness maintenance of small aircraft applicable for passenger transport.

That's why, besides missing technologies, the close mutual interconnection of the manufacturer and the operator as well as the other stakeholders is no less important for assurance of safe operation of aircraft as well as for implementation of other continuing airworthiness activities. It is therefore suitable to include in the missing capabilities also the complex systems focused on assurance of maintenance, continuing airworthiness activities, ordering spare parts and appropriate technical communication between all stakeholders participating in SAT system.

Occurrence of such systems will create feed back between all stakeholders and will facilitate in this way mutual communication at information exchange and assurance of airworthiness of operated airplanes.

Such gained data from aircraft operation is very important for the manufacturer. On the basis of this data the manufacturer can further work on enhancement of operation reliability and safety of airplanes, modify the system of maintenance of individual parts of airplanes as well as whole airplanes (e.g. by reduction of requirements on maintenance and corresponding costs).

3.3 Technology requirements for developing of SAT system to future

New technologies must be developed and implemented in order to fulfillment of the SAT visions.

In other words the SAT technology roadmap identifies research and technology development needed to be addressed in the future. Technology challenges are

- Aircraft configurations and advance propulsion and alternative power sources
- Advanced structures, manufacturing and coatings
- All weather operations
- Single pilot and autonomous operations (automation)
- Noise and emission reduction
- Safety and security
- Cabin comfort, equipment and connectivity
- Net-centric IT systems to support different operating models
- Regulations (to fulfill the pre-defined set of requirements)
- Maintenance
- Training
- ATM/ATC
- Ground infrastructures and nodal points

The technologies for SAT may incorporate technologies that are already being developed large aircraft. But in many cases the small aircraft operations are more advanced than regular airliner operations and therefore the technology needed for small aircraft cannot just rely only on development for large aircraft. These new technology are defined in report “3.1 The ROADMAP for technology development for future Small Air Transport system and its elements”. New technologies developed within the SAT can be further exploit in other branches of industry.

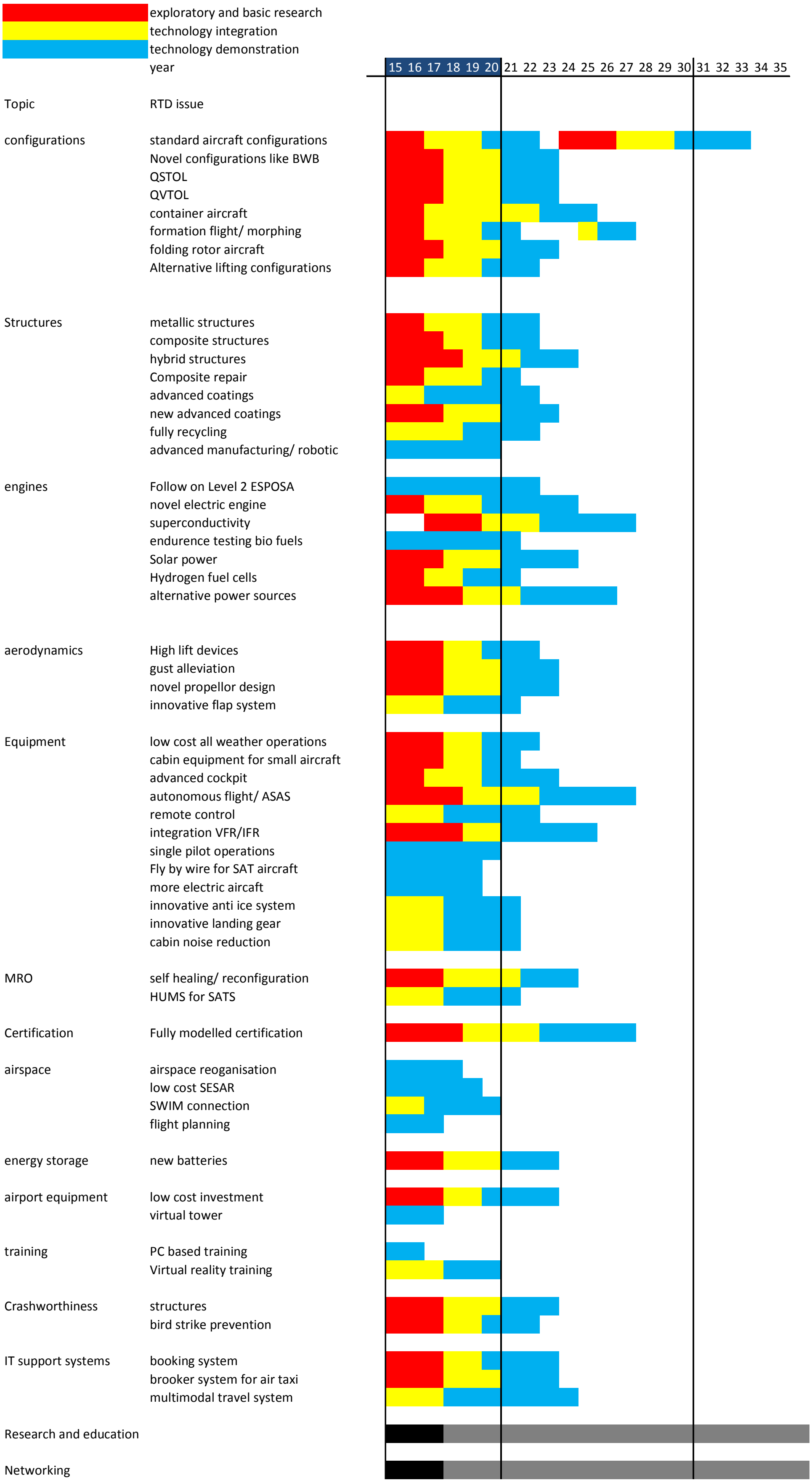

Fig.3.5 New technologies development and integration to SAT system

4. Regulations

Development of new technologies and subsequent product manufacturing with application of these developed technologies poses a significant administrative load and especially a financial load on the organizations dealing with development, production, maintenance of given products or with training of appropriate persons. The current aircraft regulations and directives issued by EASA disadvantage, to a certain extent, certification, operation and maintenance of small manufacturers and operators of aircraft from large European companies. This concerns above all a higher administrative load which operators and manufacturers of such small airplanes must manage in a range very similar to that of large manufacturers and operators of aircraft. However, this increased administrative load is not always reflected in increased operation safety of aircraft.

The highest load for manufacturers of small aircraft and relating aircraft technology is presented by certification costs and various maintenance fees for development and production of aircraft. **For a larger development of GA in Europe and in order to fulfill the idea of SAT-Rdmp project, the issue of comparing the costs of GA aircraft certification with big transport aircraft related to a ratio value (1PAX seat, person-km, etc.) should be open. Reduction of these costs will enable a larger development of GA aircraft transport segment (SAT) in Europe and it will open the way to the development of new airplanes for GA.**

The below mentioned chart shows the ratio of the certification costs related to the final price of customer's airplane. From comparison it is obvious that the certification cost ratio is, owing to the product price in the SAT area, significantly higher than in the area of big airplanes and it can be supposed that with other change of the Commission Regulation on the fees and charges it will be even higher to the detriment of SAT category of aircraft. Of course, the use of new technologies in the SAT area will further increase financial costs of certification to the detriment of SAT area.
Another important aspect, which emphasizes unfavorably and insensitively set fees for initial airworthiness of aircraft in SAT system, is that in spite of the fact that the aircraft of CS-23 MTE category or CS-23 commuter category are designed by organization with full authorities of DOA holder according to Part 21, the percentage ration of certification costs is in these categories the highest in the whole assessed area.

The fees for running supervision, which such holders of DOA (DOA 1B, resp. DOA 1A category) pay, range from 20 000 € to 90 000 € depending on organization size. It is therefore obvious that the organizations designing aircraft of CS-23 MTE category or CS-23 commuter category pay considerable amounts for maintaining the system according to Part 21 usually with full authorities in the Design Assurance System area including independent verification (CVE). Such built-up system reduces involvement of EASA supervision only for the selected areas defined by certification program. All theses facts, however, are not sufficiently reflected in decreased level of certification costs for the aircraft of CS-23 MTE category or CS-23 commuter category.
The Small Aircraft need a new simplified CS/FAR 23 rules for certification.

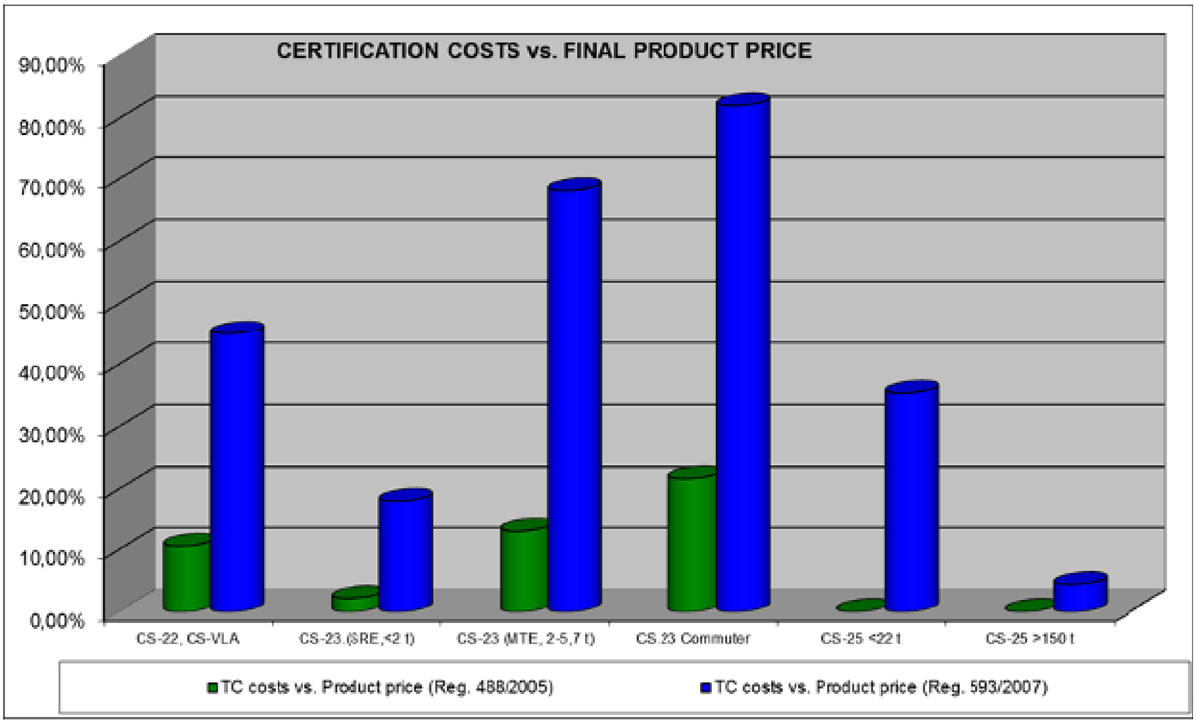

Fig. 4.1 Certification cost vs. Final product price

National authorities and EASA organization should reassess licensing aircraft personnel assigned for handling, maintenance and operation control (ATM, ANS) of aircraft for GA, especially from the time point of view (time needed for training) in connection with enhancement of safety of performed work on given aircraft. Newly arising technologies for maintenance and operation of aircraft enhance safety of operation and make the use of this technology more effective.

At the conclusion of this chapter we can say that Europe is overregulated and the reassessment of the above mentioned findings will certainly have a positive effect on fulfillment of ideas and effective function of new segment of transport SAT-Rdmp.

The report dealing with the assessment of regulations for effective function of SAT-Rdmp project is ”D1.4 Identification of existing regulation requirements, regulatory difficulties and innovative approach”.

5. Business case of SAT system

5.1 Identification of the most suitable business models for business case of SAT system in Europe

This subchapter defines relevant business models in Europe for the suggested mode of transport SAT in connection with the sphere of action of these models. As mentioned above, the business environment of SAT transport system is focused on transport of persons and cargo for the distance range of 300 to 800 km with the use of local airports, namely by means of the airplanes defined in Chapter 2 so that the meaning of the so-called door-to-door transport is fulfilled to the maximum possible extent. Business models are suggested with regard to maximum safety, positive economic impact (profit), maximum service and on the contrary with regard to the minimum impact of this mode of transport on the environment.
The most important factors influencing the demand for SAT transport system are of course the price of transport, income of inhabitants in a given region, speed of transport, level of gross domestic products (GDP), size and growth of given population in the region where this transport mode was established.

Small aircraft transportation will be a customer-oriented system fulfilling expectations of future travelers which include personalized travel, with individual tailoring of the travelling experience.

SAT models can be operated as scheduled, semi on-demand and fully on-demand.

Following business models are designed according to five variables:

- Ticket price
- Travel time
- Costs
- Revenue
- Service

According to the demand forecast a sensitivity analysis showed that the most significant influencing factor (on the passenger demand) is the SAT cost. Other key drivers of SAT demand are value of time and travel party size.

Business model 1

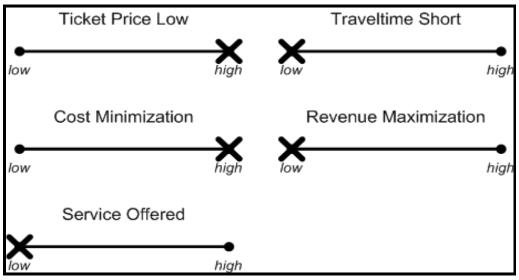

Figure 5.1: Scenario Business Model 1

The target market is the business travelers which can further be increased by attracting passengers from outside by selling empty leg flights for a discount and thus increasing the load factor.

SAT companies can also form an alliance with commercial airlines by feeding the first and business class passenger from their home or work to the airport for longer flights.

The priority parameters of business model 1 are:

- Ticket price: Low
- Aircraft type: Piston aircraft (lowest cost option)
- Target market/ demand: The business passenger (and more, by selling empty leg seats)
- Brand image: Low service; tickets per seat initially (variable in model to see the effect on profitability); semi on demand
- Alliances: Variable in model to see the effect on profitability

Business model 2

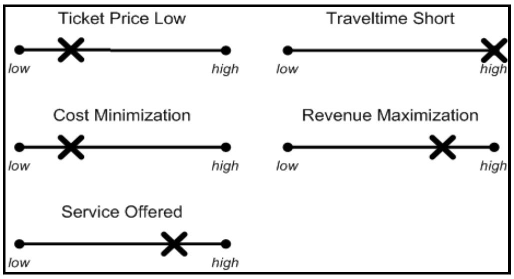

Figure 5.2: Scenario Business Model 2

This model will focus on decreasing the travel time, at a higher price.

The target market in this business model is defined more in the direction of the affluent business passenger willing to pay higher prices and the most important factor is travel time. The level of service is set prior to the ticket price.

The priority parameters of business model 2 are:
- Ticket price: Variable
- Aircraft type: VLJ
- Target market/ demand: The affluent business passenger
- Brand image: Luxury
- Alliances: Variable in model to see the effect on profitability

Business model 3

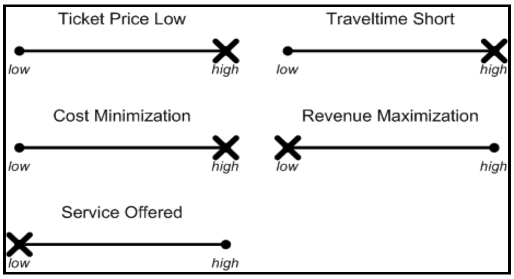

Figure 5.3: Scenario Business Model 3

This business model is a combination of the first and the second business model. Both the cost and ticket price minimization business model parameters and the travel time are important to increase demand (as a parameter to increase revenues) and decrease the costs.

In order to minimize costs even further so that a plane sharing product (and semi on demand services) should be available in case the customer decides to adapt its itinerary.

The priority parameters of business model 3 are:
- Ticket price: Low
- Aircraft type: VLJ
- Target market/ demand: The business passenger (and more, by selling empty leg seats)
- Brand image: Low service; tickets per seat initially (variable in model to see the effect on profitability); semi on demand
- Alliances: Variable in model to see the effect on profitability

Business model 4

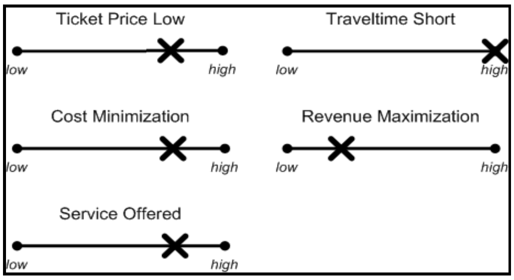

Figure 5.4: Scenario Business Model 4

This business model is a combination of the first and the second business model. It 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 set as a more important parameter (in contradiction with Business Model 3), a low ticket price and cost minimization strategy can still be realized.

VLJ will be used to offer the fastest travel time and a piston aircraft will be used to offer the lowest price.
Additionally, semi on demand services and selling empty legs flights can increase the profitability.

The priority parameters of business model 4 are:
- Ticket price: Low (for chosen aircraft type)
- Aircraft type: Piston and VLJ
- Target market demand: The business passenger (and more, by selling empty leg seats)
- Brand image: Low service, yet with aircraft upgrade possibility; tickets per seat initially (variable in model to evaluate the effect on profitability); both on demand as semi on demand
- Alliances: Variable in model to assess the effect on profitability

Business model 5

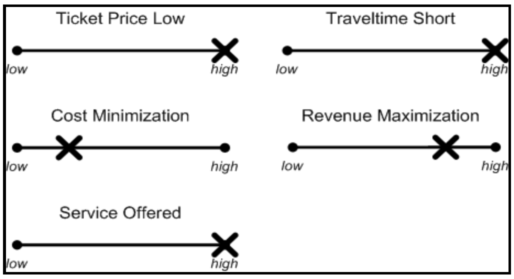

Figure 5.5: Scenario Business Model 5

By adapting the ticket prices to a minimum, while offering different aircraft for different prices so the passenger can choose his own level of service (attracting a broad target market with a broad brand image), a final attempt is made 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 travelers.
Low ticket prices are important in this part of the model. Turboprop aircraft (33% of the demand) will form an intermediate between the cheap but slower piston aircraft and the faster yet more expensive VLJ aircraft.
In addition to keeping costs as low as possible, an option should always be available. The passenger can upgrade its demand for a certain price. In order to keep costs as low as possible, the goal is to create as much as possible aircraft commonality to reduce costs.

The priority parameters are:
- Ticket price: From as low as possible for air taxi to a luxury price within the air taxi market (for chosen aircraft type)
- Aircraft type: Piston, turboprop and VLJ
- Target market/ demand: The business passenger (and more, by selling empty leg seats), both average as more affluent
- Brand image: Level of service can be chosen; tickets per seat initially (variable in model to see the effect on profitability); both on demand as semi on demand
- Alliances: Variable in model to see the effect on profitability

5.2 Input variables for the SAT business models

The primary differences in the business cases, such as the aircraft category or the offered service, the basic SAT operational input variables are assumed to be the following:

- *Travel party size* - the travel party size tends to be a driving factor of the total operational cost on a passenger-km basis. The more passengers are carried, the more seats are filled, the lower the operational cost per passenger will be, because the fixed operational costs would be divided.

- *Fleet type* – piston, turboprop, jet
- *Fleet size* - the amount of aircraft available is important towards the cost base but also the availability and therefore the possibility to fulfill the available demand
- *Buy costs / Lease costs* - Ownership cost could be based on either the process of buying or leasing an aircraft. Fractional ownership for this SAT simulator is assumed to fall in the first category.
- *Operating costs* - total operating cost depends on various other input parameters. Some of the most important (e.g. travel party size, fleet type, ownership cost, maintenance cost) and have the highest influence on the demand for small aircraft transport
- *Profit on cost margin* - the profit on cost margin is assumed to be 0% for the personal operations, and 10% for those based on remuneration or hire
- *Offered Service and willingness to pay for service* - most of the costumers are looking for the following services - seat comfort, variable tickets, reliable tickets, flight frequency (scheduled SAT). Statistics show that 33% of the passengers are willing to pay for more comfortable seats with more leg room. 26% found flexible or variable tickets important, while 33% of them wanted to pay extra money for a more reliable ticket policy with e.g. a cancellation possibility. Interestingly, flight frequency attired only 5% of the passengers, which shows that lower ticket prices over a high frequency flight with schedule operations and with higher costs are more important.
- *Demand service, Region & airports served*
- *Flight altitude* - can be chosen to minimizes the fuel consumption and thus the total operating costs
- *Region and airports served*
- *Maximum flights per OD (Origin - Destination)*

5.3 Small air transport cost estimation

Cost related to 6 different aircraft:

- Single engine (Da-40 Diamond) and twin engine (Pa-34 Seneca V) piston aircraft
- Single engine (Pilatus PC-12NG) and twin engine (Hawker Beach 1900D) turboprop aircraft
- Very light jet (Cessna Citation CJ1+) and small jet aircraft (Hawker Beech 400XP)

Costs were based on a 70% load factor single pilot operations for single engine aircraft and alternative annual flight hours.
DOC was defined as variable cost:

- Fuel
- Maintenance
- Fees and airport / route charges
- Crew

Fixed cost:

- Crew
- Hangar
- Insurance
- Training

and capital cost. Indirect costs were assumed to be 24% of the DOC.

Tab.5.1

		ACP1			ACP2			ACT1			ACT2			ACJ1			ACJ2		
Annual flight hours [FH]		500	1000	1500	500	1000	1500	500	1000	1500	500	1000	1500	500	1000	1500	500	1000	1500
Average twenty-year operational costs 2010 [EUR/FH]	DOC	277	241	230	470	437	423	1135	929	860	1570	1358	1288	1428	1398	1371	1912	1852	1827
	IOC	100	81	75	197	158	146	622	417	350	755	545	476	726	561	506	1002	769	688
	TOC	377	232	304	667	594	570	1757	1347	1210	2325	1903	1764	2164	1959	1877	2914	2621	2515
Average cost per passenger per km		**€ 0,77**	**€ 0,66**	**€ 0,62**	€ 0,43	€ 0,40	€ 0,39	**€ 0,49**	**€ 0,40**	**€ 0,37**	**€ 0,25**	**€ 0,22**	**€ 0,21**	€ 0,62	€ 0,61	€ 0,59	€ 0,48	€ 0,43	€ 0,42
Fuel		**24%**			**36%**			**33%**			**36%**			**36%**			**42%**		
Crew		25%			14%			13%			9%			15%			11%		
Maintenance		**25%**			**29%**			**26%**			**25%**			**34%**			**28%**		
Handle		22%			17%			5%			12%			5%			7%		
Fees		4%			4%			23%			18%			10%			11%		

The single engine aircraft are the most expensive and can only be used in air taxi operation. The average cost per passenger per km of the turboprop engine aircraft are the cheapest and are comparable to the cost of a luxury car.
The fuel and maintenance cost are major elements in the DOC whilst crew cost become more relevant with twin pilot operations.

The development of aircraft for SAT must forward to reduction of the costs (DOC and IOC) which is one of the requirements of attractiveness for increasing of demand.

Targets are a cost reduction of at least 50% by lowering the DOC by 38% and IOC by 10% and high utilization of 1500 to 1800 flight hours per year.

An indicative breakdown is provided below:

Tab.5.2

Cost	**Element**	**2035**
DOC	Engine related	-/- 25%
	Airframe related	-/- 8%
	Systems related	-/- 2%
	Crew related	-/- 3%
IOC	Insurance	-/- 1%
	Leasing cost	-/- 7%
	Training	-/- 1%
	Other	-/- 1%

6. Conclusion

Revitalizing European GA industry and regional airports by opening European demand for Small Commercial Aircraft and creating economically reasonable new component of Air Transport System are main aims of project SAT-Rdmp.

European action to support a new form of European transport by wider use of small aircraft, give travelers a free choice of transport mode according to their need and limited by their time value in order to enable access to more communities in less time.
EC and National policy should ensure the appropriate level of funding in order to develop the SAT system in Europe.

SAT aircraft will be low cost, low weight and small volume avionics will ensure future small aircraft to fly adverse weather conditions, during night and in general in IMC, thus ensuring safety and reliability of service. Not least SAT aircraft and whole transport mode will be environmentally friendly.

Generation of SAT mode will have consequences in traffic and employment rate support of regions with poor transport infrastructure and increase of living and economic standard of population not only these regions.
Small Air Transport complements regular air transport performed by commercial airlines on routes with low traffic, substitutes the cars traveling on long journeys and thus provides specific social and economic benefits such as increasing the mobility of citizens, the productivity of businesses and regional cohesion.

According to most SAT consortium it is recommended to launch a pilot phase in the short term phase (within 2020). The pilot phase should test some different business models; this would allow building up a success story in order to increase trust in the approach and support public acceptance and increase political leverage.

The SAT system will support following challenges:

- meeting Societal and Market Needs
- maintaining and extending Industrial Leadership
- protecting the Environment and the Energy Supply
- ensuring Safety and Security

The benefits include the prospect for reduced emissions and energy consumption, in comparison with road transport.