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15	Tony Henley Consulting Limited	THL	United Kingdom	Tony HENLEY	X
16	EUROPEAN COMMISSION	EC RD	Europe	Pablo PEREZ-ILLANA	X

Contents:

1. Forewords

Small Aircraft Transport has gained researchers attention. US has answered the GA crisis in eighties last century with published GARA (General Aviation Revitalization Act) in 1994 and they executed AGATE (Advanced General Aviation Transport Experiment), and SATS (Small Air Transportation System) Programs up to first years of XXI century. Students in the whole world learn to fly on Cessnas (sometime even older than students fathers), very successful Cirrus is also recognized in the whole world. Also Eclipse was precursor of new class – Very Light Jet Aircraft. As a result they have revitalized US GA industry.

In Europe, first SRA (Strategic Research Agenda) concentrated on areas necessary to European airliners and also manufactures of big passenger aircraft (even biggest in the world). Specific Small aircraft R&TD topics were absent in the Framework Program.

The EU Extension in 2004 brought into the picture of European aviation new stakeholders from NMSs; Czech, Poland, Romania and others in Central and Eastern part of Europe). The NMSs industry had produced commuters (L410, An28), agriculture and fire fighting aircrafts, small helicopters, small primary trainers and gliders and all hardware necessary to these products. The EU Extension gave new challenges for New Member States economies but this was connected also with the loss of their traditional eastern market.

In traditional EU MS small aircraft, business aircraft, and helicopters manufacturer are present and are interested improving their world market positioning (e.g counteracting the USA GA hegemony) with and possibly to develop a new transport mode, complementing the traditional commercial air transport mode, based on smaller aircraft/rotorcraft.

The problem has raised and European Parliament answered by publishing on 3rd Feb 2009 the “Agenda for sustainable future in general and business aviation”. Addendum to SRA has reflected some interest to small aircraft aviation. Idea that small aircraft industry can bring additional value for Europe was consequently matured. In FP6 CESAR (Cost-Effective Small Aircraft) Project has started and also EPATS (European Personal Air Transportation System). Project “Out of the Box” included personal transport as a promising idea also in long term perspective. In FP7 the project Personal Plane (PPlane) is studying one approach adopting small aircraft as personal transport.

The results of these projects were promising, and EC decided to launch a new support action in FP7 “Assessing and further developing the role of small aircraft in the air transport system”; this resulted into the support action “**Small Air Transport – Roadmap” (SAT-Rdmp)**. Furthermore, the topic “Integrated approach to efficient propulsion and related aircraft systems for small-size aircraft” was also launched in IV Call of FP7 and the Level 2 project “Efficient Systems and Propulsion for Small Aircraft” (**ESPOSA**) with a consortium of 39 Partners was funded.

In the SAT-Roadmap support action the following approach is adopted:

- The main goal of the small aircraft transportation system is to provide **fast and seamless transport service as a component of the European Integrated Transport System,**
- SAT System will serve:
  - **the need for low-intensity intercity air transport routes,** which have been dependent so far on road transport;
  - **regions out of the central European “economic banana” with less developed infrastructures** to stimulate the economic development;
  - **the needs of business** people to travel door to door. Current business aviation is expensive and only for the happy few.

- SATS transport should provide low cost travel, either as a scheduled service or as air taxi operations. Cost should be comparable to travelling by car.

In the SAT Rdmap support action a Common Vision and a Roadmap are being developed.
In order to have an appropriate consultation of the European General Aviation Community two workshop have been set up: SAT Common Vision Workshop and SAT Roadmap Workshop.

On September 28th 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 (SATS)" was elaborated, and sent to representatives of the SAT Community, EC, Regulators, Operators etc. The Discussion Paper is presenting also three Pivotal Questions to be debated at the Workshop.

Taking into account the discussion during the workshop and the written answers a "SAT System Common Vision" is being developed.

In this report the key elements discussed during the workshop and the written answers are given in dedicated sections, (see also Appendix A and Appendix B).

2. Goals of Workshop and Panel Discussion

The goals of the Workshop „Common Vision for Small Aircraft Transport Mode", held 28th September 2011 in Brussels, at Regione Campania – Brussels Office, Avenue De Cortenbergh 60, are to **discuss with representatives of the SAT Community, EC, Regulators, Operators:**

- **the elements of the SAT Vision in order to build up a "Common" shared view of the future.**
- the concept of Small Aircraft Transport (SAT) mode: a new modality for the Future ATS responding to 2020 challenges (medium term) and looking towards 2050 horizon (longer term),
- Enabling Technologies, Enabling Conditions, Priorities,

The following elements have been debated during the workshop:

- Presentation of a Vision for an Aircraft Transport System including Small Aircraft Transport (SAT) for inter-regional mobility responding to 2020 challenges (medium term) and looking towards 2050 horizon (longer term).
- Benefits by the SAT mode: High Level Objectives vs Challenges.
- Demand of SAT modes and possible Scenarios.
- SAT sectors and products where Europe wants to excel.
- Business case with operational characteristics.
- Identification of existing regulation requirements, regulatory difficulties and innovative approach in the regulation area.
- High Level Objectives for SAT Products needed to identify the enabling technologies.
- Assessment of existing and missing capabilities in Europe.
- Start-up discussion on Enabling Technologies, Enabling Conditions, Priorities to pave the way for the SAT SRIA.

Some of these elements have been discussed during two Parallel Sessions; a section of this report is dedicated to the key elements which have been discussed (see also Appendix D).

The Panel discussion was an important occasion to:

- **discuss with representatives of the SAT Community, EC, Regulators, Operators about the elements of the SAT Vision in order to build up a "Common" shared view of the future,**
- **collect answers on 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 goal might be met by 2020 using mostly currently existing aircraft, infrastructure and available ICT?

Parallel Sessions and Panel discussion was prepared by SAT Consortium preparing and distributing before the workshop the paper: "Common Vision on the Development of a Small Aircraft Transportation System (SATS), Paper for Discussion".

This Paper was sent to European General Aviation Community, to European Commission DG Research and DG Move, to experts preparing new Strategic Research and innovation Agenda, and also to personalities outside EU – from Russia, Canada, Turkey, US.

Furthermore, SAT-Rdmap Project Coordinator specifically asked Mr Bruce Holmes (President of US programs AGATE and SATS) for presentation his point of view.

3. The Workshop Agenda

08:30	Registration	
09:00	Welcome and Short introduction to the SAT-Roadmap Project	K. Piwek (IoA)
	Small Aircraft Transport Mode versus the 2020 and 2050 ATS	
09:20	SAT Vision and Roadmap - A new transport mode in Future ATS	A. de Graaff (AD Cuenta) M. Amato (CIRA)
10:00	Demand of SAT Mode	I. Laplace (M3 Systems)
10:30	Business Case with operational Characteristics	R. Curran (TUD)
11:00	Coffee Break (11:00 – 11:10)	
11:10	Future aircraft concepts (Business, GA and Small Transport Aircraft)	A. Cozzolino (Piaggio Aero)
	Enabling Conditions	
11:30	Enabling Conditions for Operations : booking system, airports	S. Ghijs (Fly Aeolus)
11:50	Enabling Conditions for Operations: pilot availability, SES, level of automations	C. Le Tallec (ONERA)
12:10	Regulatory Difficulties and Emerging Needs for Regulations	J. Duda (Evector)
12:30	Lunch (12:30 – 13:15)	
	Parallel Sessions with two Working Groups	
13:15	Workshops Approach and Working Group Creation	M. Amato (CIRA) A. de Graaff (AD Cuenta)
	Parallel Sessions WG – 1	
13:30	❖ Target Products & Technologies o Piston engine A/C - 9 seats or fewer – MTOW up to 5670 kg, o Turboprop A/C - 19 seats or less - MTOW 8618 kg o Jet A/C - 11 seats or less – MTOW up to 7600 kg ❖ HLO for Product Technologies ❖ Enabling Conditions for Product Technologies o R&TD infrastructures o Certification, Standards and Rules o Industrial Master Plan o Funding ❖ Product Technologies HLO vs Challenges	WG – 1 lead by A. de Graaff (AD Cuenta) M. Amato (CIRA)
15:30	Coffee Break (15:30 - 15:45)	

<table>
<tr><th></th><th colspan="2">Parallel Sessions WG – 2</th><th></th></tr>
<tr><td>13:30</td><td colspan="2">❖ Target Operation, System Concepts and Technologies
o Booking system
o Fleet Management
o ATM and SES
o Airports
o Automation level for SAT and operation modes
❖ HLO for Operation Technologies
❖ Enabling Conditions for Operations Technologies
O Pilot Training
O Insertion in SES
O Certification, Standards and Rules
O R&TD funding
❖ Operation Technologies HLO vs Challenges</td><td>WG – 2
lead by
T. Henley (Consulting)
S. Ghijs (Fly Aeolus)</td></tr>
<tr><td>15:30</td><td colspan="2">Coffee Break (15:30 - 15:45)</td><td></td></tr>
<tr><td></td><td colspan="2">Preliminary Results Collection</td><td></td></tr>
<tr><td>15:45</td><td colspan="2">Product Technologies and Enabling Conditions
Product Technologies HLO vs Challenges</td><td>WG-1 Leader
A. de Graaff (AD Cuenta)</td></tr>
<tr><td>16:00</td><td colspan="2">Operation Technologies - Enabling Conditions
Operation Technologies HLO vs Challenges</td><td>WG-2 Leader
T. Henley (Consulting)</td></tr>
<tr><td></td><td colspan="2">Panel Discussion on Small Aircraft Transport (SAT) mode</td><td></td></tr>
<tr><td>16:15</td><td>EC
ACARE
SESAR Community</td><td>Operators
Local Airports
EGAMA</td><td>Moderated by
K. Piwek (IoA)</td></tr>
<tr><td></td><td colspan="2">Next Steps towards SAT Common Vision and SAT Roadmap</td><td></td></tr>
<tr><td>16:45</td><td colspan="2">Next Steps</td><td>A. de Graaff (AD Cuenta)</td></tr>
<tr><td>17:00</td><td colspan="2">End of the WORKSHOP</td><td></td></tr>
</table>

The Workshop Attendance

The 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.
There were also reactions to the Discussion Paper on "SAT System Common Vision" and the related three Pivotal Questions.

Clearly, building "Common" shared view of the future Small Aircraft Transport System as a component of the European Integrated Transport is a long process, and cannot be addressed in one single meeting; anyhow, workshop discussions as well as written answers are extremely useful to collect opinions and to build a common vision for the development of a SAT System.

For the detailed Attendance list see Appendix C.

4. The Parallel Sessions

Two Parallel Sessions took place to openly collect views and opinions on key elements of the SAT Vision

Two working groups were set:

- **Working Group-1 - Product Technologies**
- **Working Group-2 - Operation Technologies**

The topics to be discussed in Working Group 1 were:

- Target Products & Technologies
- HLO for Product Technologies
- Enabling Conditions for Product Technologies
  - R&TD infrastructures
  - Certification, Standards and Rules
  - Industrial Master Plan
  - Funding
- Product Technologies HLO vs Challenges

The Topics to be discussed in Working Groups 2 were:

- Target Operation, System Concepts and Technologies
  - Booking system
  - Fleet Management
  - ATM and SES
  - Airports
  - Automation level for SAT and operation modes
- HLO for Operation Technologies
- Enabling Conditions for Operations Technologies
  - Pilot Training
  - Insertion in SES
  - Certification, Standards and Rules
  - R&TD funding
- Operation Technologies HLO vs Challenges

5. The Panel

Moderator:

- Krzysztof PIWEK (ILOT)

Panelists:

- Adriaan de GRAAFF (Ad Cuenta)
- Stefaan GHIJS (Aeolus)
- Tony HENLEY (THL)
- Marcello AMATO (CIRA)
- Jaroslav RŮŽIČKA (Evektor, EGAMA)
- Zbigniew MĄCZKA (Polish Civil Aviation Office)
- Jozsef ROHACS (BUTE)
- Pablo PEREZ-ILLANA (EC)

6. Summary of discussion during Workshop Parallel Sessions

Here below a synthesis of discussionsfrom the two parallel sessions is given; see also Appendix D

WG-1 Target Products and Technologies - Recollection from discussions

General remarks

- The importance of SATS as a new air transport mode was generally accepted.
- Better marketing for SATS is needed.
- SATS is often seen as a niche market.

The challenges adopted for the Air Transport System are recognized for the SATS

- Cost
- Quality &Competitiveness
- Environment & Energy Supply
- ATS Efficiency
- Safety
- Security

For SATS the Cost is felt to be very relevant.

Specific Challenges for SATS are:

- To provide a new affordable, accessible, energy efficient and environmentally friendly component of Air Transport System (ATS).
- To offer a lager choice for transportation through the increasing use of small aircraft serving small airports.
- To facilitate the access to transport for a large number of communities in a cost effective way.
- To create additional mobility (door-to-door/point-to-point) for the European citizens.

- To stimulate a co-modal approach for the European transport system.
- To improve the energy efficiency of transport according to the European Energy Strategy for Transport.
- To satisfy the needs of transportation in regions where transport networks (especially surface transport) are underdeveloped.

Target Products & Technologies

- Piston engine A/C - 9 seats or fewer – MTOW up to 5670 kg
- Turboprop A/C - 19 seats or less - MTOW 8618 kg
- Jet A/C - 11 seats or less – MTOW up to 7600 kg
- Light Helicopters
- Alternative Propulsion

Some considerations on products and technologies

- Simple Fixed wing aircraft and rotorcraft should service the SATS market. Also include autogyro and amphibious planes
- Little support for VLJ or jet powered aircraft (too expensive)
- Targets should be set for each requirement and trade off studies should be performed
- Cost is the most important requirement and should be added to the overall requirements.

Challenges and High Level Objectives

COST

- Tariffs are the result of the sum of DOC and IOC divided by productivity (speed x capacity x utilization)
- DOC should be lowered by at least 20% compared to the current generation
- Capacity may grow to 9/10 pax for the lower very short-haul short haul segment
- Speed minimum 400- 500Km/h
- Utilization should be 2000 hours per year (600 flights per year or 10 flights per day)
- See Cape Air for Operating Model
- Several cost issues need attention : production cost, maintenance, crew cost, off the shelf equipment and systems
- Design for maintenance must become a good practice
- Weight should be low (250Kg per seat)
- But most important is the development of new piston/ electric engines as the sector is using engines designed 50 years ago (diesel engines are not the solution)
- New configurations should be investigated for aircraft after 2020 (VTOL/Tilt rotor)
- Training cost should be low

QUALITY

- SATS will not need to operate 24h per day / 7 day a week in all weather conditions: find balance between cost and predictability of flights
- Good dispatch reliability is essential (simple aircraft like Do 227/ Islander)
- Cabin noise needs more attention (connected to location of the engines and trade off with external noise)

GREEN

- External noise is seen as a very important factor

- External noise should be reduced compared to current aircraft (better propeller design)
- Visibility of small aircraft may also be an issue (make the aircraft invisible by blending it in the environment)
- Electric propulsion should be addressed
- Flight profiles need to be changed (steep approach, take off)

TIME EFFICIENCY

- New ATM concept is needed.
- SESAR should recognize the importance of SATS
- Restructuring European airspace urgently needed
- New GNSS based equipment needed both in the cockpit and at airports (no additional infrastructure cost)
- SESAR equipment requirements for small aircraft are too costly

SAFETY

- New cockpit design for low workload. SATS technologies will be more advanced than for large airliners
- Single pilot operations / Ultimately pilotless
- Make GA aircraft safer and achieve a good safety record (also important for the image)
- Regulations need to be changed (cheaper/faster), for certification, operations/ pilot license, etc
- Insurance cost should be lower

SECURITY

This challenges was not deeply discussed for time restrictions

- Security is anyhow recognised to be a relevant element to be included in the SAT Common Vision and SAT ROADMAP

CONCLUSIONS

- **The importance of SATS as a new air transport mode was generally accepted.**
- Better marketing for SATS is needed.
- **Step changes in aircraft technology are needed.**
- **Engine technology is critical.**
- **An ATM concept and airspace classification suitable for SATS has to be developed.**
- Novel concepts for SATS aimed at longer term have to be conceived.

WG-2 Target Operations, System Concepts and Technologies - Recollection from discussions

COST

- Differential Fuel costs on international and small airports
- Insurance
  - *Agreement FOP minimize liabilities up to say 100.000*
- High SESAR costs
- ATC and navigational costs
  - *Management of resources (example fleet and pilots vs. rural areas)*
  - *Decrease empty legs*
  - *Information (traffic) and communication availability in order to share seats or empty legs*
  - *Enlarge flight hours to 2000 flight hours/year and increase load factor*
- On-demand, air taxi, sharing, FOP models have different challenges
- Reliable and affordable business model have to be adopted and possibly tested with a pilot phase in the short term (within 2020).

QUALITY AND COMPETITVENESS

- Requirement to use international airports for international on-demand travel
- The passenger does not know the real characteristics of the product
- The SAT concept is not known and marketing is expensive
- Social acceptance (+: employment, regional economy -: NIMBY, product, noise & emission)
  - *Persuade local authorities*
  - *Everybody must be a customer*
  - *Make solid and reliable numbers*
  - *Defend that the effects are better then alternatives*
  - *Work together with neighbouring associations and habitants*
- Fear of flying
  - *Improve comfort*
- Improving technology as substitute for personal travel

GREEN

- Flight profiles need to be changed (steep approach, take off)

TIME EFFICIENCY

- Air Traffic Services SESAR integration
  - *Engage towards the whole industry*
- Integration with large and small airports (non ILS at airports vs. Aircraft fitted with the necessary systems)
  - *Resolve FL issues in TMA (commercial vs. personal air traffic)*
- Maintain uncontrolled air space?
  - *Aircraft dependant*
  - *Traffic situation awareness and collision avoidance*

SAFETY

- Simplify Regulations: non-mature enough, structure of the EU, change of regulations is difficult
  - *Look at the regulatory environment (value vs. safety)*
  - *Question mark safety vs. Models (public/commercial)*
  - *Adapt instead of changing*
- Provision of effective/efficient pilot training - Pilot inexperience
  - *Reliable, certifiable on-board pilot support systems*

  - *Develop approach for mass small personalized aircraft operations services*
- Safety management system (reporting improves safety)
  - *Organization*
  - *Participation of stake holders*
- Small aircrafts are sensitive to adverse weather
  - *Develop additional support to keep the aircraft operating in adverse weather*
  - *Directly feeds into comfort and easy flying*
  - *Poor visibility of landing systems in adverse weather*
  - *Achieving high integrity of landing systems and using new infrastructure (Satelite Nav+, etc.)*

SECURITY

It is not a showstopper

- Anyhow, to secure fleet from terrorist attacks is felt as a HLO

Critical Enablers - Technological and institutional

<u>*General enablers*</u>

- Flexible fleet and pilots.
- Cooperation between airports and small aircraft providers, etc.
- The logistics to set up a SAT system and related technical issues have to be further investigated.
- Human issues related to a SAT System has to be further investigated.

CONCLUSIONS

- The importance of SATS as a new air determining transport mode was generally accepted.
- Better marketing for SATS is needed.
- Cost, Quality & Competitiveness are factors.
- Safety and Predictability of Operations are very important element.
- SATS insertion in SESAR has to be tackled.
- **The business model to be adopted is an essential element for the success of a SAT System. It has to be affordable and reliable.**
- **A pilot phase testing some different business models should be set up in the short term (within 2020); this would allow building up a success story, to increase trust in the approach, to support public acceptance and increase political leverage**.

7. Summary of the Panel discussion

Q1 - 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"?

Answers to Q1

The importance of SAT System as a new air transport mode was generally accepted by all Panellists.

A very important challenge is social acceptance.

Determining factors to reach social acceptance are: the SAT System has to be Environmentally Friendly and low Cost. Important factors for social acceptance are Safety and Predictability of Operations.

Rotorcraft should be considered as element to be included in this Vision.

The Business model to be adopted is an essential element for the success of a SAT System. It has to be affordable and reliable.

A pilot phase testing some different business models should be set up in the short term (within 2020); this would allow to build up a success story, to increase trust in the approach, to support public acceptance and increase political leverage.

Q2 - 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?

Answer to Q2

Panellist have discussed a common SATS goal definition. It was generally agreed that SAT System should not be considered to serve only "remote regions, and underdeveloped regions".

Two propositions of goal description are in consideration:

1. According to some panellists: **the main goal of the small aircraft transportation system is to provide fast and seamless transport service** serving: **the need for low-intensity air traffic intercity routes** which has been dependent so far on road transport; **regions out of the central European "economic banana" with less developed infrastructures** to stimulate the economic development; **the needs of business people to travel low cost door to door**. SATS transport should provide low cost travel, either as a scheduled service or as air taxi operations. **Cost should be comparable to travelling by car.**

2. According to Alfred Baron: 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), traveled by cars so far, and without near term perspectives for the introduction of high-speed train or scheduled airlines; mainly providing services on the routes on which travel time from door to door using available other modes of transport is greater than 4 hours.

Both views are good First one might be better for marketing purposes, second one is more specific and should be used in modeling demand calculations and simulations.

Q3 - Do you agree that this goals might be met by 2020 using mostly currently existing aircraft, infrastructure and available ICT?

Answer to Q3

Panelists are divided in view of pros and contra.

Mr. Ruzicka has pointed that General Aviation products have not technologically advanced too much in many years: "What do we use in aviation? Engines and avionics whose design is **mostly 40-50 years old**. Looking to car engines and equipment and impressive innovation was achieved and end users are acquainted to technology changes in every new car they buy! **There is a strong dependency on USA engine manufacturers that is not allowing innovative airframe design.**

Furthermore, **Europe is overregulated** and all GA regulation (training, operations, maintenance, production, certification) are closer and closer to airliners....“; this is creating **difficulties in terms of products innovation and costs.**

Mr. Mączka has another doubt: "**with existing situation on the legal infrastructure, with current society perception it is not possible to create such system today**".

A different view was also brought forward by another Panellist: "**the R&TD and rulemaking activities needed to introduce the SAT System in 2020 and to ensure public acceptance should be accelerated because competition from others strong key players is going to come soon** (China).

Rotorcraft have already the technology and on board equipment to be adopted in SAT System ensuring a door to door transport. In order **to achieve Public Acceptance some action is still needed**; noise perception, cost, and safety perception. Infrastructure requirements for rotorcraft are low. An appropriate business models should be defined and tested.

Main conclusion from Panel Discussion

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.

Currently the enabling conditions are in a poor status. European manufacturer are suffering from this situation.

There is a social need for mobility and specifically some regions and city-pairs would increase their access to transport by a SAT system; anyhow, proper dissemination and political leverage is needed to improve awareness of sustainability and social benefit of a SAT system.

The Business model to be adopted is an essential element for the success of a SAT System. It has to be affordable and reliable.

A pilot phase testing some different business models should be set up in the short term; this would allow building up a success story, to increase trust in the approach, to support public acceptance and political leverage.

The Vision and the Roadmap should also look to medium (2035) and long term (2050).

There is an agreement that **SAT System might become a small scale platform to demonstrate the European Integrated Transport functionality**.

It is worth reminding the European goal, as declared in Flightpath 2050 and EC relevant documents, to create a European Integrated Transport System which has to be safe, green and seamless - with one of goals **“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”.**

SAT-Rdmp Project is compliant with Fligfhtpath 2050 challenges.

8. Summary of written answers to Discussion Paper and to Pivotal Questions

Response to SAT Consortium's paper "Common Vision on the Development of a Small Aircraft Transportation System (SATS), Paper for Discussion" was significant. Here is summary of obtained written answers:

Adriaan de GRAAFF (Strategic Research Agenda - SRA-1,-2, SRIA – co-author; EPATS, SAT-Rdmp Partner). Mr de Graaff carefully analysed strategy and tactics of Small Aircraft Transport. SAT will meet not quite friendly acceptance by big airports, big industries, SESAR, environmental lobbies. Governments and regions should support SAT System development to get into practice. Therefore, it is necessary to take appropriate actions and a well balanced positioning.
See Appendix B.1

Jaroslav RŮŽIČKA (President of Evektor, Vice-president EGAMA). Mr Ruzicka agreed that small-size aircraft in future will be accepted as a component of European Air Transport System. He also positively answered the second question. The third question (about introduction the SAT System using today's aircraft, infrastructure and ICT) is not possible to be executed with existing European certification philosophy, and also with today's technologies in small aircraft industry. Biggest problem of Europe is overregulation!
See Appendix B.2 and B.3 (recollection after workshop).

Alfred BARON ("Father" of EPATS). Mr. Baron presented very wide comments to Common Vision Paper. He proposed SATS goal as follows: „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), travelled by cars so far, and without near term perspectives for the introduction of high-speed train or scheduled airlines, mainly providing services on the routes on which travel time from door to door using available modes of transport is greater than 4 hours.". Answers for 3PQ are generally positive with precisely consideration about each structure of SATS.
See Appendix B.4 (Comments) and"Updated Common Vision Document'.

Bruce HOLMES (President of AGATE and SATS; very Important Person in American GA) gave excellent deep comments based on his best in the world experience in Small Air Transportation System.
Mr Holmes has highlighted common main SAT/ODM (Small Aircraft Transport/On-Demand Mobility) strategies in US and EU:

- most of the demand for personal air mobility will likely be substitution for road travel;
- the smaller communities become more isolated without support of the personal air system;
- smaller airports and ATM need more attention in NextGen (the same situation in EU with SESAR);
- metrics for SAT in EU coincided with U.S. (Environmentally friendly, Affordable, Safe, Interconnected, Accessible, Predictable, Dependable, Comfortable) + in U.S. Quality of Service measured by doorstep-to-destination speed (75 mph for trips of 400 miles in length up to about 125 mph at 1000 miles);
- Social and economic benefits for communities with better connections;
- Special feature for new aircraft design that best satisfy network optimization considerations (for network-based on-demand, either per-seat, or per-aircraft), with bio

and electric propulsion, short trip distances (today 170nm for propeller aircraft, 250nm small jets), and also with greater autonomy and remote operational possibilities;
- There is significant risk involved for industry in undertaking the design and development of new aircraft for the on-demand air carrier services. Governments could support mitigation of technical and regulatory risks through public-private partnerships that target pre-competitive technology development. The investment required of a new manufacturer to develop, certify, manufacture and support a new aircraft design of the size envisioned for the on-demand markets is in the range of $1 Billion USD.
- More Automation and Autonomy. Approaches to the vehicle autonomy as operated from ground-based command centers can benefit significantly from current UAS operational lessons and will still require significant R&D to advance the most promising concepts into commercial services; Automation in the airspace management of SAT/ODM aircraft will benefit from advancements contemplated in trajectory-based operations (TBO) for airspace.
- Collaboration between US and EU in General Aviation Area is strongly needed (first common regulatory considerations).

Mr Bruce Holmes answers for 3PQ are precisely pointed:
- for First Q the answer to this question could be “Yes,” if the environmental and airspace capacity impacts can be demonstrated by analysis to be neutral or better;
- for Second Q the answer could be different in the EU (the previous operational experience for on-demand air carriers in the U.S. indicates that the average flying distance for the eastern portion of the country is around 1.0-1.5 hours)
- for Third Q answer will sound positively “if”: - if airport and airspace infrastructure can be deployed for all airport and related airspace (i.e., ADS-B, RNP, SWIM, data comm); if fares for close to current aircraft (e.g., Eclipse 500, Cirrus, et.al.) will be about $1.25 to $2.00 USD per seat mile; however, for the industry to move from serving the business markets toward the larger leisure markets, these fares need to be in the range of $.50 per seat mile – thus requiring a new generation of aircraft and utilization rates.

See Appendix B.5 (Notes on Common Vision Paper)

Frans van SCHAIK (representative NLR, Netherland, with Airport/Environmental Expertise).
Mr. van Schaik presented a letter with key elements (ref. B.6) to be taken into consideration. Among others some more important are:
- ATM capacity needs more attention. SESAR is not able to accommodate into ATM extra 50-100 thousands personal aircraft in Europe.
- Major go/no go for PATS – the noise level at existing airports shall not increase.
- Impression that stimulating governmental actions in favour of SATS are a main success driver. It has to be explained why to subsidize this mode of transport in a free market.

See Appendix B.6

Roland GURALY (Research Director Slot Consulting Ltd., Hungary, CEARES, CargoMap Project Coordinator). Mr. Guraly agreed with main idea expressed in Small Air Transport Discussion Paper. However, he emphasized the need to consider problems as well as all weather operations (reliable treatment of runway in harsh conditions, pilot weather forecasting support, fire-fighter service, de-ice service), also security issues can make the airfield-side investment considerable.
Apart from that, Mr Guraly agreed with the statements of the document, and welcomed the idea and declared the willing to contribute to the promotion of the project.
See Appendix B.7

Pierre-Marie BASSET (System Control and Flight Dynamics Department, Simulation and Flight Testing Unit, ONERA). Mr. Basset has sent an important analysis suggesting that **rotorcraft should be important part of the SATS.** Rotorcraft configurations should not be excluded "a priori" (this a priori may come from the "airplane culture" of the authors for which rotorcraft are

considered as more costly, more noisy than an airplane). Indeed, **rotorcraft are very well suited for the purposes of SATS.**
Rotorcraft can be part of the SATS already in the short term (within 2020) where they can (already now) provide door-to-door transportation and exactly in the scope needed in terms of range ~400km and travel time (~4hours). By doing so they can reduce the travel time and limit the change of transport mode nearly replacing the connection {small airplane + ground transportation (taxi or bus)}. By doing so, they can compensate their assumed higher DOC.
Also in the medium and long term (2035 – and 2050) rotorcraft concepts must be considered for SATS, knowing that new rotorcraft configurations and techno will be developed for: extending their flight envelop in terms of speed, range (e.g. see Sikorsky's X2, Eurocopter's X3, etc.) and lift capability (see Joint Heavy Lift System studies already few years ago in the USA), reducing their environmental impact (energy efficiency, air pollution, noise).
So, Mr. Basset’s answers about the three pivotal questions are:
1- YES, but add "on small-size aircraft (airplanes and rotorcraft) ... from standard airports-heliports and small airfield-helipads network"
2- YES, but why only for business travel ? SATS will be also beneficial to private interest travel (for example allowing increased distances between working and living places) and to leisure-tourism EU developments.
3- YES if we start soon !
See Appendix B.8

Tony HENLEY (Strategic Research Agenda - SRA-1,-2, SRIA – co-author; ATM – SESAR expertise, SAT-Rdmp Partner). Mr Henley has pointed very carefully comments to Common Vision Paper page by page. Some of them are:

- Have a significant impact on the viability of the concept. What is missing is (near term) all weather operation. Without this the concept is dead.
- CS-23 are ok, but I believe that for the more sophisticated aircraft CS-23 part “A” applies, which is very demanding in term of systems integrity.
- Avionics. HUD with EVS /SVS could be affordable for such small a/c/ small airport operations supported by augmented GNSS; critical additional avionics - a new Flight Control System to manage weather (gust alleviation) and pilot support including envelop protection with a simply high integrity back up mode in case of failure.
- The local transport organiser is a good concept which we should work on.

Mr Henley answers for 3PQ are precisely pointed:

- for First Q the answer to this question could be “Yes,” but..... we should define clearly what we mean by the different approaches, on demand taxi, semi scheduled , scheduled, etc., as the viability will be different for each depending on the environment.
- for Second Q the answer could be Yes.. But note that this question includes 3 different operational models which will have different business cases
    - Business travel (in the economic banana - implying on demand taxi?)
    - City pairs with low intensity traffic (outside the banana - implying Semi schedule?)
    - Regions with under developed transport infrastructure implying low capacity scheduled?)

  He suggested deleting the word 'Remote', what is important is the transport infrastructure rather than the geography or economic capacity. Remote, low income rural areas will generate little demand.
- for Third Q answer will sound positively “if”: - if some service cannot be established in that time frame it will be very difficult to maintain the necessary future investment or the regulatory and ATM environments necessary to support the long term expansion. This is not to suggest that new aircraft, systems and infrastructure will not be required to grow the opportunity, just than if there is no viable commercial operation within 9 or 10 years the concept will die.

See Appendix B.9.

Appendix A - The Panel discussion

Workshop Common Vision has foreseen Panel Discussion on Small Aircraft Transport Mode. Moderator Krzysztof PIWEK (SAT-Rdmp Project Coordinator) invited Personalities from different areas of General Aviation Community. Thanks to friendly answer, in the Discuss Panel took part representatives of the EC, Regulators, Operators, Manufactures, Research, Academia, and independent experts.

Here they are (according successive presentation order):

- **Adriaan de GRAAFF** (AdCuenta - Independent expert, co-author SRA's, EPATS, SAT-Rdmp Partner),
- **Stefaan GHIJS** (Fly Aeolus – small aircraft operator, SAT-Rdmp Partner),
- **Tony HENLEY** (THL – ATM – SESAR expertise, co-author SRA's, SAT-Rdmp Partner),
- **Marcello AMATO** (CIRA - ACARE expertise, co-author SRA's, SAT-Rdmp Partner),
- **Jaroslav RŮŽIČKA** (Evektor, EGAMA Vice-President),
- **Zbigniew MĄCZKA** (Polish Civil Aviation Office Vice-President),
- **Jozsef ROHACS** (BUTE – Professor with PATS expertise, SAT-Rdmp Partner),
- **Pablo PEREZ-ILLANA** (EC DG Research – Project Officer of SAT-Rdmp Project),

Adriaan de GRAAFF has presented his observations on workshop discussion. Mobility of European Citizens using air transport has doubled every 15 years. The air traffic concentrated on big hubs (70% traffic at 15 hubs when total number Europe's airports/airfields is about 2500) and current capacity of the airports cannot accommodate additional traffic. Road traffic (236 million car in EU-27) is also increasing. Trains are focused on areas within the main European economic centres (cost of one km High Speed Rail is 40 million Euro). Remote areas in Europe still have a bad transport infrastructure. Travellers want fast door-to-door seamless connections. From this reasons **answer for Q1** (Small Aircraft Transport System as a component of European (Air) Transport System) will **sound positively** if we manage to prove (not in a wishful thinking way) real figures of market demand for SATS. Also it is real necessity to work on positive society acceptance for this new transport mode.

Answering for Q2 (SATS goal formulating) Mr de Graaff has proposed following definition: The main goal of the small aircraft transportation system is to provide fast and seamless transport service which will serve: the need for low-intensity intercity routes which has been dependent so far on road transport; regions out of the central European "economic banana" with less developed infrastructures to stimulate the economic development; the needs of business people to travel door to door. SATS transport should provide low cost travel, either as a scheduled service or as air taxi operations. Cost should be comparable to travelling by car.

Answer for Q3 (SATS with existing aircraft infrastructure and IT). Current technology is **not sufficient** for meeting SATS goals. It is necessary effort for research and technology development.
They are: Novel aircraft technologies (single piloting, cockpit equipment supporting SESAR requirements, better noise and emissions characteristics - green propulsion, gust alleviation - ride quality, resistance for weather hazards); Network centric booking system (instant access via IT, SATS transportation management centre, on the spot flight planning); Infrastructure adaptation (airports, ATM - TMA and en-route operation mixing SATS and traditional flights,) and others.

Stefaan GHIJS represent Fly Aeolus Operator's Company. They now offer affordable, on-demand, reliable, door-to-door private flights. Fly Aeolus is example of air taxi activities and it will be developed in accordance with SAT-Rdmp findings as Fly Aeolus is Partner in SAT-Rdmp project. For these reasons his **answers for Q1, Q2, Q3 are positive**.

Mr Ghijs attached important comments via email after Workshop – see appendix B.10.
Goals should be refined using SMART (specific, measurable, attainable, realistic and timely) structure. SATS shouldn't be limited to only the underdeveloped or lack of infrastructure and low intensity traffic, but are also congested developed infrastructure (traffic jams, congested airports) and the convenience factor. Mr Ghijs does NOT envision a public system of on-demand or personal air transport in the current EU steered by one IT system. What he does believe is that on-demand an personal travel should become cheaper in order to improve mobility in Europe. He agrees with the set-up for IT system improving the on-demand business from an operational point of view, but not from a commercial point of view. Operators are not very keen to decrease their entrepreneurial dependency in obligated partnership. In an on-demand system customers do not want interdependency of other customers.
Main factors for operational success are:
- **all weather** aircraft landing systems to land at airports without ILS facilities,
- **single pilot** operations,
- **low aircraft DOCs**,
- low **maintenance** requirements,
- operational optimizers minimizing **empty legs**,
- additionally **IT** should help in automatic (flight)planning and reservations decreasing indirect and overhead costs.

Mr Ghijs agrees with the comments of Bruce Holmes. Nonetheless two major differences need to be spotted: one - the population density in the US is totally different then the EU therefore generating different drivers for on-demand transport, second - the acceptance for on-demand transport is far higher in the US than the EU.

Tony HENLEY answers for 3PQ are precisely pointed: for **Q1** the answer could be **"Yes, but..."** we should define clearly what we mean by the different approaches, on demand taxi, semi scheduled, scheduled, etc., as the viability will be different for each depending on the environment.
For **Q2** the answer could be **"Yes".** But note that this question includes 3 different operational models which will have different business cases: Business travel (in the economic banana - implying on demand taxi?); City pairs with low intensity traffic (outside the banana - implying Semi schedule?); Regions with under developed transport infrastructure implying low capacity scheduled?). Suggest delete the word 'Remote' , what is important is the transport infrastructure rather than the geography or economic capacity. Remote, low income rural areas will generate little demand.
For **Q3** answer will sound **positively "if":** - if some service can be established in that time frame it will be very difficult to maintain the necessary future investment or the regulatory and ATM environments necessary to support the long term expansion. This is not to suggest that new aircraft, systems and infrastructure will not be required to grow the opportunity, just that if there is no viable commercial operation within 9 or 10 years, the concept will die.

Marcello AMATO has very good record of animation of activities in European Research Area. He take part in ACARE, and ARG activities also he is main author of Italy Strategy of Aviation Research. Mr Amato is responsible for organizing this Common Vision Workshop.
Answering **positively on 3PQ** Mr Amato commented that it is strange that this type transport is not exploited yet, because infrastructure is enough to start operation or at least demonstrating the concept; market request is alsothere. What we need is social acceptance of SATS in short term. Demonstration of the concept and social acceptance will be a solid base for wide development of the system in the medium long term.

Jaroslav RŮŽIČKA highly appreciate the initiative to move European General Aviation forward and it was his pleasure to participate in the workshop. has considered that this is the only way how to help our segment of industry.
Mr. Růžička answers for 3 Pivotal Questions are:

Q1. – yes
Q2. – yes
Q3. – not

Answers for Question 1 and 2 must be yes – The scope of Evektor's business clearly define its position. It claims that all of us – which are active on GA has the same opinion. On Question 3, he only mentioned that it is not possible to build SATS on existing fleet of airplanes, especially existing certification philosophy and existing power plants. What it meant? Just see dynamic development UL/LSA category – This categories was not recently overregulated. Result is – reliable, environmentally friendly airplanes with car comparable prices, fuel consumption/kmpax same or similar as car's... We cannot wait with new design until 2020.... What we use in aviation? Engines which design is mostly 40-50 years old, similar equipment. how big progress was made in car engines and equipment... This is the way...

Unfortunately, time is hard and we have just limited power to improve conditions for any kind of airplanes smaller than airliner...There will be always difference between researches point of view (let's say academic) and his (industrial). The industry must make a living on result of their work – so they feel very clearly market reactions, impact of regulations, environmental requirements etc, etc...

EU have been concentrated to make Airbus real competitor for Boeing during last 30 years. They succeed. But where is EU General Aviation? Who is in Germany? Grob and Extra.. Italy – just Piaggio... France – Socata, 80% working for Airbus... GB? Etc, etc...

Just see situation in Poland clearly – so strong aircraft industry before, so many independent, real Polish projects. And what is research connection to own Polish industry now? Why so many Polish owners own planes registered in Czech Republic? Poland is wide country, flat, there is not very good road network. Why light airplane operations is not really supported? And the same in Europe… Example? Mr. Alois Peterle from Slovenia mentioned during EGAMA dinner. He planned to fly from Ljubljana to Brussels. He prepared it for several days but had to land in Antwerpen finally.. Not possible reach Brussels. Europe is overregulated and all GA regulation (training, operations, maintenance, production, certification) are closer and closer to airliners.

Simply last 20-30 EU totally didn't pay attention about GA, wide youth pilot training doesn't exist, less and less young people enter aviation education any kind...

Mr. Ruzicka is sure that SAT project is right – but who will finally use it? There is big difference between US and EU. Not needed to describe – just visit one time Oshkosh Air Show. EU is not able to compete with US in Aviation without big change of aviation spirit.

Biggest problem of Europe is overregulation... And he is happy for any voice which make any noise here that GA in Europe is still existing and has also right to be alive.

Zbigniew MĄCZKA has pointed that Small Aircraft Transport Mode should be accepted by market, citizens, lawmakers, politicians and even industry. But it is clear that this social feeling for such kind of transport is difficult to change. Mr Mączka agree in this matter with Mr de Graaff, and Mr Ruzicka.

But main goal for Small Aircraft Transport Mode is to fly (no matter private, air taxi, corporate) almost door-to-door and **answer for Q1** (Small Aircraft Transport System as a component of European (Air) Transport System) sounds **yes**.

The question Q2 (SATS goal formulating) is understandable because the definition on which we are deliberating should be established. Mr Mączka noted that it isn't important whether flight time will last 4 hours or 4,5 but it is important that SATS will serve remote, underdeveloped areas, who lack good transport infrastructure. The only tool for improving this situation is providing for this areas friendly conditions for investors – important are transport connections.

Mr Mączka **positively answers for Q2** but he propose consider to wider definition and change word "underdeveloped" for "not served routes" for example.

Future for small aircraft is needs the technology change and probably direction is to go to the automated systems supporting to take operating decisions. Mr Mączka stated his personal opinion answering **Q3** (possibility of SATS with existing aircraft infrastructure and IT) is like this: With optimal use existing technology without discussing any other thresholds with stakeholders,

politicians, society etc. – theoretically it is possible to create system (**"Low Cost Air Taxi"**) similar to SATS. But to be realistic - now - with existing situation on the legal infrastructure, with current society understanding **it is not possible** to create such system today.

Jozsef ROHACS. Hungarian government has invested a lot of money (25 million Euro per 5 years) because they want to improve research and find area in which Hungarians could succeed. This very promising area could be this kind system of small aircraft transportation, especially in the regions which lack transport infrastructure. Prof. Rohacs has recommended necessary outlook of what is going in US and how NASA has developed Small Aircraft Transportation System. Prof. Rohacs is confident that SATS could really to open new businesses, new technologies and new way of development of small aircraft used by GA (General Aviation). But what is today's status? Small Aircraft used by GA was designed 30-40 years ago - old solutions (high operational cost), old engines (significant environmental footprint).
This is very challenging situation – if we could cut operational costs, increase safety, if we manage to increase society acceptation as a new field of business, and as new field of transportation system – then we will be leading in this area, and this will be future. To do that we should develop this system; we have to define some indicators, thresholds, optimized trajectory, optimized system. It is necessary to consider cost – which is very important for common citizens. We should think about system greening otherwise society will contest airplanes, air transportation systems. To have system in real we should posses society acceptance for this kind of idea.
Prof. Rohacs considered above facts **has answered all the Three Pivotal Question "Yes".** However, he noted that we should accelerate a little more the activity because for the last 5 years we have only talked.
In the discussion Adriaan de Graaff mentioned that beside NASA programs, very potential industrial danger is going up from China. They have tomorrow in space, they have big programs on helicopters and small airplanes, they are fast, faster than we in Europe, and they do it. Mr. De Graaff's feeling is, if we are not be active enough - Chinese will cover all the market (Cirrus has just been sold to them too) and we will have only one choice – Chinese product.
Prof. Rohacs agreed with this observation and concluded that one solution for us is to stop talking and start acting.

Pablo PEREZ-ILLANA. As representative of the DG R&I at the European Commission, Mr. Perez-Illana firstly clarified that his intervention addresses R&T aspects – as this is the realm of SAT-Rdmp initiative. Although no representatives from EC-DG MOVE, EASA and SESAR were finally able to participate at this workshop, he was convinced that both EASA and SESAR have specific initiatives for the benefit of the small aircraft community and offered himself to facilitate the connection of SAT-Rdmp with those initiatives* (*POST-WS note: EASA-led initiative EGAST (www.easa.eu.int/essi/**egast**/); SESAR Lot 4 - consortium AT-one, consortium MAGNITUDE).

Answer for Q1 (**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"?**)
Yes, and as a matter of fact the European Commission's Framework Programme has funded and is co-funding several specific R&T projects for the benefit of the small aircraft community, ranging from pioneering projects on PATS such as PPlane, MyCopter, 4D-Control, ... to more downstream like FP7 SAFAR (Avionics) and large integrated projects such as FP6 CESAR and the recently approved FP7 ESPOSA (Engine/systems) – in addition to other actions such as FP6 EPATS and FP7 SAT-Rdmp itself including this workshop.
These projects should be instrumental in demonstrating the feasibility of a SATS to contribute towards the Smart Green & Integrated Mobility challenges spelled out in the different European

AAT Visions (Vision2020, FlightPath2050) and European policy references (e.g. Transport White Paper, STTP, Innovation Union /Horizon2020).

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Answer for Q2 (**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?**)
Mr. Perez-Illana underlines that the 4 hour door-to-door goal is certainly aligned with the FlightPath2050 vision. He questions whether the wording "business" is the right choice – in relation to social acceptance for this new mode of transport. As other participants, he also suggests further clarification regarding the word "remote". On this respect, he suggests SAT-rdmp also to connect with the FP7 action support action FUSETRA.

Answer for **Q3** (**Do you agree that these goals might be met by 2020 using mostly currently existing aircraft, infrastructure and available ICT?)**
Beyond the key role of non-research aspects (such as regulation, certification, ATM, pilot availability and training, …), Mr. Perez-Illana assumes that a degree of innovation in aircraft & infrastructure can help achieve the goals. Results from EC-funded projects can contribute, even if very challenging for 2020. The upcoming EU programme Horizon2020 (H2020) can be instrumental, as embracing not only R&T but also innovation for earlier uptake of results into products and services. What "scale & scope" in H2020 for aviation at large, and for small aircraft in particular, are questions to be decided by the EU Member States next year. The European SATS stakeholders can be influential. Firstly, convincing their Member States that aviation research at large is of paramount importance (not only for the States with large aircraft manufacturers). Secondly, participating pro-actively in the working groups of ACARE to translate the FlightPath2050 goals into a Strategic Research & Innovation Agenda. This agenda will be influential in the structure and implementation of the aviation programme in H2020. European SATS stakeholder can ensure then that their views are taken into account, and that some technology (and budget) synergies (rather than competition) can be established with other aviation segments initiatives – e.g. larger aircraft technology demonstration, UAS or inter-modality for instance. Additional enablers can be better coordination of national initiatives in Member States – as well as targeted international cooperation, which the EU can certainly support.

Appendix B - Written Answers to Discussion Paper and Pivotal Questions

- APPENDIX B.1 "ADRIAAN DE GRAAFF COMMENTS, 2 SEPT 2011"
- APPENDIX B.2 "JAROSLAV RUZICKA COMMENTS, 19 SEPT 2011"
- APPENDIX B.3 "JAROSLAV RUZICKA COMMENTS, 12 OCT 2011"
- APPENDIX B.4 "ALFRED BARON COMMENTS, 26 SEPT 2011"
- APPENDIX B.5 "BRUCE HOLMES COMMENTS, 26 SEPT 2011"
- APPENDIX B.6 "FRANS VAN SCHAIK COMMENTS, 26 SEPT 2011"
- APPENDIX B.7 "ROLAND GURALY COMMENTS, 26 SEPT 2011"
- APPENDIX B.8 "PIERRE-MARIE BASSET COMMENTS, 27 SEPT 2011"
- APPENDIX B.9 "TONY HENLEY COMMENTS, 30 SEPT 2011"
- APPENDIX B.10 "STEFAAN GHIJS COMMENTS, 6 DEC 2011"

Appendix B.1 "Adriaan de Graaff Comments, 2 Sept 2011"

SAT Common Vision – Paper for Discussion
110902-Adriaan de Graaff-Comments

Dear friends, in addition to my email last night i would like to stress that we carefully need to define our strategy and tactics. Asking for money from the Commission at this point of time can be counterproductive. Why? look at the stakeholders:

Airlines do not like the PATS concept as it may take away business class passengers
Big airports want to give their slots to large aircraft as these produce customers for shops and parking lots
Big industries are not interested as it consumes money they need for big aircraft development and profitable projects. Airbus, Thales and RR will not support it
SESAR does not like PATS as it will complicate its concept of operations that s fully based on scheduled flights
Environmental lobby groups will argue that it will create more emissions and noise (we have seen the reaction to the EPATS report from Germany: whilst the German car industry is developing more powerful and bigger cars, the green lobby is against small aircraft)
Passengers have no combined lobby club to defend their interest

So we are fighting an uphill battle.

Regards Ad

Appendix B.2 "Jaroslav Ruzicka Comments, 19 Sept 2011"

Email from Jaroslav Ruzicka 19 IX 2011
Dear Krzysztof,
I am very pleased by your email, asking if I can be "Panelist" during the coming Common Vision workshop next week. And I am sorry that I answer with little bit delay – I was out from the office and need discuss with my team.
My answers for 3 Pivotal Questions are:
1. – yes
2. – yes
3. – not
My answers for Question 1 and 2 must be yes – The scope of Evektor's business clearly define my position. I think that all of us – which are active on GA has the same opinion on Question 3, I only think that it is not possible to build SATS on existing fleet of airplanes, especially existing certification philosophy and existing power plants. What I mean? Just see dynamic development UL/LSA category – This categories was not recently overregulated. Result is – reliable, environmentally friendly airplanes with car comparable prices, fuel consumption/kmpax same or similar as car... We cannot wait with new design until 2020.... What we use in aviation? Engines which design is mostly 40-50 years old, similar equipment. how big progress was made in car engines and equipment... This is the way...
Looking forward to meet you next week
Jaroslav

Appendix B.3 "Jaroslav Ruzicka Comments, 12 Oct 2011"

Common Vision – Three Pivotal Questions
Jaroslav RŮŽIČKA – Comments 11Y10.12

Dear Krzysztof,

I highly appreciate your initiative to move European General Aviation forward and it was my pleasure to participate on your workshop.
I think that this is the only way how to help our segment of industry.
Unfortunately, time is hard and we have just limited power how to improve conditions for any kind of airplanes smaller than airliner...
There will be always difference between your point of view (let's say academic) and my (industrial). We must survive from result of our work – so we feel very clearly market reactions, impact of regulations, environmental requirements etc, etc...

EU have been concentrated to make Airbus real competitor for Boeing during last 30 years. They succeed. But Where is EU General Aviation? Who is in Germany? Grob and Extra.. Italy – just Piaggio... France –Socata, 80% working for Airbus... GB? Etc, etc... Just see situation in Poland clearly – so strong aircraft industry before, so many independent, real Polish projects. And what is your connection to own Polish industry now? And sure – you know better than me why so many PL UL owners own planes registered under OK. Poland is wide country, flat, there is not very good road network. Why light airplanes operations is not really supported?

Just one segment of industry boomed during last 20 years – UL/LSA planes, but only in countries where regulations are maintained by enthusiasts (CZ, D, maybe I)... As MEP Mr. Alois Peterle from Slovenia mentioned during EGAMA dinner. He planned to fly from Ljubljana to Brussels. He prepared it for several days but had to land in Antwerpen finally.. Not possible reach Brussels. Europe is overregulated and all GA regulation (training, operations, maintenance, production, certification) are closer and closer to airliners.

Simply last 20-30 EU totally didn't pay attention about GA, wide youth pilot training doesn't exist, less and less young people enter aviation education any kind...
What I am afraid SAT project is right – but who will finally use it? There is big difference between US and EU. Not needed to describe – just visit one time Oshkosh Air Show. EU is not able to compete with US in Aviation without big change of aviation spirit.

Biggest problem of Europe is overregulation... And I am happy for any voice which make any noise here that GA in Europe is still existing and has also right to be alive.

Best regards!

Jaroslav

Appendix B.4 "Alfred Baron Comments, 26 Sept 2011"

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"*

This means, that the maximum distance between the regions served by SATS is limited by time of flight (4h) and speed of the aircraft – this means that the network connections are limited by aircraft performances. Meanwhile, the network connection should result from the transportation needs, and the aircraft mission requirements should be adapted to them. Hence, the correct statement should be: …thus enabling door-to-door travel between EU regions/cities in less than 4 hours.

Inserting the first the need to provide fast passenger transport service for European business travel affect the hierarchy of objectives. According to the concept described in the Vision the first objective of SATS is to meet the transport needs of remote areas to ensure sustainable development of all Europeans regions. This is to meet the needs of business travel generated in these regions, but also the needs of commuting, lifestyle travelling, repositioning and others.

The second objective: "enabling door-to-door travel between EU regions/city pairs in less than 4 hours " aims to enable each business trips in the EU area in one day. There is a growing need to perform long-distance inter-city travel within 1 day. In most cases meet this need occurs when the travel time from door to door between cities does not exceed 4 hours. Much of intercity distance is below 300 km, and these cities are served by passenger cars, train or coach in less than 4 h. The remainder of intercity connections is in the range from 300 to 2500 km. Just a little part of those door to door connections (these of high density traffic) can be realized by fast trains or air lines in less than 4 hours. The remainder part such opportunities has not. This is precisely the area of intercity connectivity, which is intended to be serviced by SATS, and therefore, it is why the travel time, for the longest network segment operated by the plane, cannot be greater than 4 h.

I suggest the following goal formulation:

The Main Goal of Small Aircraft Transportation System is to provide high-speed passenger transport service for remotes underdeveloped regions and city pairs with low traffic intensity connections and to enabling door-to-door travel between EU regions/city pairs in less than 4h

Three Pivotal Questions

The 1 question: " Do You agree… that SAT System ... should be accepted as a component of the European Air Transport System ? " is meaningless. *Whatever has been authorized in Europe to perform transportation flights is a component of the European Air Transport System.*

ANSWERS

Answering the question if the designated objective can be achieved by using the existing aircrafts, infrastructure and available IT technologies depends on the way of interpretation of this objective. If we focus on providing fast means of transport for business travel, the answer will depend on the degree of meeting this need we consider. If we consider satisfying only the elites (less than a per mille of the business population) then the answer is yes, because the

elites are already using the business flights and aero-taxi services and are able to travel to each city in Europe and back to origin within one day.
However if we consider a wider range of business population, including the business conducted in remote areas then the answer will depend on how we understand the 'wider range' statement (is it 1%, 20%, 50% of population or so?) and how we predict this develop-ment in time, what is our knowledge of aviation and it's traffic management and what kind of requirements we set for air transport. The answer will also depend on from what point of view, we evaluate the objectives: technical, ecological, economical and social points of view.

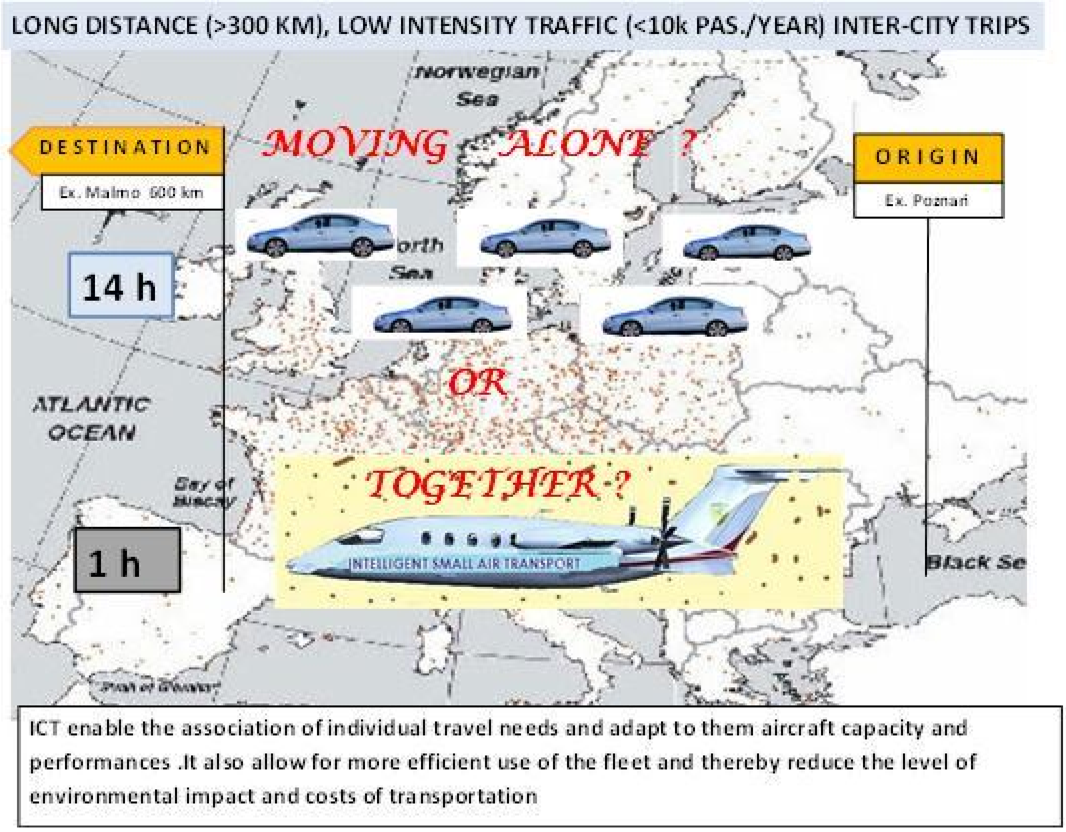
Considering particularly each of every 3 components of SAT system we can state:

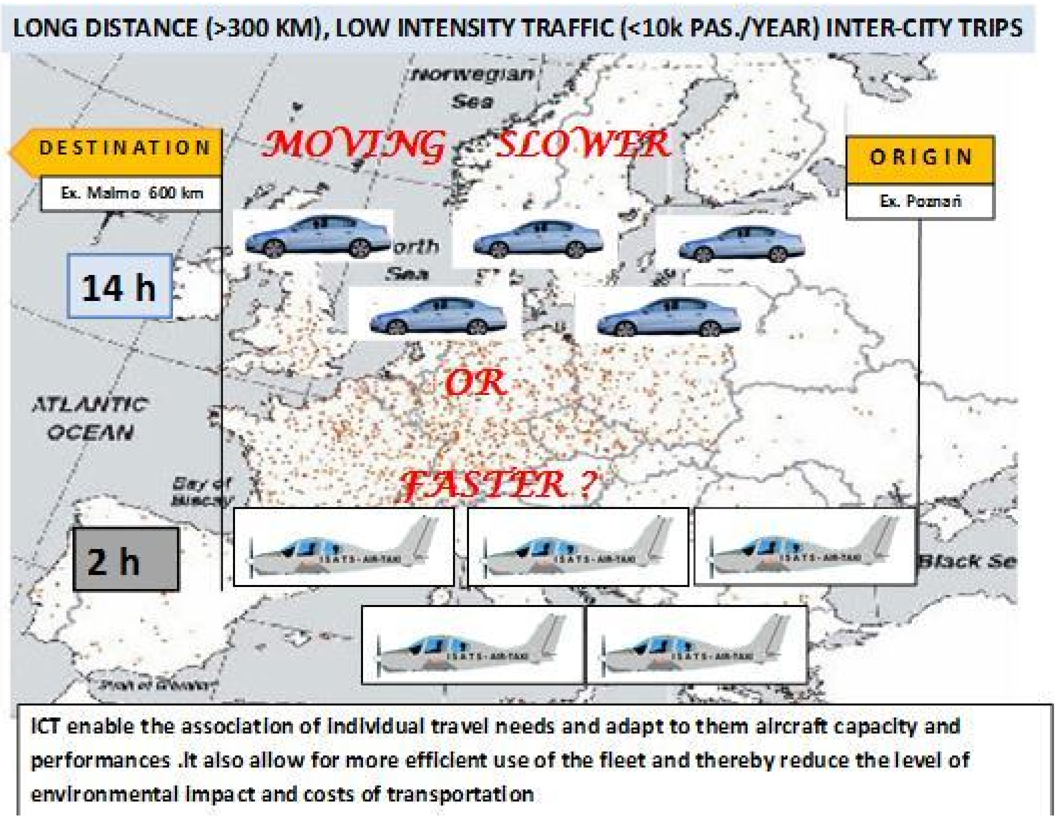
Aircraft
In the first part of SATS development phase (until 2020) existing business-purposed aircrafts are meeting the technical (mission requirements), ecological (energy consumption, gas and sound emission) and social (security) requirements. But they do not satisfy the economical requirements – production and operational costs Reducing those costs and further decrease of the impact on environment should be the basis to formulate the research and development objectives of those aircrafts in upcoming years.

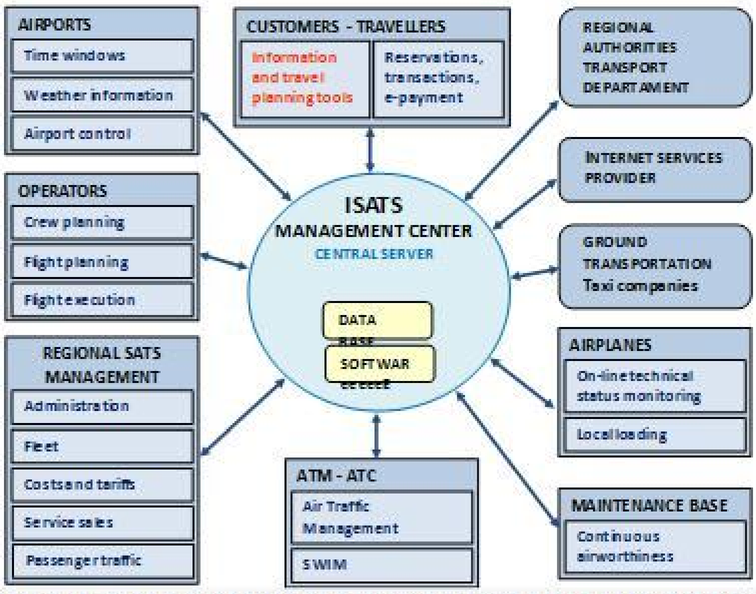
Infrastructure
The existing airports and flight management systems allow significant increase in air traffic, particularly in remote regions. Realizing the existing plans of airports' modernization and the SESAR program will enable further development of the SATS program after 2020.

Information & Communication Technologies – ICT
The condition to achieve the defined goals is to add a specialized and centralized information and communication system to SATS infrastructure. This system will allow to introduce interactive communication between service providers and their customers thus reducing the number of indirect agents and improving the quality of information and service, developing mission effectiveness of aircraft (increasing annual flight hours and load factor , reducing repositioning flights to 5%), better coordination of flight operations and ground services etc.
Adding this system to SATS infrastructure creates an environment for the Intelligent Small Air Transport System (ISATS). Creating ISATS is the basis to significant reduction of the costs of SAT services. Increasing annual flight number to the level of 1200 – 1500 hours and decreasing repositioning flights to 5%, while using an appropriate business model, would allow to reduce the cost of passenger-kilometers, in relation to the current aero-taxi services, by several dozen percent which would lead to significant increase of demand for these services. Considering the existing ICT technologies and available IT centers, after defining the system guidelines and input data being the result of assumed business models, developing and implementing specialized and centralized information and communication system to SATS could be executed within few years time.

SATS Concept in Pictures







The answers to the above questions will provide Information and travel planning tools included in reservation system, which is subsystem of the ISATS net-centric management system,.
Based on input provided by the customer (itinerary, time, individual value of time, preferences, etc.) and the data included in the dynamic database, the model allows you to select the optimum means of transportation for any proposed reservation
ICT enable the association of individual travel needs and adapt to them aircraft capacity and performances .It also allow for more efficient use of the fleet and thereby reduce the level of environmental impact and costs of transportation

Appendix B.5 "Bruce Holmes Comments, 26 Sept 2011"

110926 Notes on Common Vision Paper

Bruce J. Holmes
NextGen AeroSciences, LLC
Williamsburg, VA USA

The following points of strategy for SAT in the EU are in common with the "On-Demand Mobility" concept in the U.S.:

- **Substitution for road travel:** As in the U.S., highway modes in the EU 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 the U.S. The benefits include the prospect for reduced emissions and energy consumption, in comparison with highway travel.
- **Small community air service:** In both the EU and U.S., scheduled air carrier service is in decline in smaller markets. These markets are too thin, or small, to support daily scheduled service; these markets can, however, support on-demand air carrier services, as has been demonstrated in certain industrial innovations in such services in the U.S. and in Europe. This decline in scheduled service is an expected result of airline industry responses to economic forces, include fuel costs. The result over the recent decade in the U.S. is that a decline 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[1]. The consequence is that smaller communities become more isolated from the economic mainstream and opportunities to contribute to innovation, with coincidental losses in quality of life.
- **RTD activities for smaller airports:** Current NextGen implementation programs in the U.S. focus on the largest of airports and related airspace and airline users; this is a similar situation to that in the EU with SESAR. The implementation of ADS-B, data communications systems, airborne access to SWIM, and other NextGen technologies has not included the General Aviation community in the U.S. The result is that the pace of implementation and the realization of benefits are somewhat delayed compared to a situation in which the small aircraft community were more fully engaged. For example, projects could be implemented today that demonstrate the positive business case for applications of ADS-B OUT and IN, data communication systems, airborne access to SWIM, and remote tower functions that eliminate procedural separation at non-towered airports.
- **Metrics:** The proposed metrics for SAT in Europe coincide directly with those of value in the U.S., including:
    - Environmentally friendly
    - Affordable
    - Safe
    - Interconnected
    - Accessible
    - Predictable
    - Dependable
    - Comfortable

  In the U.S., we would emphasize one more metric: Quality of Service, as measured by doorstep-to-destination speed or time (which is also referenced in the SAT papers). In the U.S., an average door-to-door speed for airline travel ranges between 75 mph for trips of 400 miles in length up to about 125 mph at 1000 miles. These figures are the result of origin-to-destination distance divided by all of the time required to move through each mode involved in the total trip. It is possible to travel at twice these average speeds in the

[1] Air Transport Association, Washington, DC

personal air mobility mode, at total mission costs that are competitive with highway or certain scheduled air carrier prices, in certain markets that are poorly served by airlines.

- **Social and economic benefits:** The degree to which communities in a nation or between nations are connected drives economic performance as well as the capacities for innovation in products and services. The small aircraft transport concept fills a void created by the emerging challenges and constraints in highway and scheduled air service modes.
- **Aircraft design:** Based on experience over the past ten years in the U.S. on-demand air carrier industry, the average segment length for small jets is about 250 nm and for small propeller-driven aircraft is about 170 nm. For each, the average segment duration is about one hour. This means that aircraft designs that satisfy economic and performance metrics based on these experiences should be considered for future aircraft development. Studies should be conducted of the performance requirements that best satisfy network optimization considerations for network-based on-demand (either per-seat, or per-aircraft) operational benefits. These design requirements should consider both alternative fuels (bio-derived Diesel for example) and electric propulsion. Based on current rates of progress in both of these fields, the opportunities to introduce new aircraft into on-demand fleet operations appears plausible as early as about 2020, for earliest adopters. Aircraft that are designed for greater autonomy and remote operational support pose new challenges to certification. Early engagement of the regulators is essential.
- **Industrial engagement:** There is significant risk involved for industry in undertaking the design and development of aircraft for the on-demand air carrier services. The performance and economics of such aircraft may not optimally suit the historical market for general aviation manufacturers of owner-flown personal aircraft. Therefore, governments could support mitigation of technical and regulatory risks through public-private partnerships that target pre-competitive technology development. The investment required of a new manufacturer to develop, certify, manufacture and support a new aircraft design of the size envisioned for the on-demand markets is in the range of $1 Billion (USD). This is approximately the expenditure experienced lately for new startups in aircraft OEM production. Existing corporations can bring a new aircraft to market for substantially less due to existing manufacturing and product support infrastructures. However, the nature of the new markets and design requirements for on-demand aircraft may dissuade most extant OEMs from taking on the risks attendant to these new markets.
- **Automation and Autonomy:** The concepts associated with more autonomy in aircraft and more automation in airspace management under both the US NextGen and EU SESAR programs hold significant promise in enabling advancements in future (post 2020) small transportation aircraft for the SAT/On-Demand Mobility concepts. Approaches to the vehicle autonomy as operated from ground-based command centers can benefit significantly from current UAS operational lessons and will still require significant R&D to advance the most promising of the concepts into commercial services. Automation in the airspace management of SAT/ODM aircraft will benefit from advancements contemplated in trajectory-based operations (TBO) for airspace. R&D involving government, industry, and regulators to mitigate risks is an essential ingredient for progress in these areas.
- **Regulatory considerations:** 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 on both sides.

- **The 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 nonscheduled flights from standard airports and small airfield network, should be accepted as a component of the European (Air) Transport System"?**

A: In the U.S., the answer to this question could be "Yes," if the environmental and airspace capacity impacts can be demonstrated by analysis to be neutral or better.

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?**

A: The previous operational experience for on-demand air carriers in the U.S. indicates that the average flying distance for the eastern portion of the country is around 1.0-1.5 hours. The distribution of flying segments around this average has a deviation of about plus one hour and minus .25 hour. The answer could be different in the EU, however, modeling studies should be conducted that can determine these figures.

3. **Do you agree that this goal might be met by 2020 using mostly currently existing aircraft, infrastructure and available ICT?**

A: Business case evidence in the U.S. supports the premise that if the airport and airspace infrastructure can be deployed to all airports and related airspace (i.e., ADS-B, RNP, SWIM, data comm), then operators can put reliable services into operation with business cases that close using current aircraft (e.g., Eclipse 500, Cirrus, et.al.). This premise is based on fares of about $1.25 to $2.00 USD per seat mile. However, for the industry to move from serving the business markets towards the larger leisure markets, these fares need to be in the range of $.50 per seat mile – thus requiring a new generation of aircraft and utilization rates.

###END###

Appendix B.6 "Frans van Schaik Comments, 26 Sept 2011"

1. Please put a time horizon in the title of this Common Vision: like "up to the year 2030".
2. In some paragraphs it is not clear where the statements come from; please add more references
3. ATM deserves more attention. Page 5 could state that SESAR is not able to provide ATS to 50.000 or 100.00 extra personal aircraft in Europe, but there are more places in the vision, like chapter 3b to expose the ATM problems
4. Is known what the effect will be of new web-based communications? I would expect that the web meetings, web based conferences, web based telecom would lower the need for travelling.
5. The noise level at existing airports shall not increase. This might become a major go/no-go item for PATS. We shall put more emphasis on it.
6. We are up to now talking about aircraft with 4 up to 19 seats; chapter 4a signals a "gap to fill" for aircraft with 19 to 40 pax. No problem for me, but (1) we shall be very clear what we are talking about, (2) please give more references and (3) indicate the consequences for e.g. certification (costs).
7. Chapter 3e contains a message to stimulate governmental actions in favour of SATS. This gives me the impression that such is needed for the success of PATS. It could be explained as if we already know that any PA is not profitable.
8. Same remark for with 3f and the Public Service Obligations. In a free market, tariffs will be known.
9. How do we cope in the business case with airports that subsidize air transport (related to 3f)?
10. Please add references to chapter 3g
11. Do we need some statements (actions) to increase the believe of Banking people? We need money for our investments.
12. Chapter 4: how do we estimate the effect of web-based communications, making travelling not needed?
13. Chapter 4: should we emphasise more on the effects of fuel price? I assume this to be the most important cost.
14. Should we emphasize more on the effect of mass production of PA? Think about 10.000 aircraft per type or even more.
15. Chapter 4b, add ATM, Safety, Training and Safety Management to the list:
   - How to provide Air Traffic Services to 10.000 or 100.000 more European Personal Aircraft?
   - How to fly those PA safely?
   - How to train and check 10.000 extra PA pilots?
   - How to introduce and maintain a safety management System for those numbers?
16. Question 3: It will really evoke reactions, if we don't need new aircraft!

Appendix B.7 "Roland Guraly Comments, 26 Sept 2011"

The SATS vision is quite right divisioning the feasibility around three aspects: Aircraft, Airports and Airspace/ATM. Regarding the aircraft part, I agree with the statements of the material, adding that the onboard avionics of the state-of-the-art small aircraft evolved so fast in the last few years that the gap between the situational awareness of the pilots of an airliner and a small airplane is rapidly vanishing. This is good news for all-weather operations safety.
Moreover, time will soon come when satellite-aided onboard systems completely outrule such ground-based equipment as ILS, VOR and DME, connecting each-and-every strip of concrete equipped with some runway lights to the rest of the world. As the paper indicates, this allows small airports to get into the business with a relatively small investment.
From the avionics side, it is right. However, I fear, there is more in the box. For example, all-weather operations may require

- the proper and reliable treatment of runway surface in harsh met conditions,
- weather reporting and forecasting service,
- firefighter service defined by the traffic,
- de-icing service available,

Another tricky question can be the security issue. Security control provided by small airfields is usually far from the service operating at public airports. We all hope that SATS makes traffic volume increase on these places, so they will most likely have to provide the equivalent level of security to eliminate a new threat towards the public. This, along with the constraints related to the proper all-weather-operations can make the airfield-side investment considerable.
Apart from that, I agree with the statements of the document, and welcome the idea. Please let me know whether we can contribute to the promotion of the project. Among my Colleagues are airport and ATM experts, as well as aircraft-engineers experienced in small aircraft design, so the topic fits well into our field of work.

Appendix B.8 “Pierre-Marie Basset Comments, 27 Sept 2011”

The paper is very comprehensive addressing nearly exhaustively all aspects expected regarding SATS.
BUT to my great surprise, there is absolutely not mention about helicopters or any rotorcraft concepts.
Even in the part "4.b - Future needs and new technologies (after 2020)", there is a paragraph about "Innovative concepts and configurations", but with only the general very short mention "New configurations may be introduced".

I believe that:
Rotorcraft configurations should not be excluded "a priori",
(this a priori may come from the "airplane culture" of the authors for which rotorcraft are considered as more costly, more noisy than an airplane).
Indeed they are very well suited for the purposes of SATS !

Rotorcraft can be part of the SATS:
a) during the first phase (until 2020):
thanks to their Vertical TakeOff and Landing (VTOL) capabilities, they can (already now) provide door-to-door transportation nearly everywhere (with low investment in ground infrastructure in places where there are not yet heliport available) and exactly in the scope needed in terms of range ~400km and travel time (~4hours). By doing so they can reduce the travel time and limit the change of transport mode nearly replacing the connection {small airplane + ground transportation (taxi or bus)}. By doing so they can compensate their assumed higher DOC.

Already in this first period, the acoustic impact is reduced thanks to much progress in the rotorcraft design (e.g. see Blue edge techno) and also thanks to adapted flight path approaches reducing the noise footprint. Helicopters can land on top of buildings or other helipads where the detrimental impact is reduced and very close if not in the city centres.

b) During the second phase (after 2020):
Rotorcraft concepts must be considered for SATS,
knowing that new rotorcraft configurations and techno will be developed for :
extending their flight envelop in terms of speed, range (e.g. see Sikorsky's X2, Eurocopter's X3, etc.) and lift capability (see Joint Heavy Lift System studies already few years ago in the USA), reducing their environmental impact (energy efficiency, air pollution, noise).

SO, about the three pivotal questions at the end of the report:
1- YES, but add "on small-size aircraft (airplanes and rotorcraft) ... from standard airports-heliports and small airfield-helipads newtwork"
2- YES, but why only for business travel ? SATS will be also beneficial to private interest travel (for example allowing increased distances between working and living places) and to leisure-tourism EU developments.
3- YES if we start soon !

Appendix B.9 "Tony Henley Comments, 30 Sept 2011"

Questions not addressed:

- Fuel use per passenger mile – today - What is necessary to compete with cars
- Acceptable weather minima specifically the number of days per year when flight not possible will depend on the aircraft and the infrastructure and can be improved with technology

Page 9
o Per-seat on demand (aircraft sharing).
o Aero-taxi service.
o Seat reservation on a scheduled flight
o Transport services information system, including a tool for choice of best available transport to carry out the travel planned by customer.

There are too many options for the pricing model –

The local transport organiser is a good concept which we should expand on

Annual flight hours over 1000 hours.
o Load factor 0,75 or more.
o Allocation of airplane bases adapted to serviced network and lowering idle flights of 5%

Need more justification of why an IT system will improve these.

Page 10
Mission requirements include the following main airplane characteristics:
o number of passenger seats,
o cruise speed,
o operative range,
o takeoff and landing distance,
o typical flight profile,
o propulsion,
o avionics,
o economic and operational parameters.

Add altitude of cruise and weather minima to this list

Page 11
Specifically, it should be expected that a category should emerge to fill a gap between 19 seater commuter and 40 seater regional aircraft.
Only true if based on a scheduled service – 40 seats seem too many ,19 is a lot given the current alternative transport options

Of the list of issue on pages 11 and 12 it is likely that only

- **Flight management:**
- **Flight safety:**
- **Comfort:**

And to some extent Airplane control
Have a significant impact on the viability of the concept. What is missing is (Near) **all weather operation** - without this the concept is dead

SMALL AIRCRAFT TRANSPORTATION SYSTEM MISSION REQUIREMENTS

Altitude implies mostly class G airspace (other than for jets)
Weather is a problem at these altitudes
CS23 a Ok but I believe that for the more sophisticated aircraft CS23 part 4 applies which is very demanding in term of systems integrity.

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

Weather is a key issue especially with the small aircraft
ILS will not be available at small airfield therefore no value consider GPS (GNSS) plus WASS (EGNOS) and Local Area augmentation for precision landing guidance to the pliot

HUD with EVS /SVS could be affordable for such small a/c/ small airport operations supported by augmented GNSS

Critical additional avionics - a new Flight Control System to manage weather(gust alleviation) and pilot support including envelop protection with a simply high integrity back up mode in case of failure

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 (more likely to be successful if it could run only as Scheduled or semi scheduled service) from standard airports and small airfield network, should be accepted as a component of the European (Air) Transport System"?

Yes, but..... we should define clearly what we mean by the different approaches , on demand taxi, semi schedules , scheduled, etc., as the viability will be different for each depending on the environment. See below

2. Do you agree with the formulated goal: "The main goal of Small Aircraft Transportation System is to provide fast (and reliable and affordable) 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?

Yes .. But note that this question includes 3 different operational models which will have different business cases

- Business travel (in the economic banana- implying on demand taxi?)
- City pairs with low intensity traffic (outside the banana - implying Semi schedule?)
- Regions with under developed transport infrastructure (implying low capacity scheduled?)

Suggest delete the word 'Remote' , what is important is the transport infrastuture rather than the geography or economic capacity. Remote, low income rural areas will generate little demand

3. Do you agree that this goals might be met by 2020 using mostly currently existing aircraft, infrastructure and available ICT?.

Yes and more importantly if some service can be established in that time frame it will be very difficult to maintain the necessary future investment or the regulatory and ATM environments necessary to support the long term expansion. This is not to suggest that new aircraft, systems and infrastructure will not be required to grow the opportunity, just than if there is no viable commercial operation within 9 or 10 years the concept will die.

Appendix B.10 "Stefaan Ghijs Comments, 6 Dec 2011"

- I do think the goals are not very clear and should be made objective (SMART).
- I do NOT envision a public system of on-demand or personal air transport in the current EU steered by one IT system. What I do believe is that on-demand an personal travel should become cheaper in order to improve mobility in Europe.
  Decreasing the price majorly (goal still to be set in the document) for personal flying (and increasing safety and the easiness to fly) will set-out a boost on the demand for of on-demand personal air transport, therefore setting out a necessity for a controlled air transport environment for safe free flight (including ATM, regulations, airports, air space etc.).
- The driver for on-demand personal travel is not only the underdeveloped or lack of infrastructure and low intensity traffic, but are also congested developed infrastructure (traffic jams, congested airports) and the convenience factor.
- I do agree with the set-up for IT system improving the on-demand business from an operational point of view, but not from a commercial point of view. Gathering demand by IT systems, to increase the load factor will always eventually become a scheduled service. Additionally operators are not very keen to decrease their entrepreneurial dependency in obligated partnerships, steered by demand gathering IT systems with other operators because of quality reasons. Additionally chances that more than one customer needs to join another customer on the same moment to the same place on-demand is low. In an on-demand system customers do not want interdependency of other customers.
- Looking at an on-demand system an intermodal match should be made (ref. Lufthansa en business jet services, providing a differentiated product to high end customers).
- Main factors for operational success are all weather aircraft landing systems to land at airports without ILS facilities, single pilot operations, low aircraft DOCs with low maintenance requirements and operational optimizers minimizing empty legs. Additionally IT should help in automatic (flight)planning and reservations decreasing indirect and overhead costs.
- I agree with the comments of Bruce. Nonetheless two major differences need to be spotted:
  1. The population density in the US is totally different then the EU therefore generating different drivers for on-demand transport, the acceptance for on-demand transport is far higher in the US than the EU. The average travel time distribution for the EU needs to be made.

Appendix C – Workshop Attendance list

item	Name	Country	Organisation	E-mail	Attended	Speaker	Moderator	Panelist	WG1	WG2
					30	10	5	9	13	16
1	AMATO Marcello	IT	CIRA	m.amato@cira.it	1	1	1	1	1	
2	BARON Alfred	PL	IoA	baron@ilot.edu.pl	1					1
3	BERGHOF Ralf	DE	DLR	ralf.berghof@dlr.de	1					1
4	COZZOLINO Aniello	IT	Piaggio	acozzolino@piaggioaero.it	1	1			1	
5	de GRAAFF Adriaan	NL	AD CUENTA	adgraaff@hetnet.nl	1	1	1	1	1	
6	DUDA Jiri	CZ	Evektor	jduda@EVEKTOR.CZ	1	1			1	
7	DZIUGIEL Bartosz	PL	IoA	bartosz.dziugiel@ilot.edu.pl	1				1	
8	GHIJS Stefaan	BE	Fly Aeolus	ssaghijs@flyaeolus.com	1	1	1	1		1
9	HENLEY Tony	UK	THL	tony.henley1@btinternet.com	1		1	1		1
10	IWANIUK Andrzej	PL	IoA	andiw @ilot.edu.pla	1					1
11	JABLONSKI Aurelie	FR	ACARE	aurelie.jablonski@clora.eu	1					1
12	KERSTEN Tom	BE	Fly Aeolus	tkersten@flyaeolus.com	1					1
13	LAPLACE Isabelle	FR	M3S	laplace@m3systems.net	1	1				1
14	le TALLEC Claude	FR	ONERA	claude.letallec@onera.fr	1	1				1
15	LECOMTE Eric	EU	EC-DG R&I-Aeronautics	eric.lecomte@ec.europa.eu	1					
16	MARCISZEWSKA Elżbieta	PL	SGH	emarci@sgh.w aw .pl	1					1
17	MĄCZKA Zbigniew	PL	Polish Civil Aviation Office	zbigniew maczka@ulc.gov.pl	1			1		1
18	NAE Catalin	RO	INCAS	cnae@incas.ro	1	1			1	
19	NAGEL Bjoern	DE	DLR	bjoern.nagel@dlr.de	1				1	
20	NIKIFOROV Nikolay	RU	Independent Expert	nickolay.nikiforov@gmail.com	1				1	
21	OVCACIK Jiri	CZ	Evektor	jovcacik@evektor.cz	1				1	
22	PEREZ-ILLANA Pablo	EU	EC-DG R&I-Aeronautics	Pablo.Perez-Illana@ec.europa.eu	1			1		1
23	PIWEK Krzysztof	PL	IoA	khp@ilot.edu.pl	1	1	1	1	1	
24	ROHACS Daniel	HU	BUTE	d_rohacs@hotmail.com	1					1
25	ROHACS Jozsef	HU	BUTE	rohacs@rht.bme.hu	1			1	1	
26	RUZICKA Jaroslav	CZ	Evektor	jruzicka@evektor.cz	1			1	1	
27	SCHOLLAART Vincent	NL	TUD	V.P.Schollaart@student.tudelft.nl	1	1				1
28	van SCHAIK Frans J.	NL	NLR	schaik@nlr.nl	1					1
29	WOŁEJSZA Zbigniew	PL	IoA	zwol@ilot.edu.pl	1				1	
30	ŻÓŁTAK Jerzy	PL	IoA	geor@ilot.edu.pl	1					1

Appendix D – Synthesis of Workshop Parallel Sessions

The synthesis from the two working groups is reported in this Appendix:

- **Working Group-1 - Product Technologies**
- **Working Group-2 - Operation Technologies**

See to Appendix D "Recollection of WG-1 and WG-2 Discussion"

Appendix E – Workshop Material

1. Welcome and Short introduction to the SAT-Roadmap Project - K. Piwek (IoA)
2. SAT Vision and Roadmap - A new transport mode in Future ATS - A. de Graaff (AD Cuenta), M. Amato (CIRA)
3. Demand of SAT Mode - I. Laplace (M3 Systems)
4. Business Case with operational Characteristics - R. Curran (TUD)
5. Future aircraft concepts (Business, GA and Small Transport Aircraft) - A. Cozzolino (Piaggio Aero)
6. Enabling Conditions for Operations : booking system, airports - S. Ghijs (Fly Aeolus)
7. Enabling Conditions for Operations: pilot availability, SES, level of automations - C. Le Tallec (ONERA).
8. Regulatory Difficulties and Emerging Needs for Regulations - J. Duda (Evector)
9. Workshops Approach and Working Group Creation - M. Amato (CIRA), A. de Graaff (AD Cuenta)
10. Product Technologies and Enabling Conditions, Product Technologies HLO vs Challenge - WG-1 Leader A. de Graaff (AD Cuenta)
11. Operation Technologies - Enabling Conditions, Operation Technologies HLO vs Challenges - WG-2 Leader T. Henley (Consulting)
12. Next Steps - A. de Graaff (AD Cuenta)

See to Appendix E Part1 and Part2

Common Vision Workshop
on
Small Aircraft Transport (SAT) System

Brussels, September 28, 2011

Recollection of WG-1 and WG-2 Discussion

M. Amato (CIRA) - WP Leader

A. de Graaff (AD Cuenta)

T. Henley (Consulting)

S. Ghijs (Fly Aeolus)

SAT Common Vision

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

Small Aircraft Transport 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”)
- **the needs of European business travel**

SAT Common Vision

Challenges

COST	Quality & Competitiveness	Environment & Energy Supply	ATS Efficiency	Safety	Security

- To provide a new affordable, accessible, energy efficient and environmentally friendly component of Air Transport System (ATS).
- To offer a lager choice for transportation through the increasing use of small aircraft serving small airports
- To facilitate the access to transport for a large number of communities in a cost effective way. To satisfy the needs of transportation in regions where transport networks (especially surface transport) are underdeveloped.
- To create additional mobility (door-to-door/point-to-point) for the European citizens.
- To stimulate a co-modal approach for the European transport system.
- To improve the energy efficiency of transport according to the European Energy Strategy for Transport.

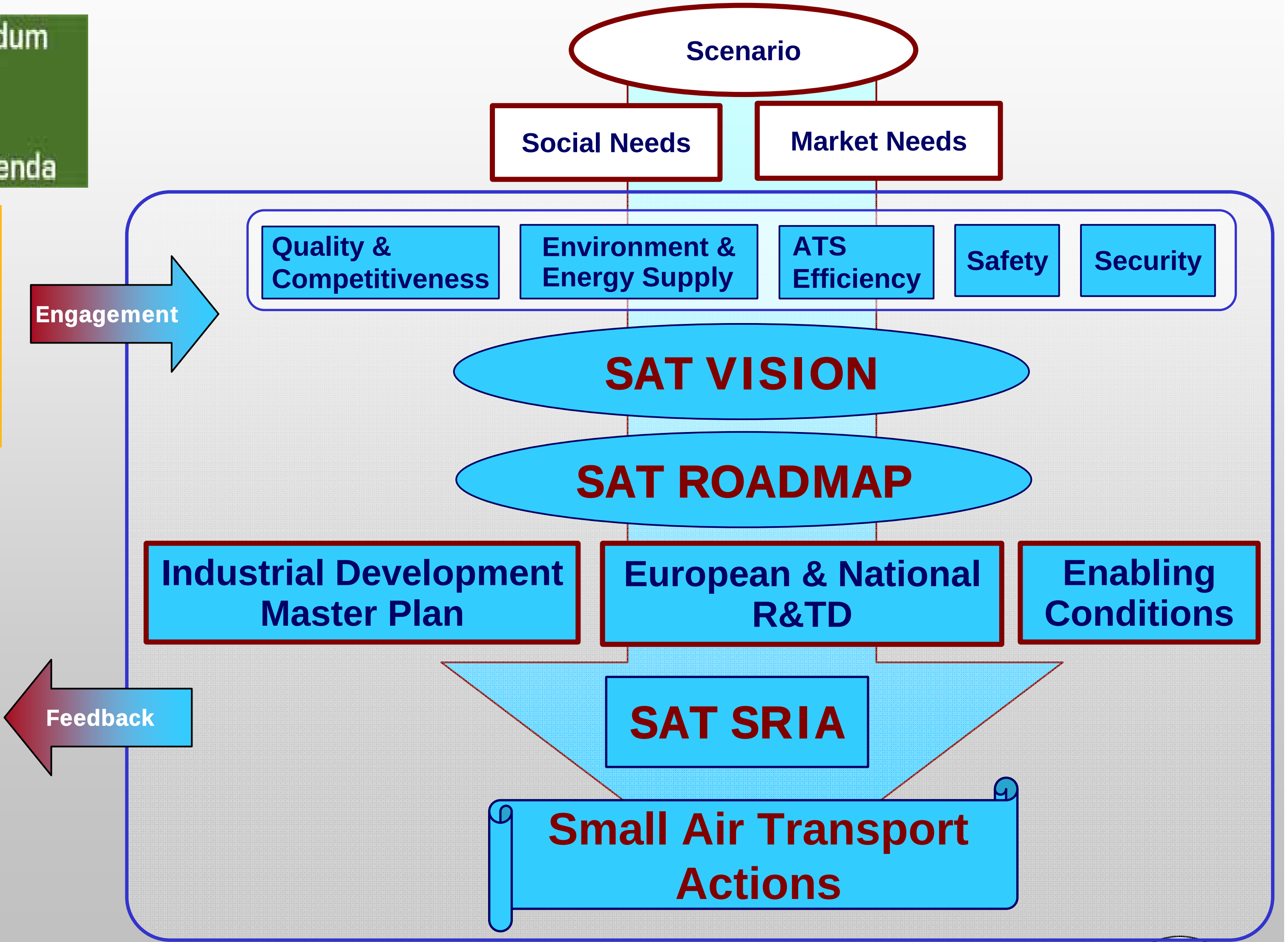
SAT Common Vision

Turning SAT mode into practice

2008 Addendum to the Strategic Research Agenda

Flightpath 2050 Europe's Vision for Aviation

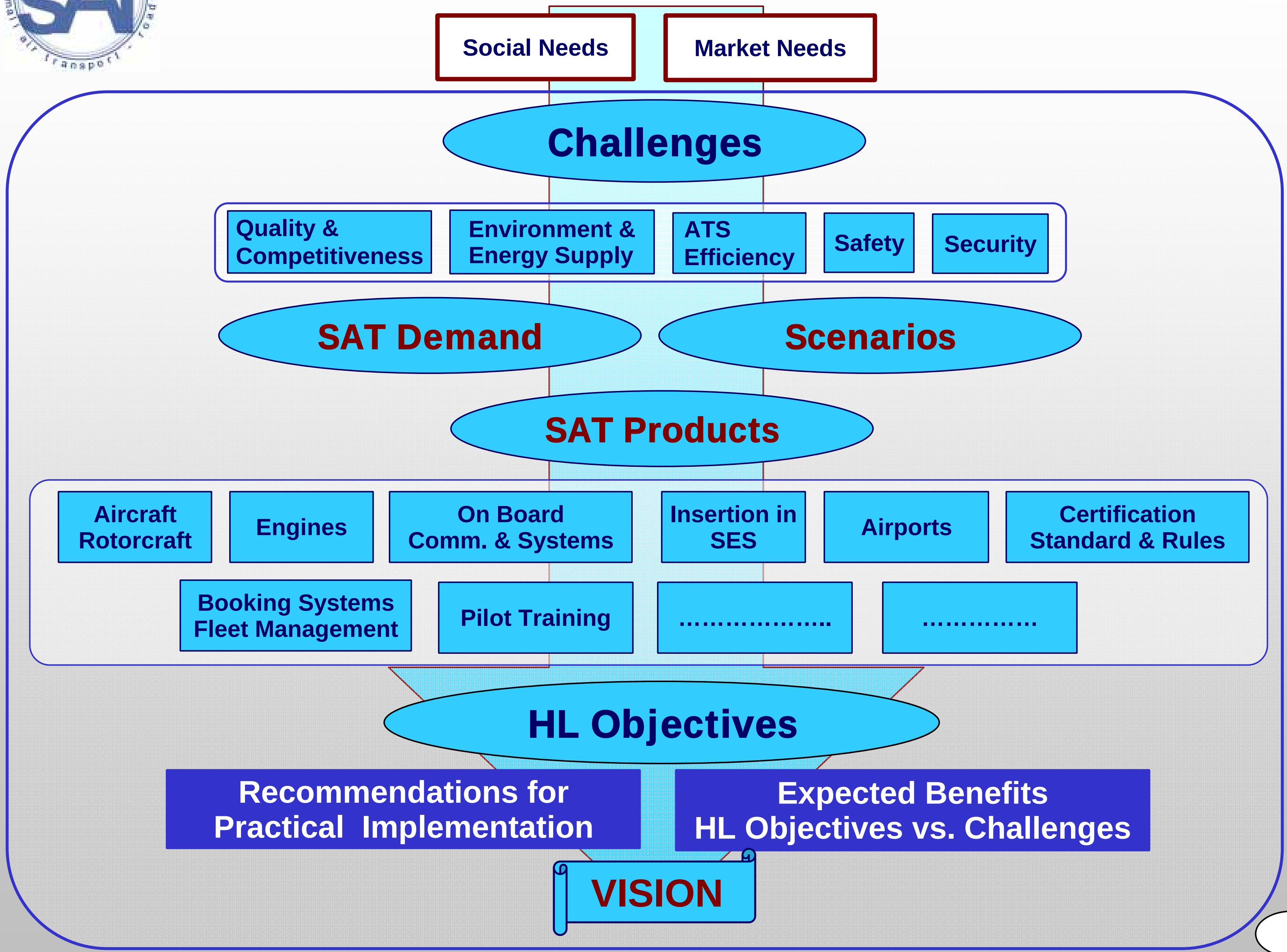
Report of the High Level Group on Aviation Research

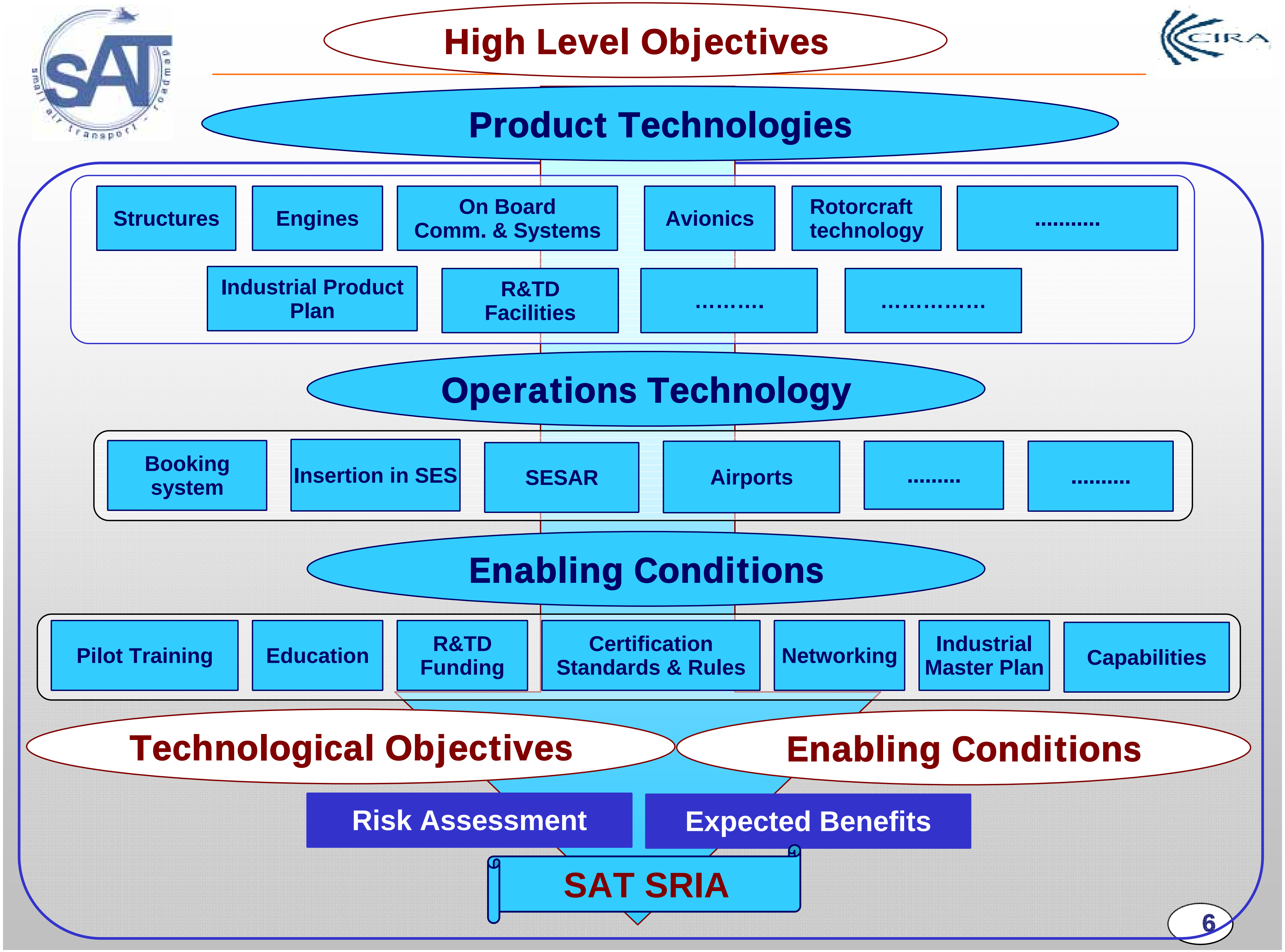


EUROPEAN COMMISSION

ACARE

SAT Common Vision




High Level Objectives
Product Technologies
Structures
Engines
On Board Comm. & Systems
Avionics
Rotorcraft technology
....
Industrial Product Plan
R&TD Facilities
……….
……………
Operations Technology
Booking system
Insertion in SES
SESAR
Airports
………
……….
Enabling Conditions
Pilot Training
Education
R&TD Funding
Certification Standards & Rules
Networking
Industrial Master Plan
Capabilities
Technological Objectives
Enabling Conditions
Risk Assessment
Expected Benefits
SAT SRIA

SAT Common Vision

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.**

Workshop Approach

- A Discussion Paper was distributed
- Key elements of a vision for a SAT System are presented to set-up the scenario
- Two Parallel Session take place to openly collect views and opinions on key elements of the SAT Vision
- Presentation of preliminary Collection of results from Parallel Sessions
- Panel Discussion on three Pivotal Questions
- SAT-Roadmap next steps are discussed

Activities for SAT Vision to be discussed in the Parallel Sessions

- **Main characteristics of future Small Aircraft Transport System**
- **SAT sectors and products where Europe wants to excel**
  - characteristics of new environmentally friendly and efficient aircraft and systems
- **When products are needed in the market ?**
- **High Level Objectives for SAT Products**

	Parallel Sessions with two Working Groups	
	Parallel Sessions WG – 1	
13:30	❖ Target Products & Technologies o Piston engine A/C - 9 seats or fewer – MTOW up to 5670 kg, o Turboprop A/C - 19 seats or less - MTOW 8618 kg o Jet A/C - 11 seats or less – MTOW up to 7600 kg ❖ HLO for Product Technologies ❖ Enabling Conditions for Product Technologies o R&TD infrastructures o Certification, Standards and Rules o Industrial Master Plan o Funding ❖ Product Technologies HLO vs Challenges	WG – 1 lead by A. de Graaff (AD Cuenta) M. Amato (CIRA)
15:30	Coffee Break (15:30 - 15:45)	

	Parallel Sessions WG – 2	
13:30	❖ Target Operation, System Concepts and Technologies o Booking system o Fleet Management o ATM and SES o Airports o Automation level for SAT and operation modes ❖ HLO for Operation Technologies ❖ Enabling Conditions for Operations Technologies o Pilot Training o Insertion in SES o Certification, Standards and Rules o R&TD funding ❖ Operation Technologies HLO vs Challenges	WG – 2 lead by T. Henley (Consulting) S. Ghijs (Fly Aeolus)
15:30	Coffee Break (15:30 - 15:45)	

WG1 **WG2**

	Preliminary Results Collection	
15:45	Product Technologies and Enabling Conditions Product Technologies HLO vs Challenges	WG-1 Leader A. de Graaff (AD Cuenta)
16:00	Operation Technologies - Enabling Conditions Operation Technologies HLO vs Challenges	WG-2 Leader T. Henley (Consulting)

Common Vision Workshop
on
Small Aircraft Transport (SAT) System

Brussels, September 28, 2011

Working Group 1

Target Products and Technologies

Target Products and Technologies

To be tackled in the Common Vision

- SATS Vision
- Target Products & Technologies
  - Piston engine A/C - 9 seats or fewer – MTOW up to 5670 kg,
  - Turboprop A/C - 19 seats or less - MTOW 8618 kg
  - Jet A/C - 11 seats or less – MTOW up to 7600 kg
  - …….
- Challenges and HLO for Product Technologies
- Enabling Conditions for Product Technologies
  - R&TD infrastructures
  - Certification, Standards and Rules
  - Industrial Master Plan
  - Funding
- Product Technologies HLO vs Challenges

Recollection WG-1 discussions

SATS Vision

- The importance of SATS as a new air transport mode was generally accepted.
- Better marketing for SATS needed
- SATS is seen as a niche market

Challenges and HLO

COST	Quality & Competitiveness	Environment & Energy Supply	ATS Efficiency	Safety	Security

COST IS FELT AS VERY RELEVANT

Target Products and Technologies

Target Products & Technologies

- ❖ Piston engine A/C - 9 seats or fewer – MTOW up to 5670 kg
- ❖ Turboprop A/C - 19 seats or less - MTOW 8618 kg
- ❖ Jet A/C - 11 seats or less – MTOW up to 7600 kg
- ❖ Light Helicopters
- ❖ Alternative Propulsion

❖**Simple Fixed wing aircraft and rotorcraft should service the SATS market. Also include autogyro and amphibious planes**

❖**Little support for VLJ or jet powered aircraft (too expensive)**

❖**Targets should be set for each requirement and trade off studies should be performed**

❖**Cost is the most important requirement and should be added to the overall requirements.**

Challenges and HLO

COST

- Tariffs are the result of the sum of DOC and IOC divided by productivity (*speed x capacity x utilization*)
- DOC should be lowered by at least 20% compared to the current generation
- Capacity may grow to 9/10 pax for the lower very short-haul short-haul segment
- Speed minimum 400-500Km per hour
- Utilization should be 2000 hours per year (*600 flights per year or 10 flights per day*)
- See Cape Air for Operating Model

Challenges and HLO

COST

- Several cost issues need attention : production cost, maintenance, crew cost, off the shelf equipment and systems
- Design for maintenance must become a good practice
- Weight should be low (250Kg per seat)
- But most important is the development of new piston/ electric engines as the sector is using engines designed 50 years ago (diesel engines are not the solution)
- New configurations should be investigated for aircraft after 2020 (VTOL/Tilt rotor)
- Training cost should be low

Challenges and HLO

QUALITY

- **SATS will not need to operate 24h per day / 7 day a week in all weather conditions: find balance between cost and predictability of flights**
- **Good dispatch reliability is essential (*simple aircraft like Do 227/ Islander*)**
- **Cabin noise needs more attention (*connected to location of the engines and trade off with external noise*)**

Challenges and HLO

GREEN

- **External noise is seen as the most important factor**
- **External noise should be reduced compared to current aircraft *(better propeller design)***
- **Visibility of small aircraft may also be an issue (*make the aircraft invisible by blending it in the environment*)**
- **Electric propulsion should be addressed**
- **Flight profiles need to be changed (*steep approach, take off*)**

Challenges and HLO

TIME EFFICIENCY

- **New ATM concept is needed.**
- **SESAR should recognize the importance of SATS**
- **Restructuring European airspace urgently needed**
- **New GNSS based equipment needed both in the cockpit and at airports (*no additional infrastructure cost*)**
- **SESAR equipment requirements for small aircraft are too costly**

Challenges and HLO

SAFETY

- **New cockpit design for low workload. SATS technologies will be more advanced than for large airliners**
- **Single pilot operations / Ultimately pilotless**
- **Make GA aircraft safer and achieve a good safety record (*also important for the image*)**
- **Regulations need to be changed (*cheaper/faster*), for certification, operations/ pilot license, etc**
- **Insurance cost should be lower**

Challenges and HLO

SECURITY

- Not discussed
- Security is anyhow recognised to be a relevant element t be included in the SAT Common Vision and SAT ROADMAP

Target Products and Technologies

High Level Objectives

Challenges / Products		Challenges					
		Cost	*Quality*	*Environment & Energy Supply*	*AT[illegible] Ef[illegible]*	*[illegible]ety*	*Security*
SAT PRODUCTS	Piston engine A/C - 9 seats <9 MTOW < 5670 kg						
	Turboprop A/C Seats < 19 MTOW < 8618 kg						
	Light Helicopt[illegible]						
	Alternative Propulsion						

TO BE FILLED

Technological Objectives
Piston engine A/C – seats < 9 – MTOW < 5670 kg

Tech. Objectives / HLO		Technical Objectives: Low Noise Low Emission Configuration	Out of autoclave production	Low energy low weight Ice Protection	[illegible]	Crash-worthiness
HLO						
	All Weather Operations			❖		

TO BE FILLED

Enabling Conditions for Product Technologies

- **R&TD infrastructures**
  - …………
- **Certification, Standards and Rules**
  - …………
- **Industrial Master Plan**
  - …………
- **Funding**
  - …………

TO BE FILLED

Challenges and HLO

CONCLUSIONS

- The importance of SATS as a new air transport mode was generally accepted.
- Better marketing for SATS needed
- Step change in aircraft technology needed
- Engine technology is critical
- To be developed ATM concept and airspace classification suitable for SATS
- Novel concepts for SATS aimed at longer term

Common Vision Workshop on Small Aircraft Transport (SAT) System

Brussels, September 28, 2011

Working Group 2

Target Operations, System Concepts and Technologies

To be tackled in the Common Vision

- **Target Operation, System Concepts and Technologies**
  - **Booking system**
  - **Fleet Management**
  - **ATM and SES**
  - **Airports**
  - **Automation level for SAT and operation modes**
- **HLO for Operation Technologies**
- **Enabling Conditions for Operations Technologies**
  - **Pilot Training**
  - **Insertion in SES**
  - **Certification, Standards and Rules**
  - **R&TD funding**
- **Operation Technologies HLO vs Challenges**

Recollection WG-2 discussions

Challenges and HLO

COST	Quality & Competitiveness	Environment & Energy Supply	ATS Efficiency	Safety	Security

Challenges and HLO

in bold "HLO" / "ENABLERS" in red

COST

- **Differential Fuel costs on international and small airports**
- **Insurance**
  - Agreement FOP minimize liabilities up to say 100.000
- **High SESAR costs**
- **ATC and navigational costs**

Challenges and HLO

in bold "HLO" / "ENABLERS" in red

COST

- **Management of resources (example fleet and pilots vs. rural areas)**
  - Decrease empty legs
  - Information (traffic) and communication availability in order to share seats or empty legs
  - Enlarge flight hours to 2000 flight hours/year and increase load factor
- **On-demand, air taxi, sharing, FOP models have different challenges**

Challenges and HLO

in bold “HLO” / “ENABLERS” in red

QUALITY AND COMPETITVENESS

- **Requirement to use international airports for international on-demand travel**
- **The passenger does not know the real characteristics of the product**
- **The SAT concept is not known and marketing is expensive**
- **Social acceptance (+: employment, regional economy -: NIMBY, product, noise & emission)**
  - Persuade local authorities
  - Everybody must be a customer
  - Make solid and reliable numbers
  - Defend that the effects are better then alternatives
  - Work together with neighbouring associations and habitants

Challenges and HLO

in bold "HLO" / "ENABLERS" in red

QUALITY AND COMPETITVENESS

- **Fear of flying**
  - Improve comfort
- **Improving technology as substitute for personal travel**

Challenges and HLO

in bold "HLO" / "ENABLERS" in red

GREEN

- **xx**
- **Flight profiles need to be changed (steep approach, take off)**

Challenges and HLO

in bold "HLO" / "ENABLERS" in red

TIME EFFICIENCY

- **Air Traffic Services SESAR integration**
  - Engage towards the whole industry
- **Integration with large and small airports (non ILS at airports vs. Aircraft fitted with the necessary systems)**
  - Resolve FL issues in TMA (commercial vs. personal air traffic)
- **Maintain uncontrolled air space?**
  - Aircraft dependant
  - Traffic situation awareness and collision avoidance

Challenges and HLO

in bold "HLO" / "ENABLERS" in red

SAFETY

- **Simplify Regulations: non-mature enough, structure of the EU, change of regulations is difficult**
  - Look at the regulatory environment (value vs. safety)
  - Question mark safety vs. Models (public/commercial)
  - Adapt instead of changing

- **Provision of effective/efficient pilot training - Pilot inexperience**
  - Reliable, certifiable on-board pilot support systems
  - Develop approach for mass small personalized aircraft operations services

Challenges and HLO

in bold "HLO" / "ENABLERS" in red

SAFETY

- **Safety management system (reporting improves safety)**
  - Organization
  - Participation of stake holders

- **Small aircrafts are sensitive to adverse weather**
  - Develop additional support to keep the aircraft operating in adverse weather
  - Directly feeds into comfort and easy flying
  - Poor visibility of landing systems in adverse weather
  - Achieving high integrity of landing systems and using new infrastructure (Satelite Nav+, etc.)

Challenges and HLO

in bold "HLO" / "ENABLERS" in red

SECURITY

- **NO SHOWSTOPPER Secure fleet from terrorist attacks**

High Level Objectives

Challenges / Products		Cost	Quality	Environment & Energy Supply	AT[illegible] Ef[illegible]	[illegible]ty	Security
SAT PRODUCTS	Booking System						
	Fleet Management						
	ATM & SES						
	Fuel Cost						

TO BE FILLED

Technological Objectives
Booking System

Tech. Objectives / HLO		Technical Objectives				
		AA	BB	CC		EE
HLO	A	❖			❖	
	B	❖	❖	❖	❖	❖
	C			❖		

TO BE FILLED

Critical Enablers
Technological and institutional

- **General enablers**
  - **Flexible fleet and pilots**
  - **Cooperation between airports and small aircraft providers, etc.**

Enabling Conditions for Product Technologies

- **Pilot Training**
  - …………
- **Insertion in SES**
  - …………
- **Certification, Standards and R…**
  - …………
- **R&TD fundi…**
  - ……

TO BE FILLED

Some definitions that we should think about

- On-demand vs. air-taxi
- Scheduled vs. Un-scheduled
- Share aircraft vs. Fractional aircraft
- Remote region (not accessible within 4 hours ?)
- What is noise ?
- Make the goals SMART

Challenges and HLO

CONCLUSIONS

- The importance of SATS as a new air transport mode was generally accepted.
- Better marketing for SATS needed
- Cost, Quality & Competitiveness Challenges are determining factors
- Safety and Predictability of Operations are very important element
- SATS insertion in SESAR has to be tackled

Welcome and Short Introduction to the SAT-Roadmap Project

Brussells, 28 Sept 2011

Krzysztof PIWEK, Institute of Aviation

Main goal of the Workshop

Discuss with representatives of the SAT Community, EC, Regulators, Operators in order to build up a "Common" shared view of the future.

COMMON VISION
ON THE DEVELOPMENT OF A
SMALL AIRCRAFT TRANSPORTATION SYSTEM

Workshop Approach

- A Discussion Paper was distributed
- Key elements of a vision for a SAT System will be presented in the morning to set-up the scenario
- Two Parallel Session will take place in the afternoon to openly collect views and opinions on key elements of the SAT Vision
- Preliminary Collection of results from Parallel Sessions
- Panel Discussion on three Pivotal Questions
- SAT-Roadmap next steps

What is the Small Aircraft Transport System?

It is a segment of high-speed transport market that serves local and regional connections

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

Small Aircraft Transport 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 out of the central European "economic banana" with less developed infrastructures.**
- **the needs of European business travel;**

What is the Small Aircraft Transport System?

Aircraft

- small 4 to 19 seats, that are low DOC, green, safe, and secure

Infrastructure

- On the ground and in the air - Regional Airports + ATM/ATC services integrated in SESAR

Net – Centric Management & Acquisition

- ICT based logistic and management system for SATS, integrated within the SESAR's System Wide Information Management (SWIM)





Three Pivotal Questions

1 “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 “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?

Short Introduction to the SAT-Roadmap Project

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

SAT
small air transport - roadmap

EPATS – STUDY Reports:

- D1.1 Report on European Business& Personal Aviation Data Base
- D2.1 Potential transfer of passenger demand to personal aviation by 2020
- D3.1 EPATS ATM General requirements & related issues to be solved
- D3.2 EPATS airports General requirements, safety and environmental aspects
- D4.1 EPATS aircraft missions specification
- D4.2 Operating Costs Analysis Report
- D4.3 Fuel consumption and transportation energy effectiveness Analysis Report
- D5.1 EPATS Research and Development Program
- D5.2 EPATS Roadmap

http://epats.eu

Some studies suggest that the number of cars in the world will increase from around

700 milion today

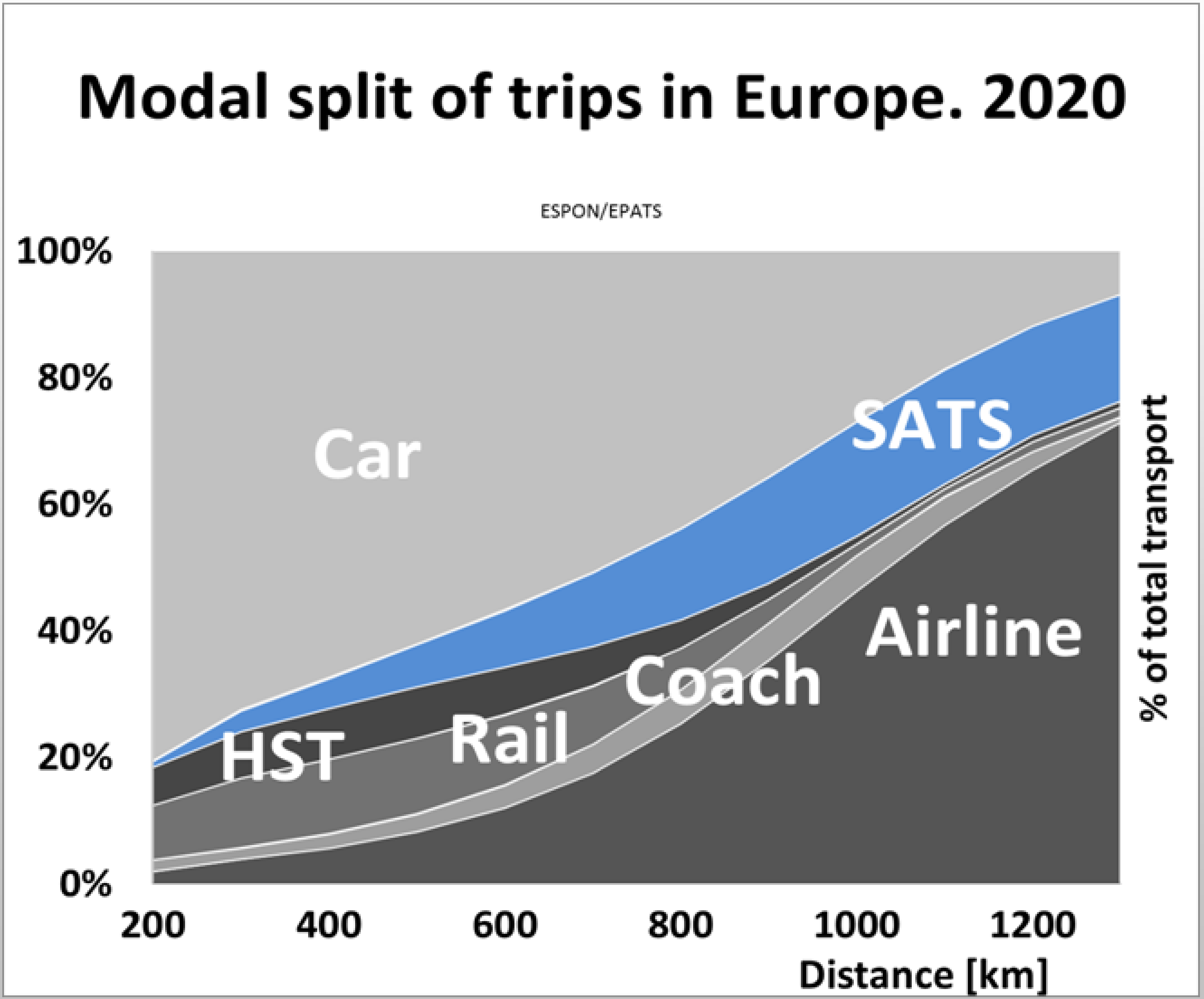
to more than

3 bilion in 2050…

Communication from the EC 17 June 2009

This calls for a modal shift!

Main Idea



Shift part of
long distance
business trips
from cars
to
small aircrafts

SAT – Roadmap (CSA)

- **Definition of a common vision** of the small aircraft transport system for inter-regional mobility through the identification of the corresponding requirements. The requirements will identify the technology needs and regulatory issues to be addressed.
- **Definition of a business** case compliant with the identified requirements which describes the relations among all the system's components.
- **Assessment of current capabilities** versus the ATS demand, collection of previous results and involvement of the stakeholders in Europe among all actors (manufacturers, research establishment, EASA, airspace users, infrastructure providers, airport managers, small aircraft service providers).
- **Definition of a roadmap to fill the technology/regulatory/operative gaps** in order to fulfil the requirements considering the current capabilities. Identification of dissemination actions and establishment of a network of stakeholders.
- **Assessment of risks and benefits** of the identified new system's concept

Common Vision & Roadmap

What	What (topics)	To	When
COMMON VISION Workshop, Joint meeting with GA Projects	1. European Mobility, Demand, and Business Models 2. System Requirements 3. Common Vision on Small Air Transport	RTD Community, Airlines, Airtaxi Community EC, ACARE	**Sept 2011**
ROADMAP Workshop	1. The Capabilities 2. Master Plan for development of Small Air Transport Aircraft 3. The Roadmap of RTD 4. Recommendations on content and timing of EU Framework calls	Manufacturers Community EC, EGAMA, IMG	April 2012
SAT-RDMP Conference	1. Synthesis of Small Air Transport Roadmap	General Aviation Community, Public	ILA Airshow 2012

European Aviation Research

- Vision for 2020 - by GoP 2001
- SRAs – by ACARE
- An Agenda for Sustainable Futurein General and Business Aviation (EuroParliament Resolution 2009)
- National and FP projects connected to SATS
- Flightpath 2050 – by High Level Group 2011

Conclusions

- **Small Aircraft Transport System** should be seen **as a component of European Transport System** (Flexible & point-to-point, Integrated in the intermodal European Transport System, reaching also peripheral regions)
- SATS could be useful as a **research platform** for testing intermodality within ETS
- In order to develop a SATS within ETS is important to
  - **build-up a Common Vision**
  - **build-up a Technology Roadmap**
  - **Create critical mass to implement the Vision and the Technology Roadmap**

Agenda

08:30	Registration	
09:00	Welcome and Short introduction to the SAT-Roadmap Project	K. Piwek (IoA)
	Small Aircraft Transport Mode versus the 2020 and 2050 ATS	
09:20	SAT Vision and Roadmap - A new transport mode in Future ATS	M. Amato (CIRA) A. de Graaff (AD Cuenta)
10:00	Demand of SAT Mode	I. Laplace (M3 Systems)
10:30	Business Case with operational Characteristics	R. Curran (TUD)
11:00	Coffee Break (11:00 – 11:10)	
11:10	Future aircraft concepts (Business, GA and Small Transport Aircraft)	A. Cozzolino (Piaggio Aero)
	Enabling Conditions	
11:30	Enabling Conditions for Operations : booking system, airports	S. Ghijs (Fly Aeolus)
11:50	Enabling Conditions for Operations: pilot availability, SES, level of automations	C. Le Tallec (ONERA)
12:10	Regulatory Difficulties and Emerging Needs for Regulations	J. Duda (Evector)

Agenda

12:30	Lunch (12:30 – 13:15)	
	Parallel Sessions with two Working Groups	
13:15	Workshops Approach and Working Group Creation	M. Amato (CIRA) A. de Graaff (AD Cuenta)
	Parallel Sessions WG – 1	
13:30	❖ Target Products & Technologies o Piston engine A/C - 9 seats or fewer – MTOW up to 5670 kg, o Turboprop A/C - 19 seats or less - MTOW 8618 kg o Jet A/C - 11 seats or less – MTOW up to 7600 kg ❖ HLO for Product Technologies ❖ Enabling Conditions for Product Technologies o R&TD infrastructures o Certification, Standards and Rules o Industrial Master Plan o Funding ❖ Product Technologies HLO vs Challenges	WG – 1 led by A. de Graaff (AD Cuenta) M. Amato (CIRA)
15:30	Coffee Break (15:30 - 15:45)	

Agenda

	Parallel Sessions WG – 2	
13:30	❖ **Target Operation, System Concepts and Technologies** o Booking system o Fleet Management o ATM and SES o Airports o Automation level for SAT and operation modes ❖ **HLO for Operation Technologies** ❖ **Enabling Conditions for Operations Technologies** o Pilot Training o Insertion in SES o Certification, Standards and Rules o R&TD funding ❖ **Operation Technologies HLO vs Challenges**	WG – 2 led by T. Henley (THL) S. Ghijs (Fly Aeolus)
15:30	Coffee Break (15:30 - 15:45)	

Agenda

	Preliminary Results Collection		
15:45	Product Technologies and Enabling Conditions Product Technologies HLO vs Challenges		WG-1 Leader A. de Graaff (AD Cuenta)
16:00	Operation Technologies - Enabling Conditions Operation Technologies HLO vs Challenges		WG-2 Leader T. Henley (THL)
	Panel Discussion on Small Aircraft Transport (SAT) mode		
16:15	EC ACARE SESAR Community	Operators National authority EGAMA	Moderated by K. Piwek (IoA)
	Next Steps towards SAT Common Vision and SAT Roadmap		
16:45	Next Steps		A. de Graaff (AD Cuenta)
17:00	End of the WORKSHOP		

Thank You for attention.

I wish you fruitful day!

Krzysztof PIWEK
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02 - 256 Warsaw, Poland
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Common Vision Workshop

SAT Vision and Roadmap
A new transport mode in future ATS

Brussels, September 28, 2011
9.20-10.00 hours

Marcello Amato
CIRA Scpa

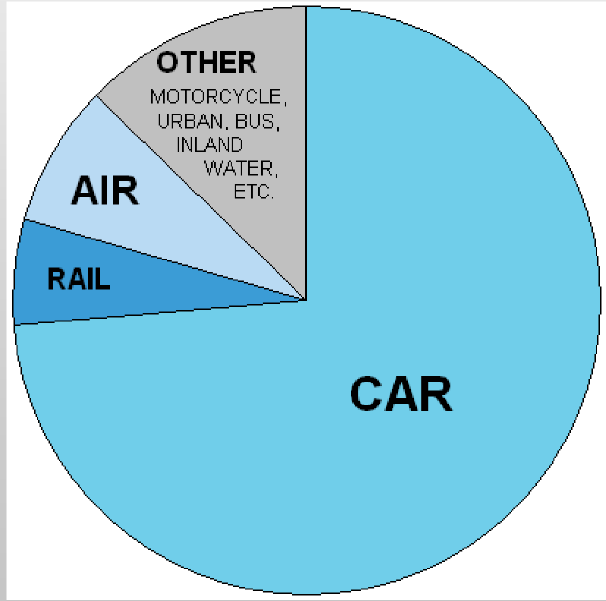
Ad de Graaff
AD Cuenta

Mobility in EU 27
Volume of passenger-kilometers: 2009 and growth in last 10 years

- ***Road transport (4,78 trillions pkm; dynamics: +11% pa)***

- ***Train transport (0,40 trillions pkm; dynamics: +10% pa)***

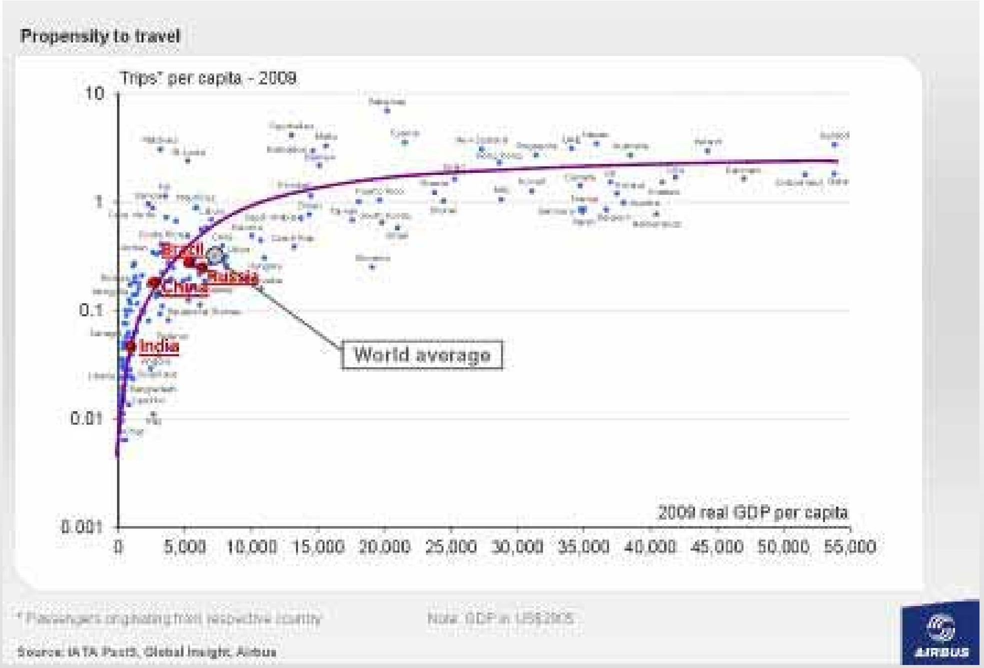
- ***Air transport (0,52 trillions pkm; share: dynamics: +14% pa)***

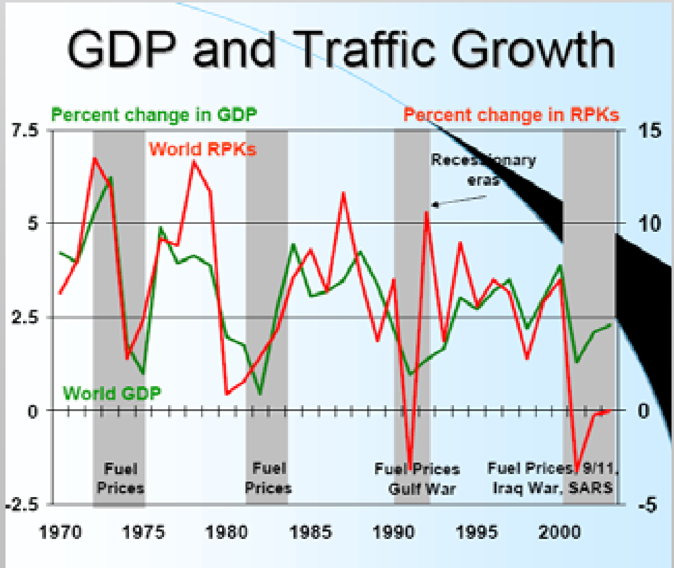


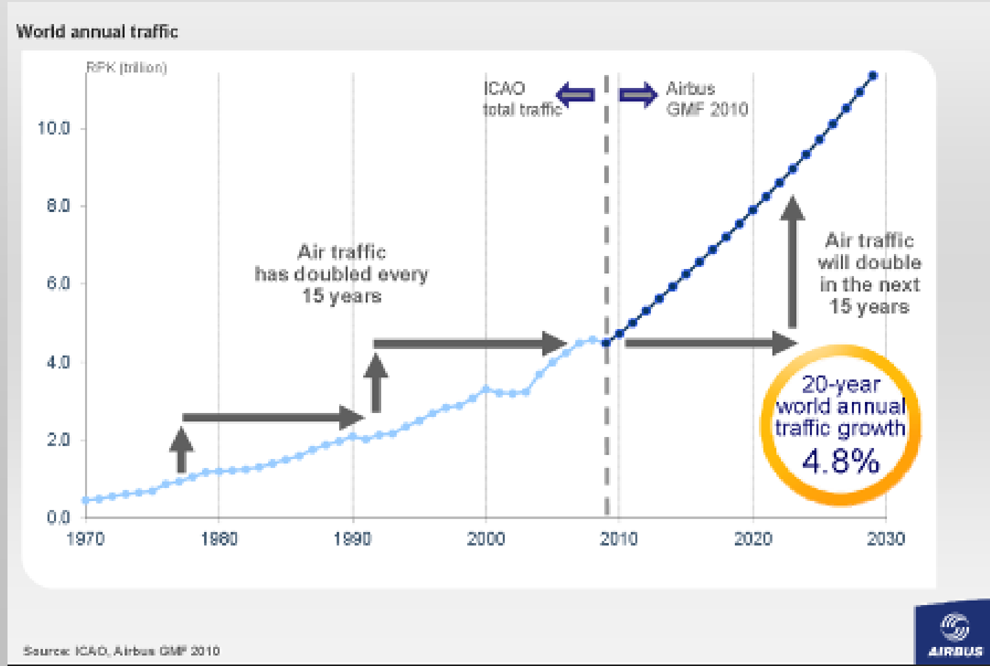
2009 data

Worldwide Air Transport grows

- The demand for air transport is related to the growth of **GDP**(jobs and leisure), **air fares** and **frequency**.
- There is a positive relationship between **GDP** and air travel demand.







Air transport pricing

- **Air fares** have been dropping by 60% over the last 40 years despite increasing fuel cost: thanks to high load factors, high productivity and new business models.

Note: today load factor in Europe is 78%

Air transport productivity

Increase of productivity: Example speed x capacity (seatmiles/hour) leads to lower seatmile cost

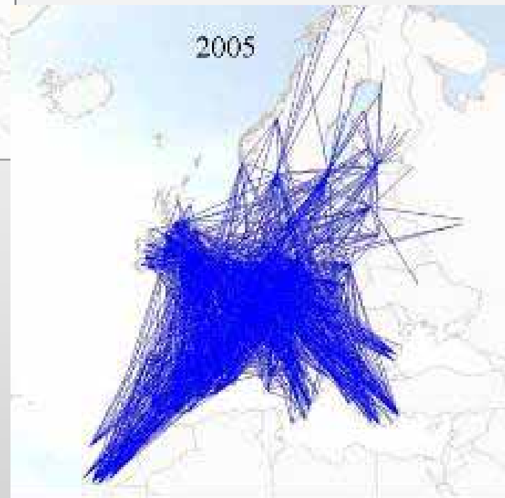
DC-7: 20.000

B-707/320: 125.000

A-380: 390.000

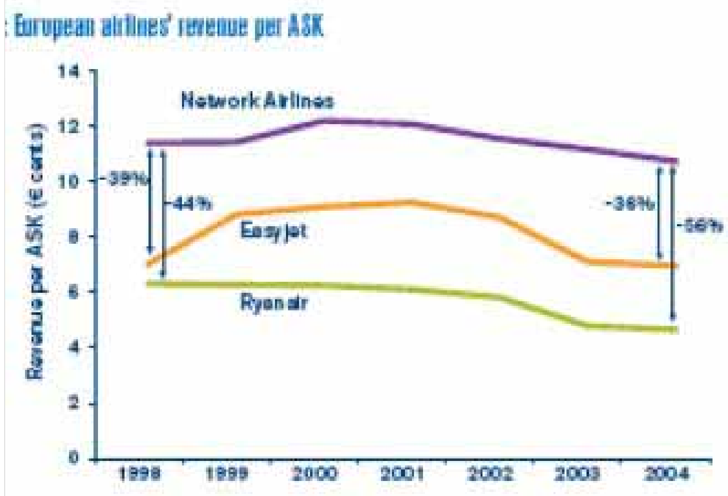
New business models: new demand

- New **business models** were developed like Low Cost Carriers that serve thick routes in Europe.



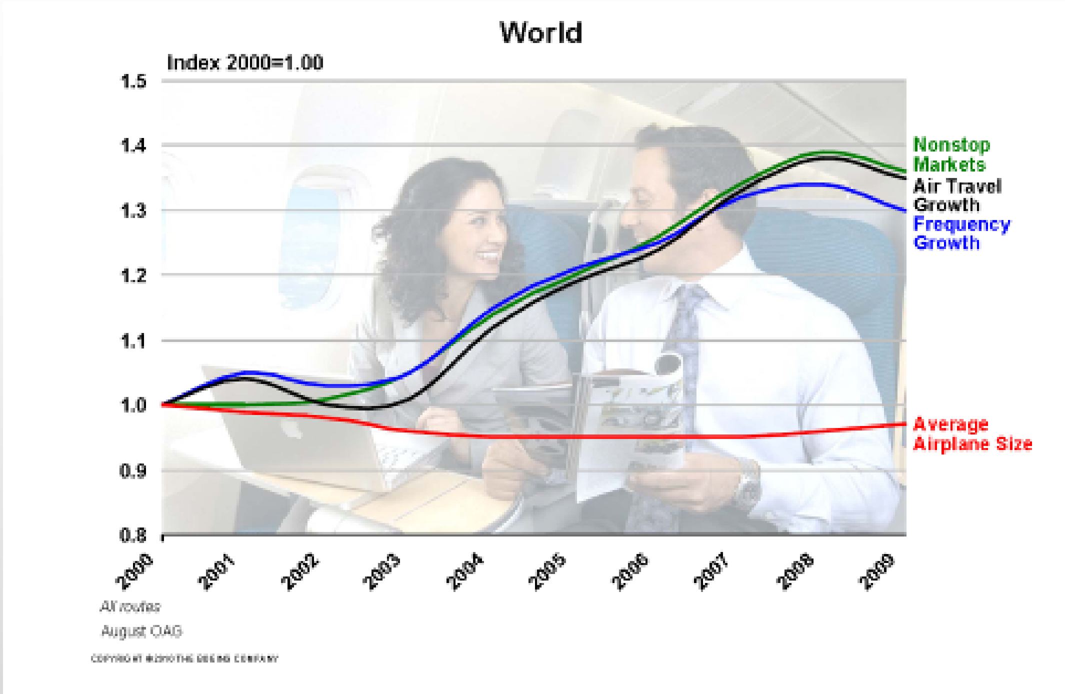
New entrants used:

- New distribution outlets (internet)
- Higher asset utilisation (fleet, staff)
- Lower costs- airports, aircraft, distribution
- Ancillary revenues (add ons, specific charges, partnerships)
- Stimulate new traffic from lower fares
- **Simplicity!**

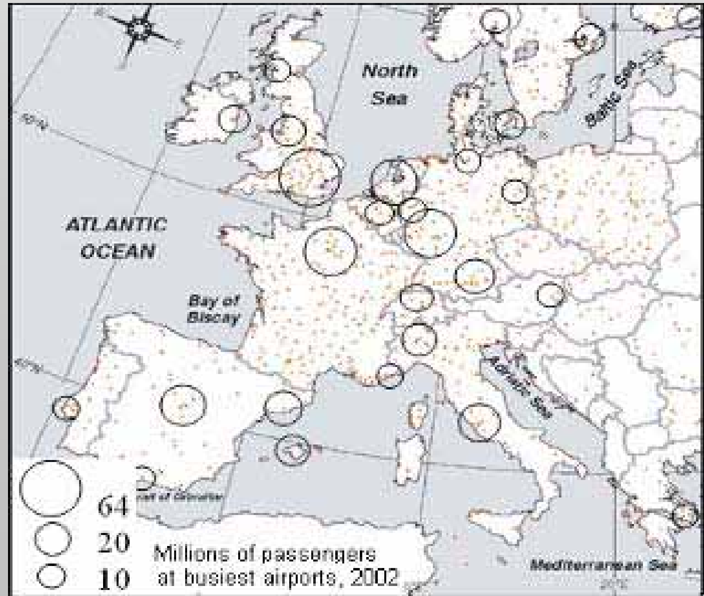


Air transport and airports

- The air transport sector translates increased demand into higher frequencies leading to more air movements and saturation of current airport capacities.



In Europe 85% of air traffic concentrated at 43 larger airports



Congested airports

- Continuous growth leads to severe runway capacity shortage and crowded terminals.

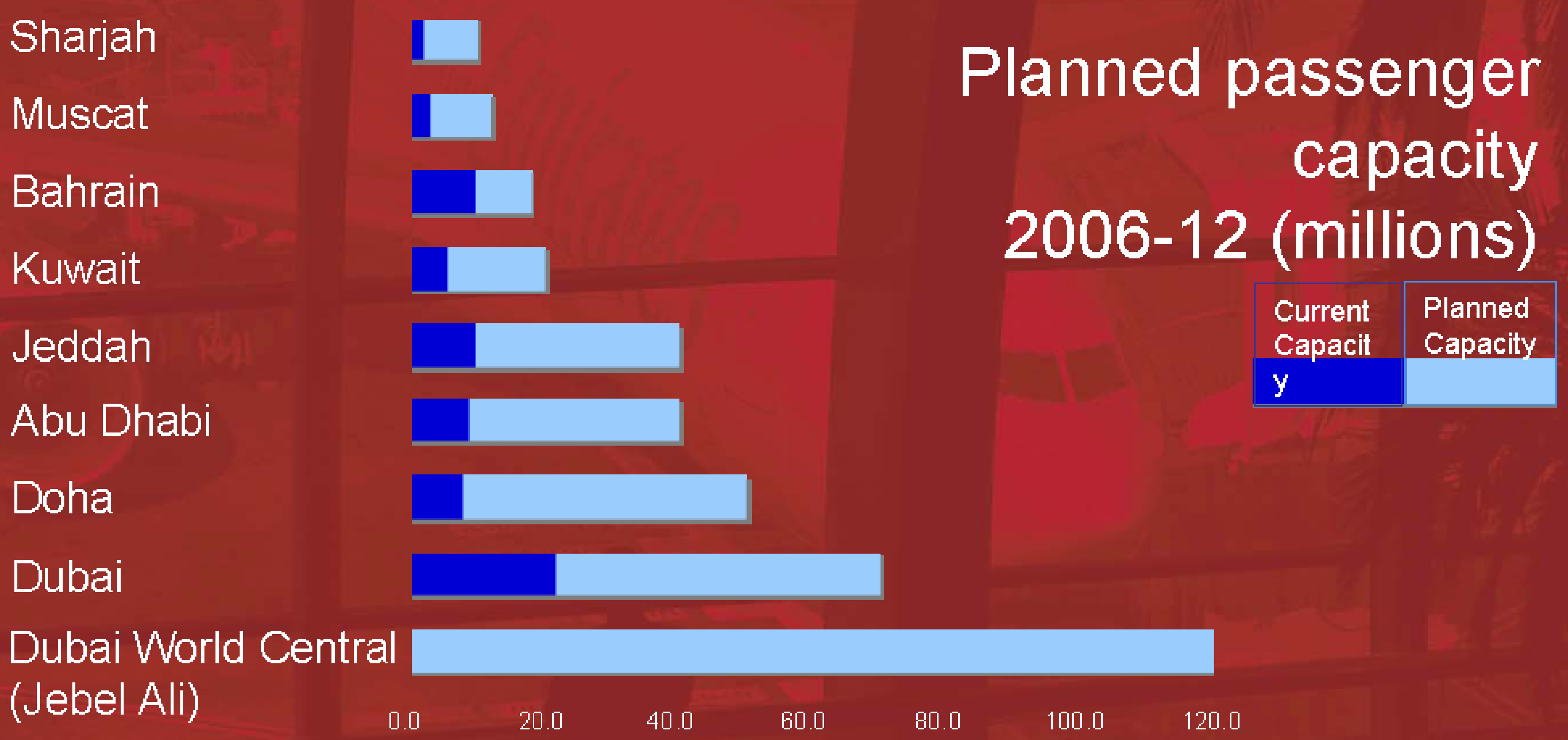
. Flights lost to airport capacity constraints

	Unaccommodated IFR Movements (million)			Unaccommodated demand (%)		
	2020	2025	2030	2020	2025	2030
A: Global Growth	0.7	2.1	5.0	4%	10%	19%

- Strict security measures are an inconvenience for the passenger (even those travelling business class).

New Hubs in the Middle East may require more longer range regional aircraft to Europe and mini HUBs

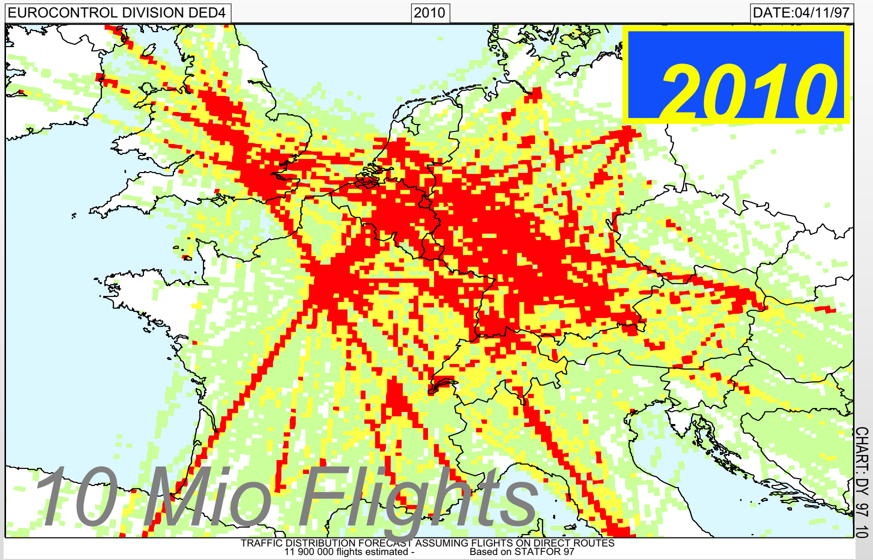
The Middle East: airports investing in capacity expansion

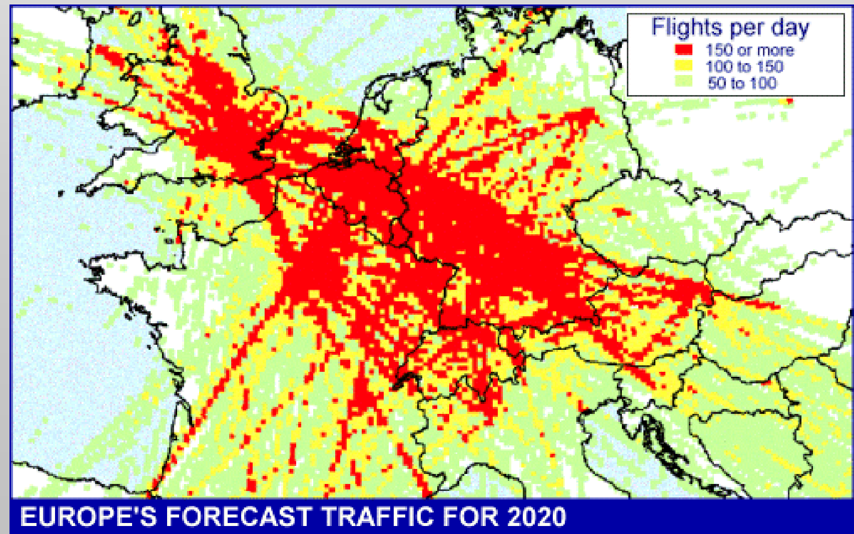


Source: Centre for Asia Pacific Aviation

Where they fly

- Airline operations in Europe are concentrated over Western Europe.
- There are about 10 million IFR flight per year.
- Main airways get saturated leading to delays.





Sensitive to small changes

- The air transport system is very sensitive to small changes.
- This illustrates that the air transport system has little inherent redundancy.
- With SESAR the flexibility of airlines may even be reduced further.
- Due to delays the predictability of airline connections may deteriorate again.

Growth in air transport

- Air transport has become mass transport resulting in queuing, delays and discomfort.

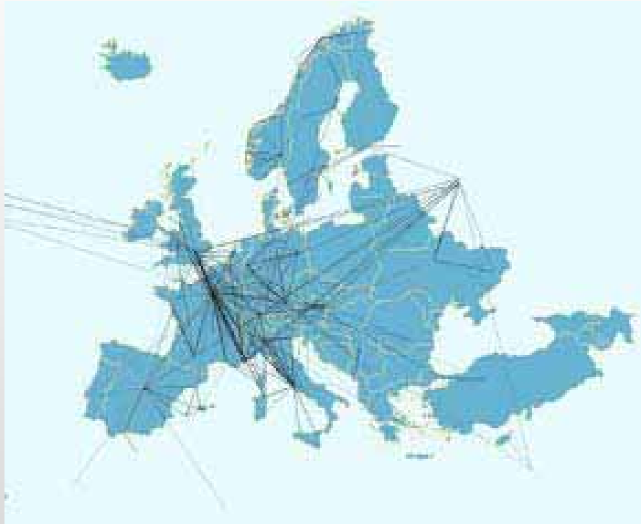
- For **business people** and those who can afford it, alternative **on demand** air transport solutions will satisfy their needs.

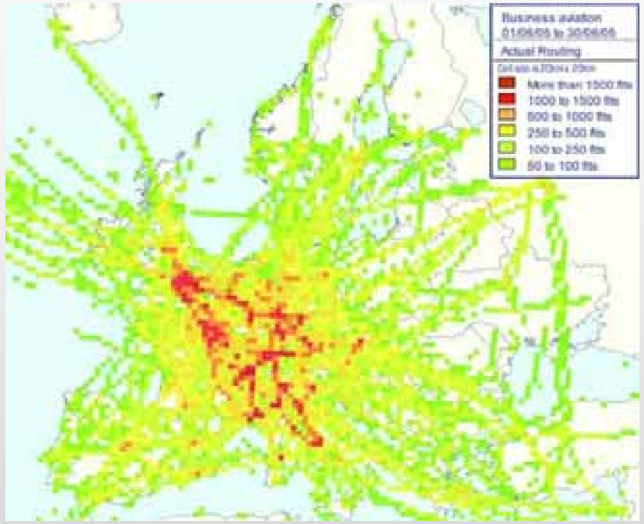
For business customers time, safety and quality are most important

- For business people travelling is tiresome.
- They want to **travel fast door to door** while using as few different transport modes as possible.
- They want to spend as little time as possible on an airport or in transit (not to queue)
- They would like to use the travelling time to work
- They care about safety

Business and corporate air transport provide limited and expensive solutions

- Business aviation is very expensive.
- Business aviation is focused on a limited number of airports only.
- As a consequence ordinary business people often take the car to reach their destination.





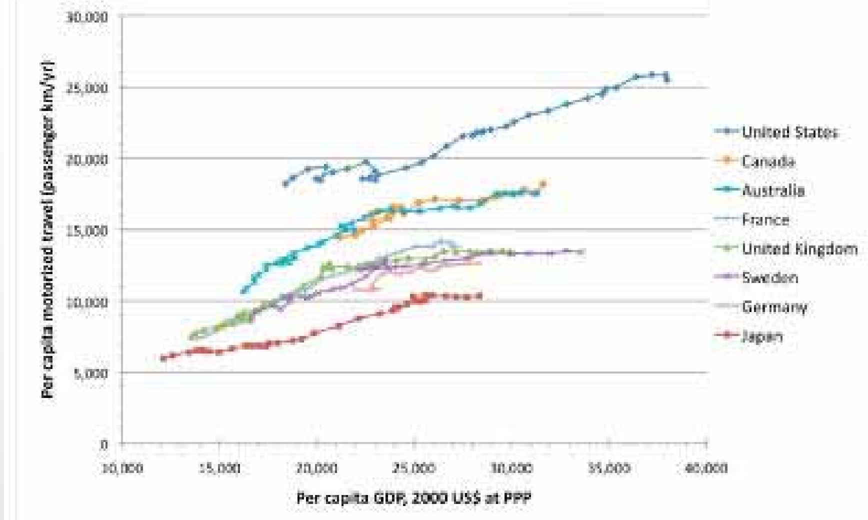
Observation 1

- Due to the growth in demand for air transport, airport capacity is stretched to the limits. This results **in long transit times and crowded access to airports.**
- Capacity of currently used airports will **not be sufficient** to accommodate the additional traffic expected.
- Business travellers want **fast door to door seamless connections**, using as few transport modes as possible. ***Time is money***.

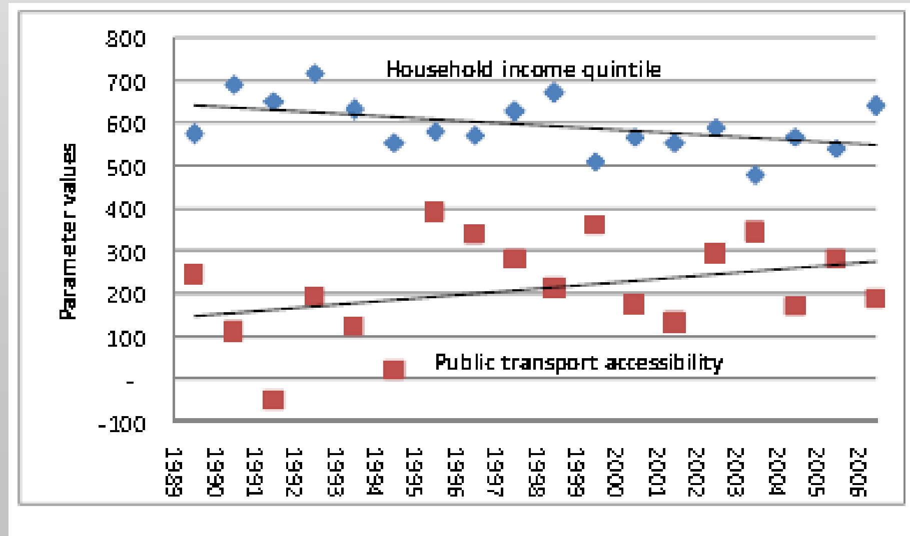
- Some business areas in Europe are difficult to reach. As a consequence business people often **use their cars** to travel.

Road travel

- The increase in car travel in Europe has been paramount...



- The use of cars is especially evident in those places where public transport is difficult to access. (UK example)



Roads in Europe

- ***236.147.000 cars in EU27***
- ***+3 million cars/year***
- ***1.977.000km of paved roads***
  - ***65.100km of motorways***
- ***+1.500 km/years***

2007 data

- 80,5% of EU27 traffic is passenger cars
- 8.8% is bus and coaches
- 7.0% is railways
- 1.5% is tram and metro

Congestion

Roads in Europe

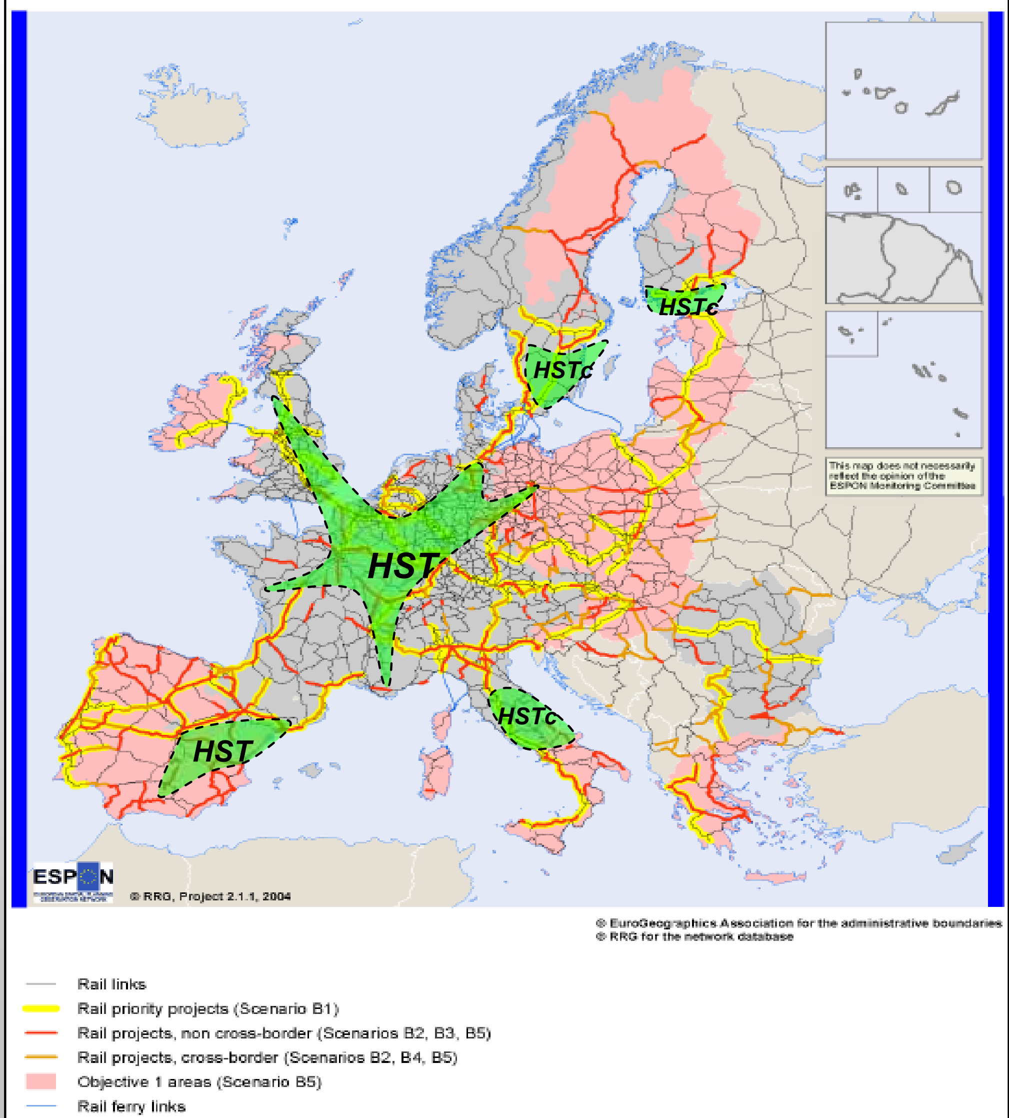
- Roads are not only used for passenger cars.
- Trucks, lorries and vans constitute an increasing portion of the road traffic. (236 million passenger cars and 34 million goods vehicles)

- If freight traffic can no longer be accommodated, the economy will stop.

Concern EU Commission

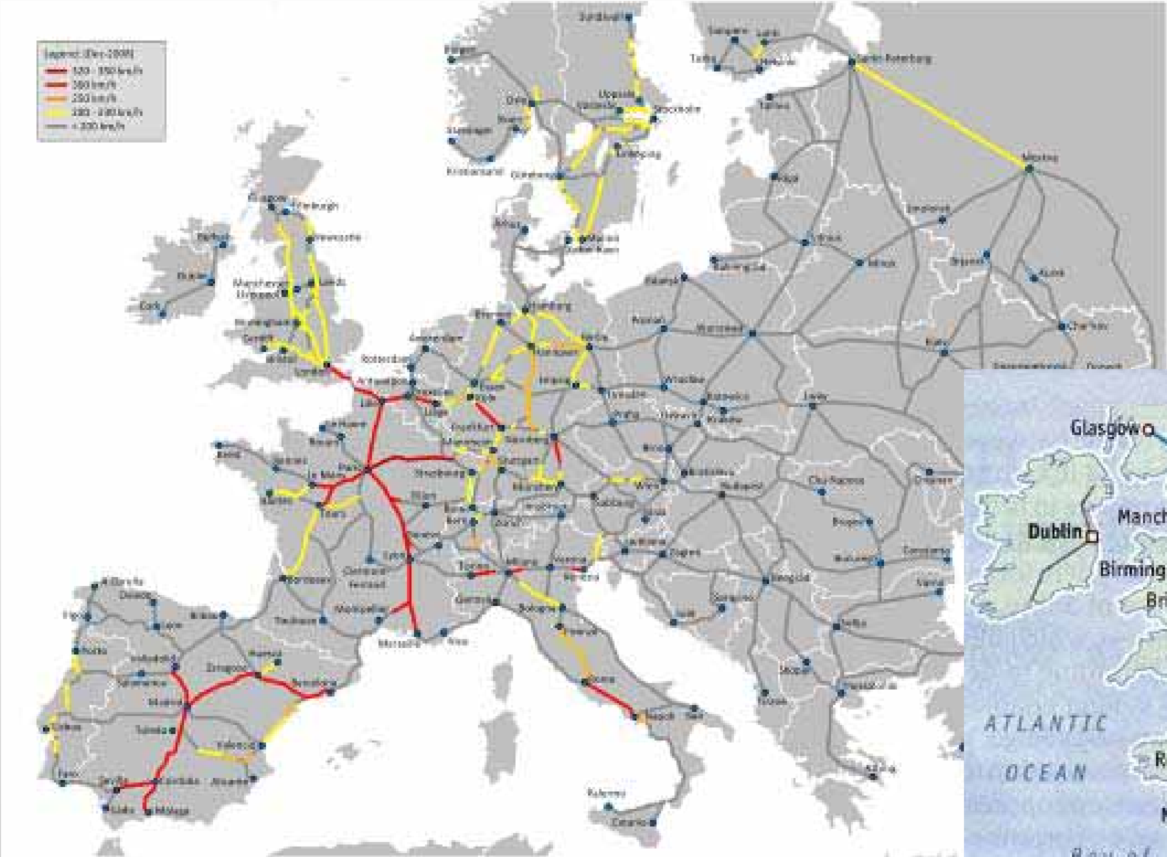
- In its **White Paper** on Transport the European Commission has advocated the **substitution of car travel to rail travel**.
- TEN-T funding is available to create more high speed rail connections.
- However High Speed rail infrastructure is expensive: about € 40 million per km.

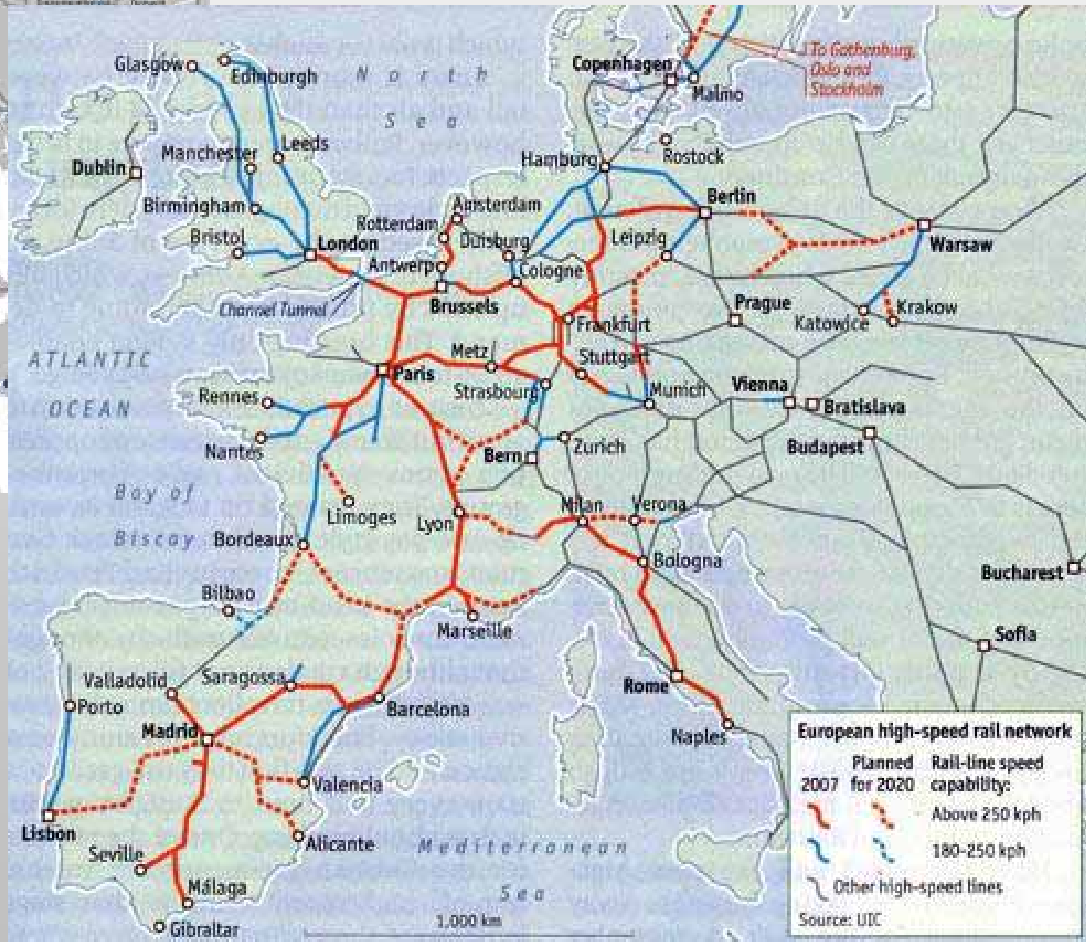
Rail network



Map 2.2 Rail network development of the infrastructure scenarios

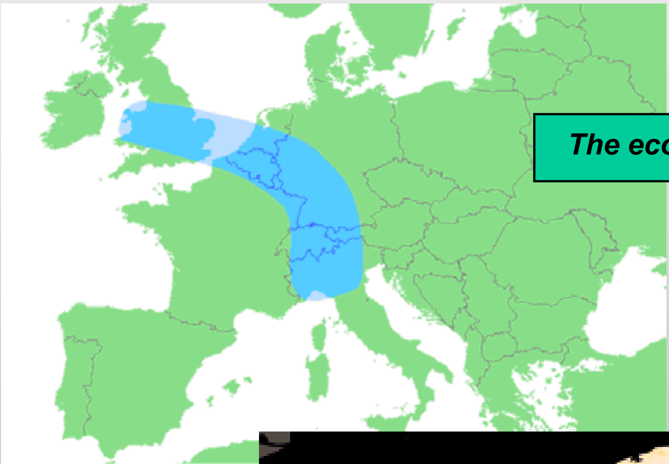
Current and planned High Speed Rail



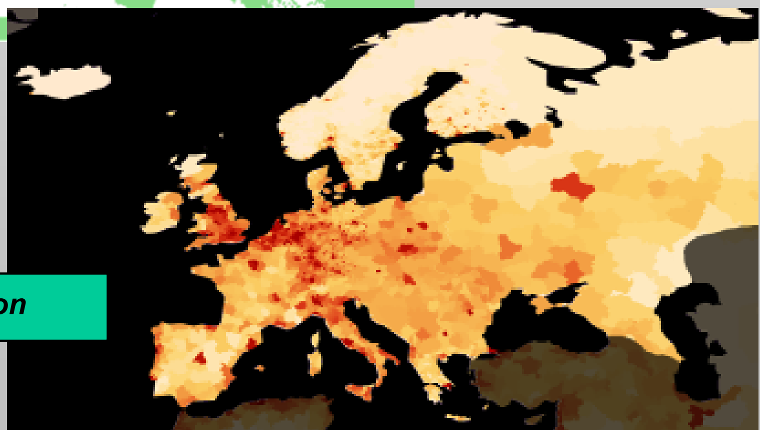


Regions of Europe

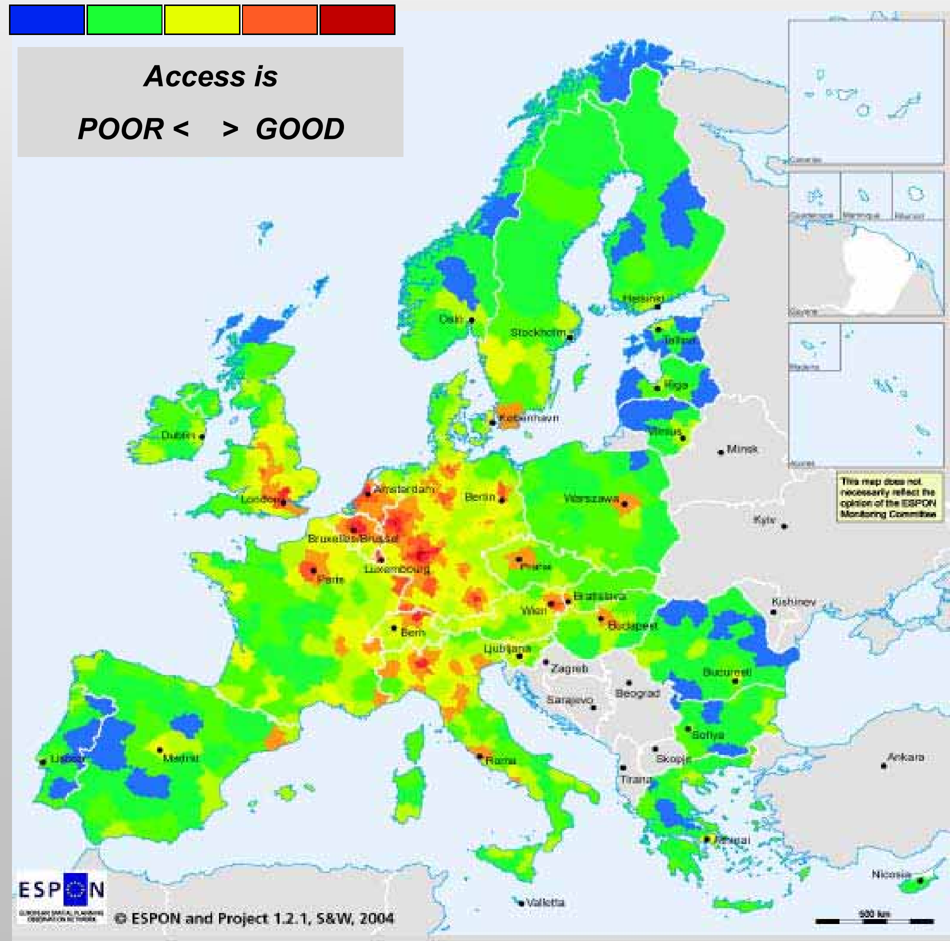
- Extended (high speed) rail connections will not help access to regions outside the European Economic Banana, to further develop their economics and welfare. These regions are mainly depending on road transport development.



The economic banana



The population



Observation 2

- In view of the increasing road traffic, a **modal shift** is needed.
- Trains and other public transport means can alleviate the problem. However the high speed rail network is primarily focused on **areas within the main European economic centres**.
- **Remote areas** in Europe still have a bad transport infrastructure and depend on car travel. This will create barriers to their economic development.

- ***Can a step change in aviation help?***

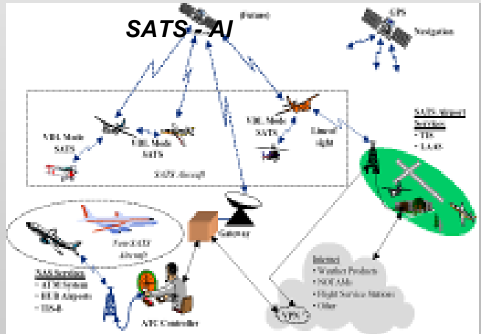
The USA was the first to investigate

US studies

- NASA started studies on personal **on demand** air transport to see if an **air taxi business or private planes travel** would have a future in the USA.
- Large scale use of small aircraft would not only create additional door to door transport opportunities but would also **revitalize the small aircraft industry** in the USA.

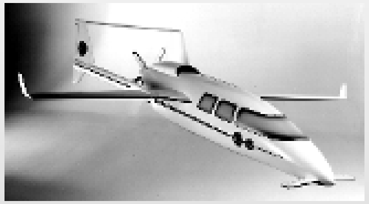
NGATS

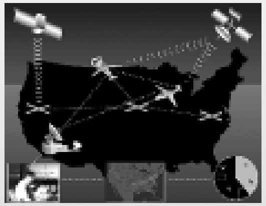
VLJ **SATS**



Affordable Alternative Transportation AGATE -- Revitalizing General Aviation

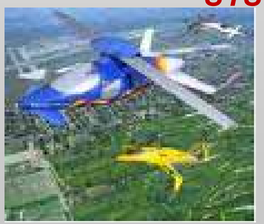
Advanced General Aviation Transport Experiments



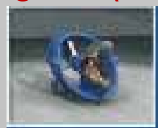


- **AGATE**
- **TAMDAR - Troposphere Airborne Meteorological Data Reporting**

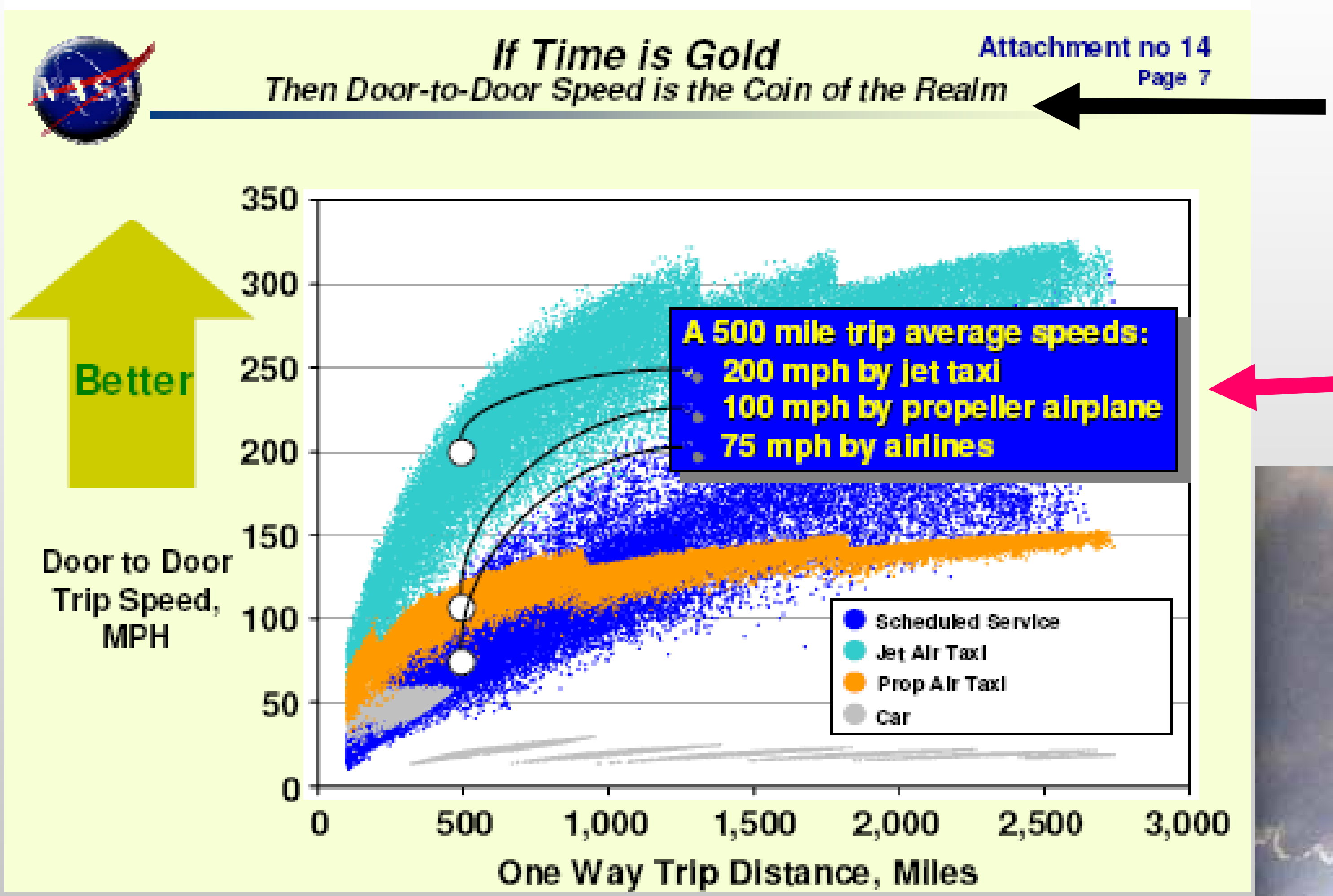
A RURAL/ REGIONAL AND INTRA-URBAN ON-DEMAND TRANSPORTATION SYSTEM



NASA Vehicle SystemsPrograms (VSP): PAV - Personal Air Transportation Technologies



The NASA system approach

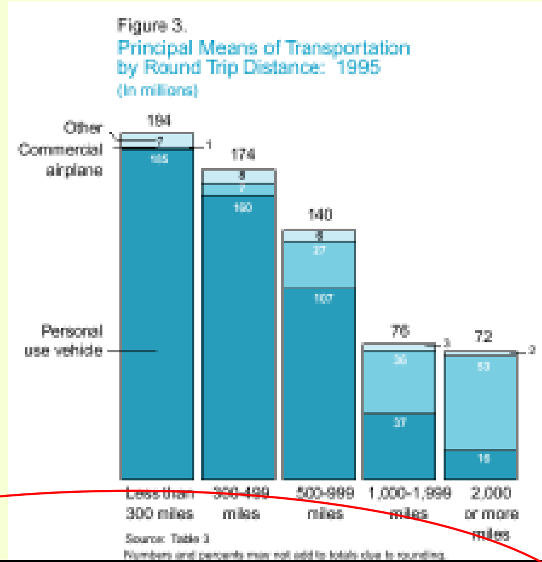


NASA conclusions

Future Aircraft Market
Diverted Demand and Sensitivity Assessments

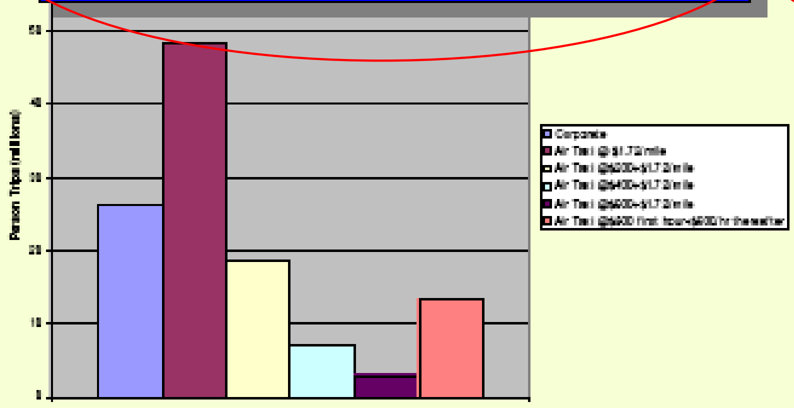
Attachment no 14
Page 11

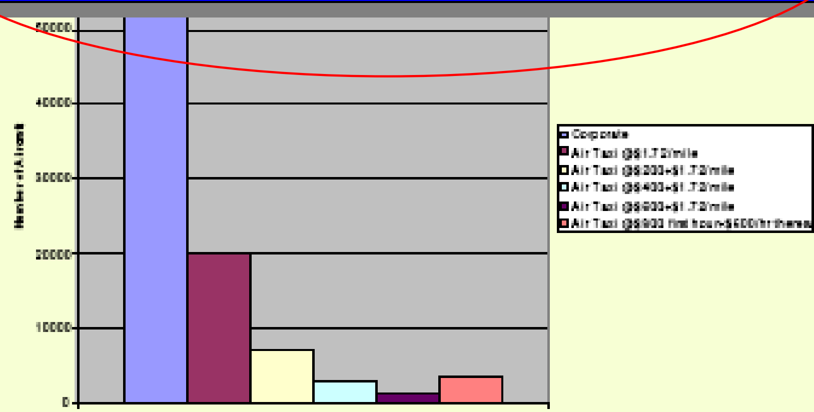
- Approach - Predict diverted mode choice at National level between automobile, scheduled air, and on-demand air travel based on the value of a traveler's time and the cost of the trip (NASA CR 2002-211927).
  - Data Source - 1995 American Travel Survey + 2000 US Census
  - Tools - Integrated Air Transportation System Evaluation Tool (IATSET), macro economic model



Between 13 and 47 million trips at ~$2/sm operating cost

Between 7,000 and 52,000 aircraft required to serve new markets





A big market was predicted for the USA.

Is such a potential market also present in **Europe** , in view of a different transport infrastructure and different geographic situation?

The EPATS study sponsored by the EU was to assess.

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

EPATS - SATS
Concept difference

- ***low passenger volume interregional on demand and scheduled transport,***
- ***access to hi-speed travel modes for remote European regions***
- ***4-19-seat piston, turboprop and jet aircraft operating at small regional and local airports***
- ***private, air taxi or public mode of transport (for remote areas)***

- ***door-to-door travel time reduction and daily range of activity of businessmen increase***
- ***4-7-seat, piston and jet aircraft, operating at small and large airports***
- ***A/c mainly owned privately***
- ***private or corporate mode of transport***

Aircraft

GENERAL AVIATION AIRCRAFT
CS-23

EPATS Aircraft
(Small Travel Aircraft)
JAR-23 Normal & Commuter categories
(extended to jet driven, multiengine airplane, and with supplementary requirements)

All others GA & Aerial Work Aircraft
JAR-23 all categories

EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

- Single and multiengine Piston
- Single and multiengine Turboprop
- Single and multiengine jet

Ownership

- Private
- Fractional
- Corporate
- Public

Operations

Non Commercial transport
Part 91

Individuals or corporate operations

Commercial Transport
Part 135

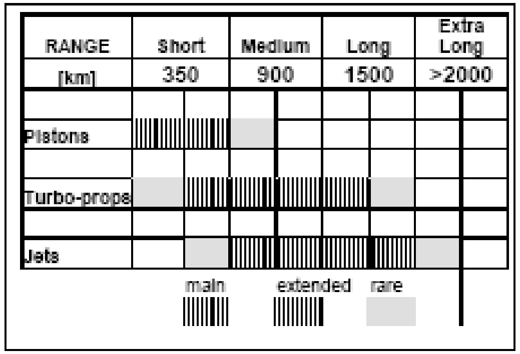
On demand passenger services - Air-Taxi

Scheduled passenger services - Commuter

Missions

Free Flight Travel from point to point in all weather conditions in time not more than 2 hours for the most of inter regional relations and not more than 4 hours for maximum range. Aircraft have to operate from local airports and serve all EU sub regions NUTS-3 (1150)

One day trips for individual or business travel and two flight dayly for scheduled passenger service on low density intercity traffic flow



Scheduled passenger services affordable for the most of population. Corporate and on demand taxi services profitable for business travellers,

EPATS

EPATS key elements

Aircraft fleet

- *Technically Advanced Aircraft fleet consisting of:*
  - *Single and twin engine piston, 4 to 6 seats*
  - *Single and twin engine turboprop, 9 to 19 seats*
  - *Single and twin engine jet, 6 to 7 seats*

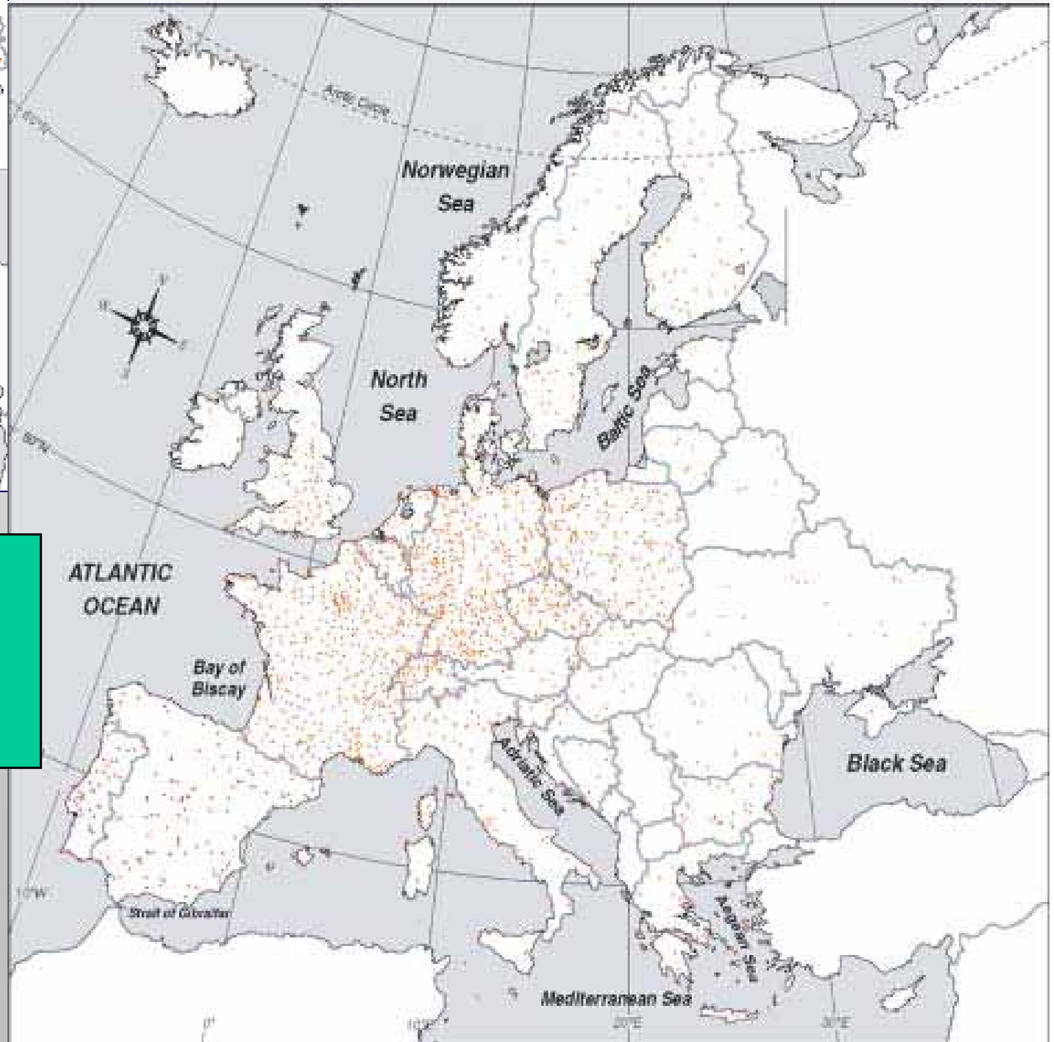
  - *Certificated IFR according to enhanced JAR-23, operating under FAR 135 for commercial operation and FAR-91 for non-commercial operation*

Airports

EPATS

1270 airports which have an ICAO code

1300 aerodromes in Europe that can be used for EPATS traffic



EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

A total overview of all European airports

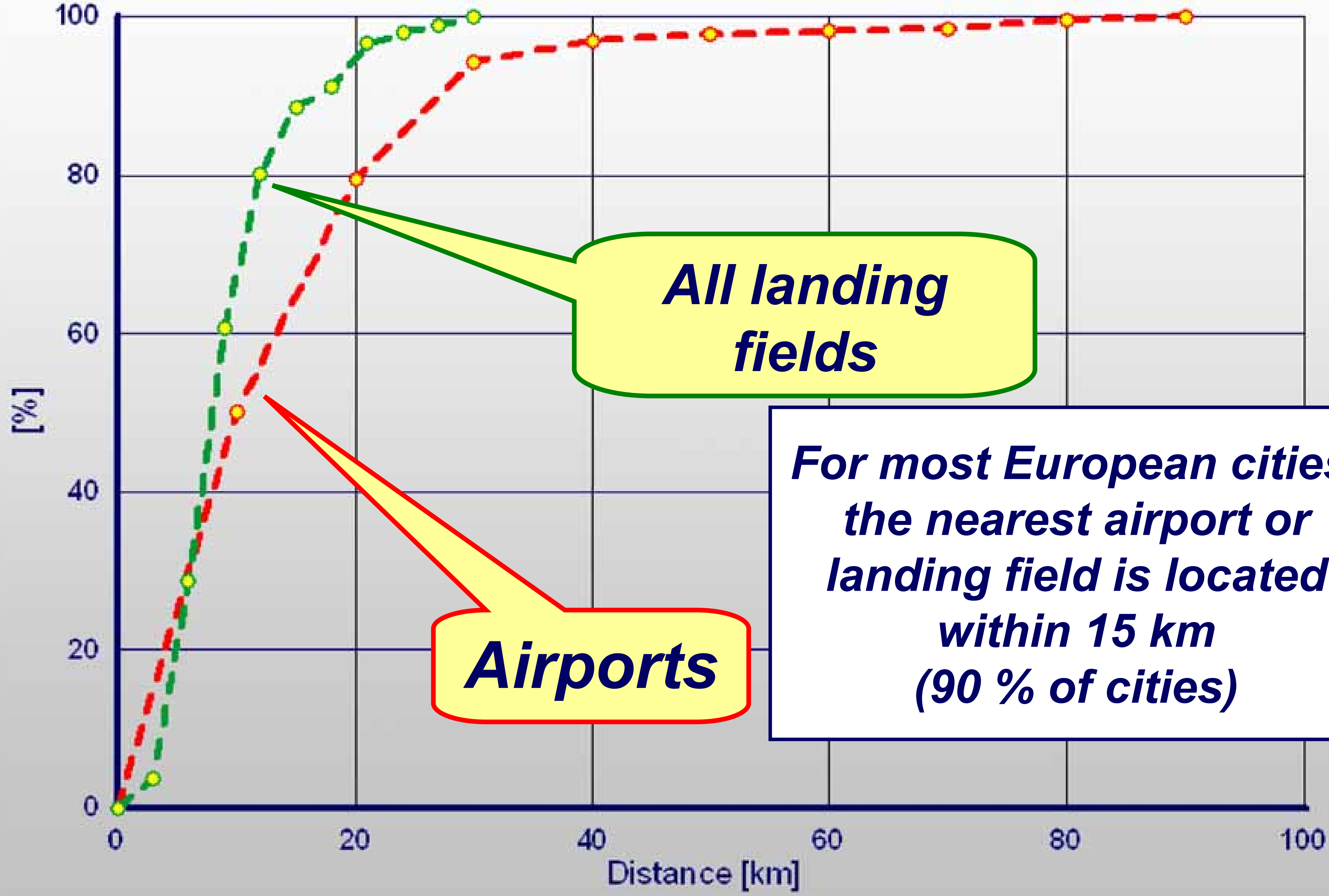
1,270 airports and 1,300 landing fields

One airport per 2850 km^2

390 000 inhabitants per one airport

Europe is a special area with unique features favouring the development of regional passenger air transportation system

City distance to the nearest airport



For most European cities, the nearest airport or landing field is located within 15 km (90 % of cities)

For main European cities

Estimation Method for modal shift

- ***Generalized Cost method** including:*
  - *The travel cost borne by the traveler*
  - *The travel time and its associated cost value*

⇨A traveler will choose the transport mode that minimizes his/her generalized cost

➢ Travel Cost = monetary cost

The direct cost borne by the passenger (= Out-of-pocket cost) is composed of:

- **Access cost** C_{Access} = cost to access the terminal. This cost is fixed.

Note: It is assumed that the passenger goes to the terminal by car.

⇨ Access cost = average distance from origin point to terminal * cost per km by car

- **Egress cost** C_{Egress} = cost to leave the terminal and reach the destination. This cost is fixed.

⇨ Egress cost = average distance from terminal to destination point * cost per km by car

- **Transport cost** $C_{Transport}$: varies with the distance. It corresponds to the multiplication of a "**unit cost**" (a cost per pkm) with the distance. This unit cost is the price per km paid by a passenger to use a transport service (commercial aircraft, EPATS) or to use his personal car.

- Potential **additional cost** $C_{Additional}$ such as accommodation cost (for car when stopping in a hotel)

$$C_{Travel} = C_{Access} + \underbrace{Distance \times C_{Unit}}_{C_{Transport}} + C_{Egress} + C_{Additional}$$

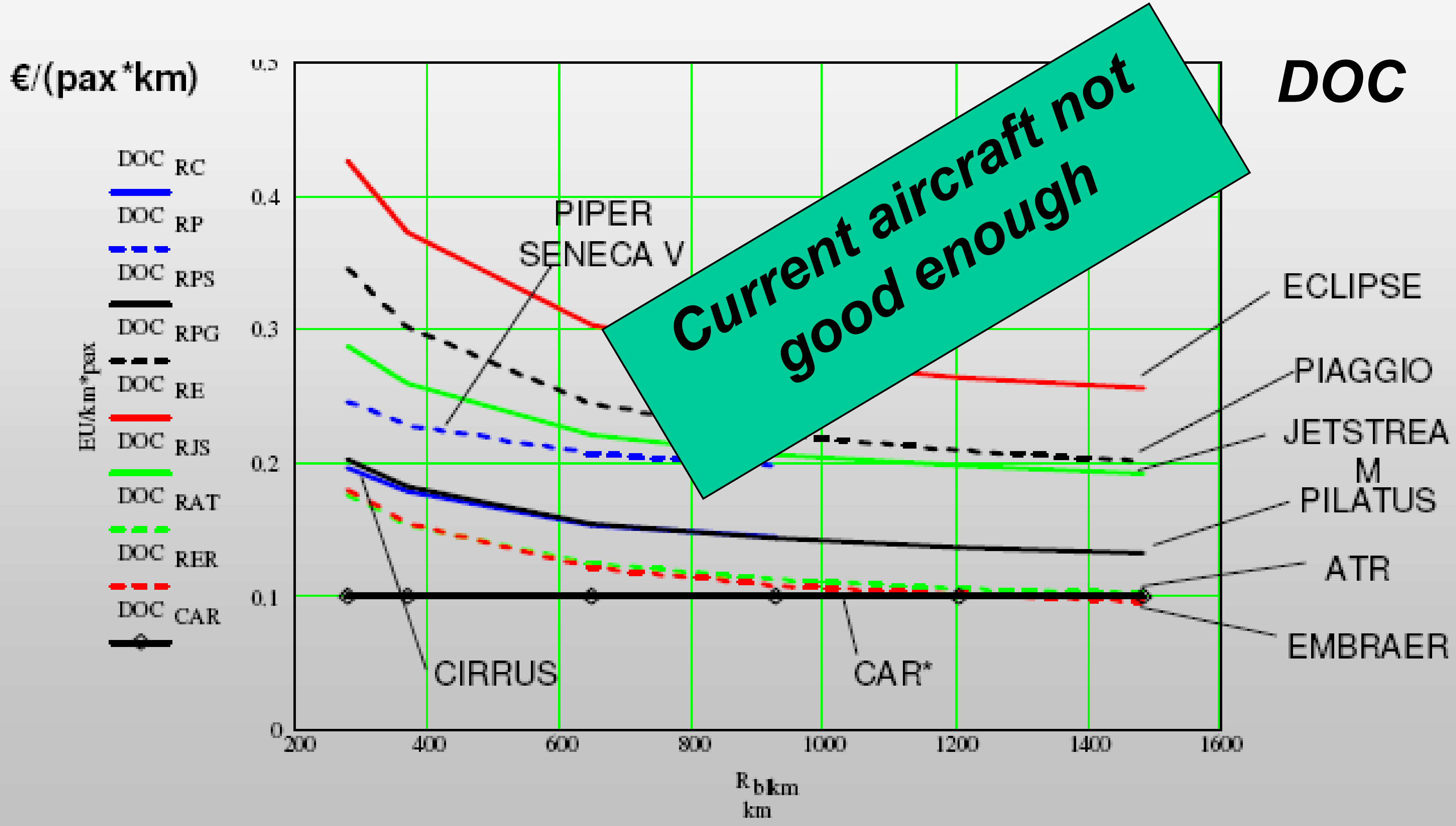
$$T_{Travel} = T_{access} + \underbrace{\frac{d}{Vm}}_{T_{Transport}} + T_{egress} + T_{additional}$$

➢ Travel Time

The travel time T_{Travel} can be separated into four distinct parts:

- **Access time** T_{access} to the transport mode = Time to go from origin point to the transport mode
  = access time to the transport terminal + time spent at the terminal for procedures (checking, waiting, boarding)
- **Egress time** T_{Egress} = Time to go from transport mode to destination mode
  = Time spent at terminal after arriving (Transfer Time, Time for picking up luggage) + Time to go from terminal to destination point
- **Transport time** $T_{journey}$ = time spent in transit only
  = Distance ÷ Average Speed
- **Additional time** $T_{additional}$: this should be taken into account only in the case of car travel. It corresponds to the potential breaks the traveller can take while driving. These breaks can be short breaks, as well as stops in hotel for very long distance trips. Time used for sleeping (at hotel) is not included in additional time since it is not considered wasted time. However, time spent eating is included in travel time because for the traveller it could be time spent with his family rather than time spent in a hotel.

Transport cost versus distance



* Mercedes-Benz 350 CLASSIC AUT – Car Category E

AIRCRAFT COMPARISION: Reference vs Future to

estimate DOC

2020

PISTONS

1eng 4seat 2eng 6seat

TURBO-PROPS

2eng 8pax 2eng 19pax

JETS

2eng 8pax

	PISTONS 1eng 4seat	PISTONS 2eng 6seat	TURBO-PROPS 2eng 8pax	TURBO-PROPS 2eng 19pax	JETS 2eng 8pax
Range full seats	1000 km	1.500 km	2000 km	1000 km	2000 km
Speed (bl.) km/h	Similar	+11to13%	-10 to17%	+10 to17%	Similar
DOC €/(pax*km)	-18%	-37%	-23 to 32%	-12 to15%	-24%
SFC l/(pax*km)	-20%	-26%	-11 to 28%	-16%	-21%

The **passenger-km distribution versus value of time and travelled distance**, for each transport mode (Aircraft / Car) is obtained as shown in Figure 3-2

Journeys distribution by population category

POP CAT.	Journeys distrib.
Cat 1	%X1
Cat 2	%X2
Cat 3	%X2

Source : ENT

Link
Population category / Labour Cost

Source : Eurostat, Insee

Journeys distribution by Labour cost category

Labour Cost - € / h	Journeys distrib.
LC1	%X1
LC2	%X2
LC3	%X2

Relationship
Labour Cost / Value of time

Source : Boiteux Report
Cf. ANNEX « Value of time »

Journeys distribution by value of time

Value of Time € / h	Journeys distrib.
LC1	%X1
LC2	%X2
LC3	%X2

Journeys distribution by Distance category

Distance Category	D1	D2	D3
Journeys distrib.	%Y1	%Y2	%Y3

Source : Dateline

Combination

Journeys distribution in % by value of time and distance category

Journeys Distribution		Distance Category D1	D2	D3
Value of time € / h	LC1	%..	..	..
	LC2	..	..	..
	LC3	..	..	..

Value of travel time

Formula

Relationship
Journeys / Pkm

Pkm distribution in % by value of time and distance category

Source : Tremove

Application of pkm distribution to total pkm

Pkm distribution (in number) by value of time and distance category

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

MODAL SPLIT VIA DISTANCE AND TIME VALUE

Inverse Cummulati Frequency %	Time value [Euro/h]	One way travel Great Circle Distance [km]							
		200	300	500	700	900	1100	1300	1500
80	3	Car	Car	Car	Car	Car	Car	Car	Car
60	5	Car	Car	ACP-1	ACP-1	ACP-1	ACP-1	ACJ-1	ACJ-1
40	8	Car	ACP-1	ACP-1	ACP-1	ACP-1	ACP-1	ACJ-1	ACJ-1
20	13	Car	ACP-1	ACP-1	ACP-1	ACP-1	ACJ-1	ACJ-1	ACJ-1
10	18	Car	ACP-1	ACP-1	ACP-1	ACP-1	ACJ-1	ACJ-1	ACJ-1
5	22	Car	ACP-1	ACP-1	ACP-1	ACP-1	ACJ-1	ACJ-1	ACJ-1
1	33	Car	ACP-1	ACP-1	ACP-1	ACP-1	ACJ-1	ACJ-1	ACJ-1
0,1	64	ACP-1	ACP-1	ACP-1	ACP-1	ACP-1	ACJ-1	ACJ-1	ACJ-1
0,01	80	ACP-1	ACP-1	ACP-1	ACP-1	ACJ-1	ACJ-1	ACJ-1	ACJ-1

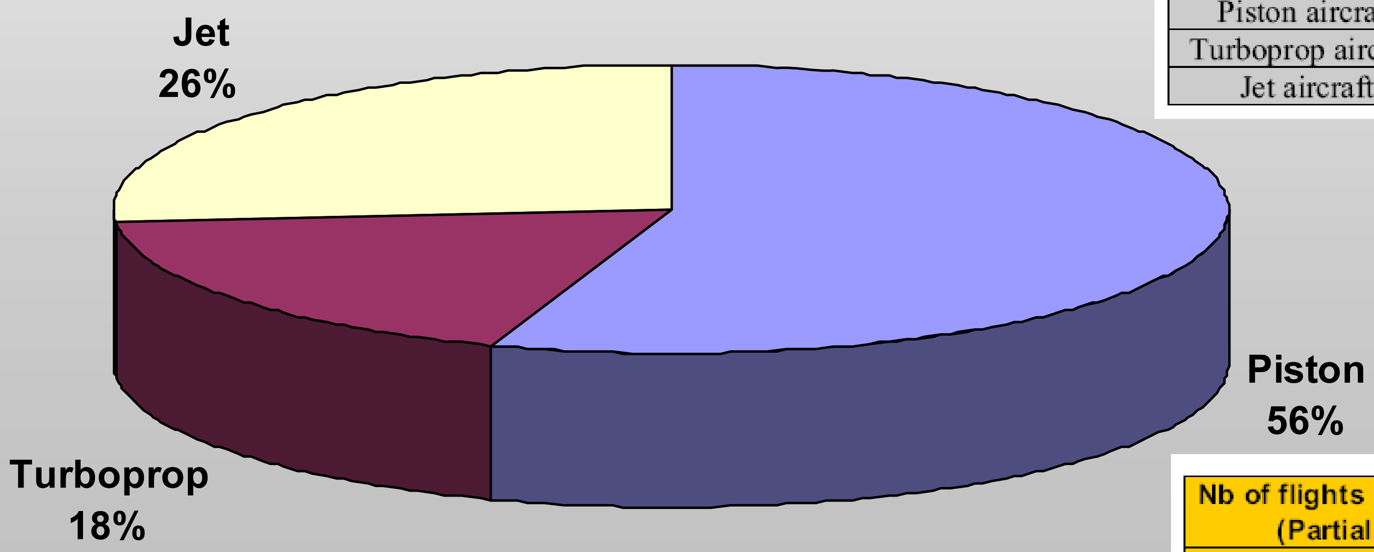
Car	Car, Average travel speed = 80 km/h, Operating Costs = 0,5 E/km
ACP-1	4 seat Piston Aircraft, Vcr = 320 km/h, Operating Costs = 350 E/h
ACJ-1	5 seats Jet Aircraft, Vcr = 700 km/h, Operating Costs = 1050 E/h

The demand

We only considered twin engined aircraft for the EPATS travel. These would be fully IFR equipped. We assumed a 70% load factor and single pilot operations.

EPATS calculated that between 90.000 and 99.000 aircraft would be needed to carry 320 million business passengers and enable 44 million flights, given the distances between the city pairs selected and the range of the different aircraft types. The split between the different aircraft categories is shown below

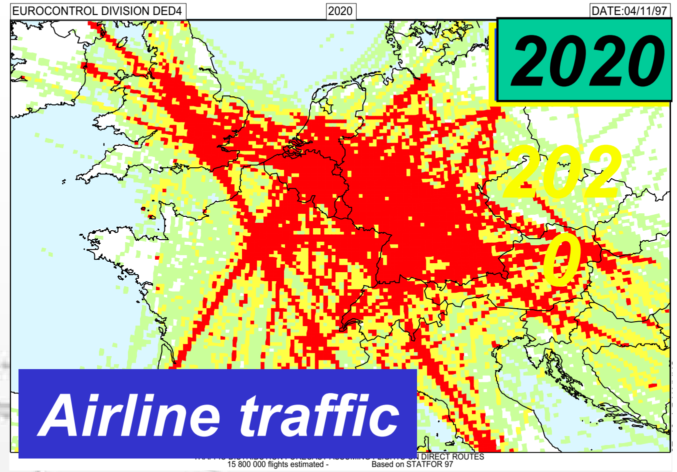
Aircraft types	CASE A	CASE B
Piston aircraft	200km-250km	200km-250km
Turboprop aircraft	200km-800km	200km-1000km
Jet aircraft	800km-2500km	1000km-2500km

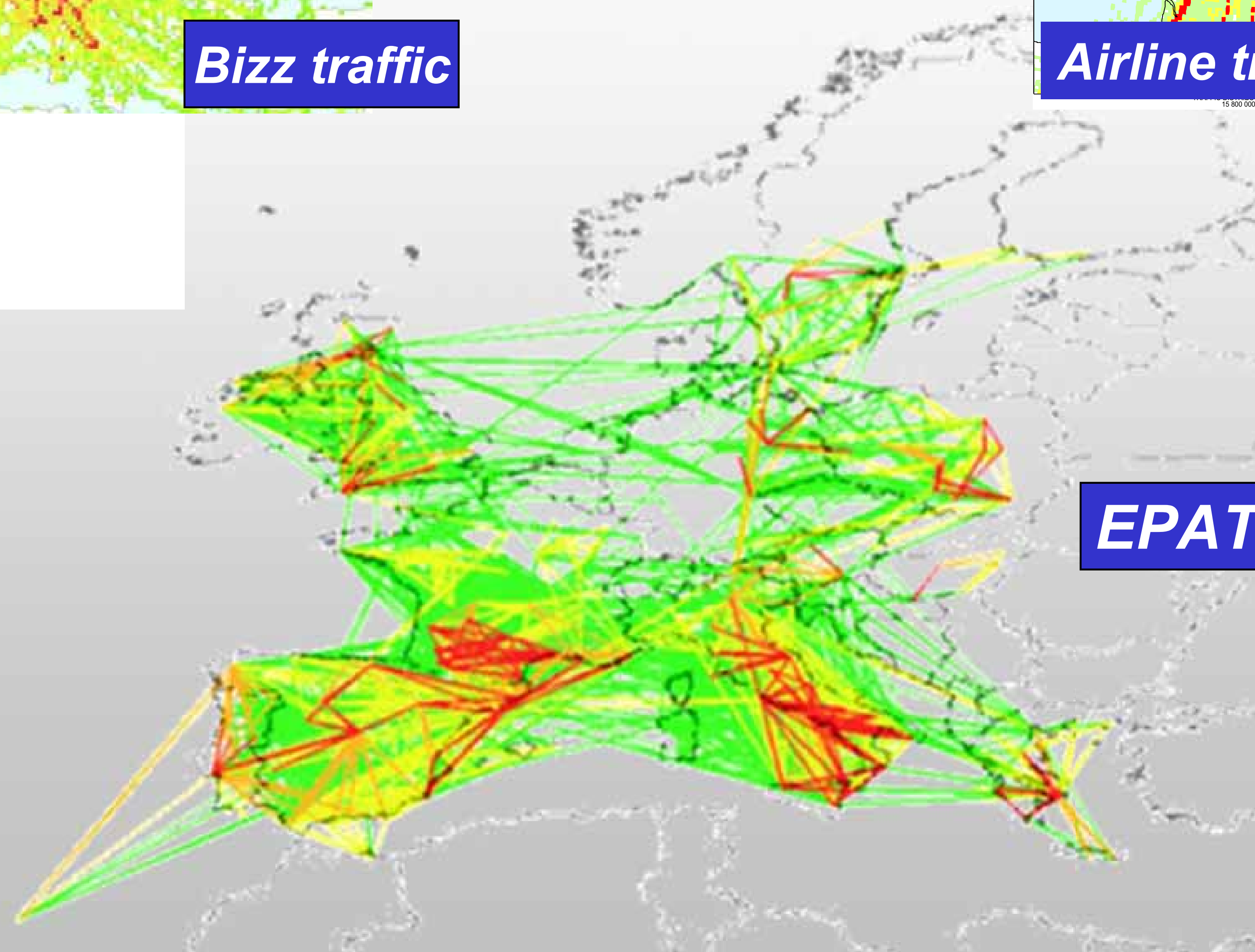


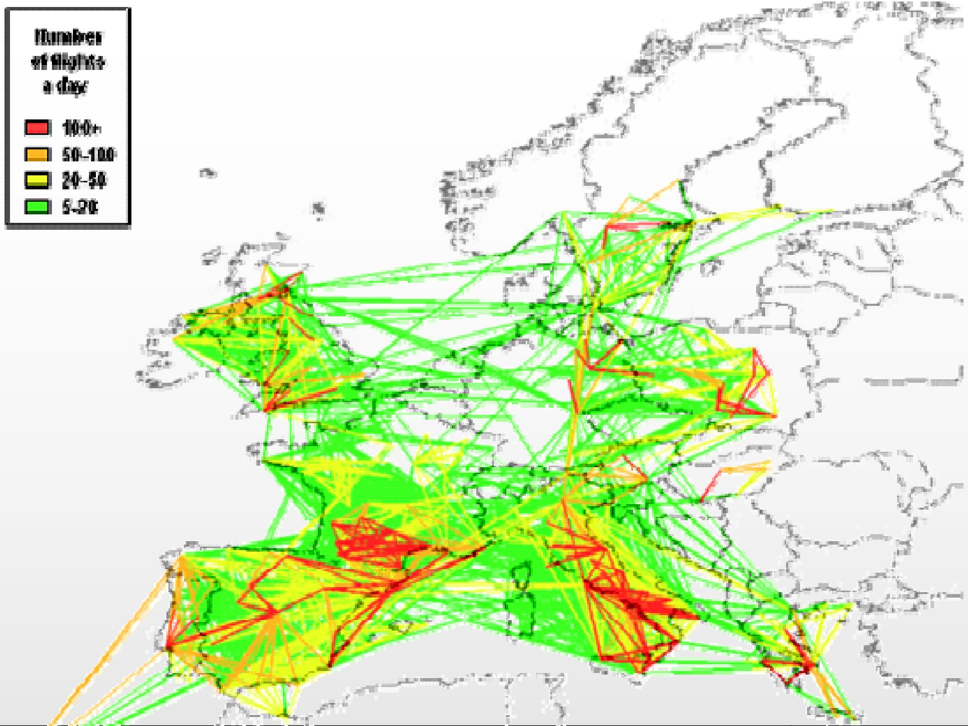
Nb of flights per aircraft type (Partial scenario)	CASE A	CASE B
ACP-2	22 910 747	22 910 747
ACT-2	14 990 357	16 313 325
ACJ-2	6 277 927	3 700 219
Total	**44 179 030**	**42 924 291**

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

Where they fly







Validation

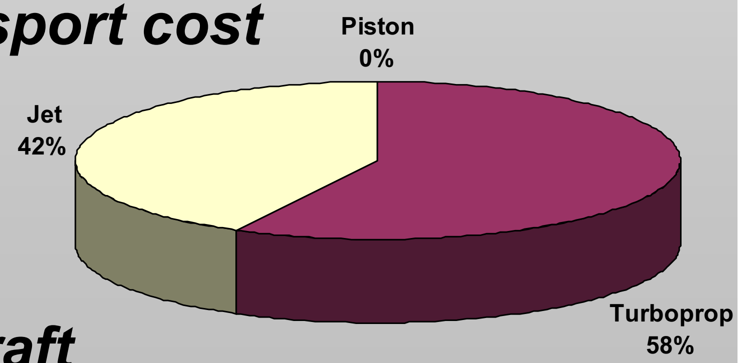
EPATS traffic and fleet in France	*EPATS traffic and fleet in Poland*
302 French domestic EPATS connections	***70 Polish domestic EPATS connections***
Estimated Traffic: ***15 billion Passenger-Km*** ***36 million passengers*** ***4.7 million flights***	***Estimated Traffic:*** ***8 billion Passenger-Km*** ***28 million passengers*** ***4 million flights***
8400 personal aircraft: ***71% piston*** ***23% turboprop*** ***6% jet***	***7000 personal aircraft:*** ***87% piston*** ***13% turboprop*** ***0% jet***

Sensitivity analysis

- ***Sensitivity analysis***
  - ***Operating cost may increase in the future:***
    - ***Strong fuel price increase***
    - ***New environmental taxes***
    - ***New avionics in aircraft to be compliant with SESAR***
    - ***Etc.***

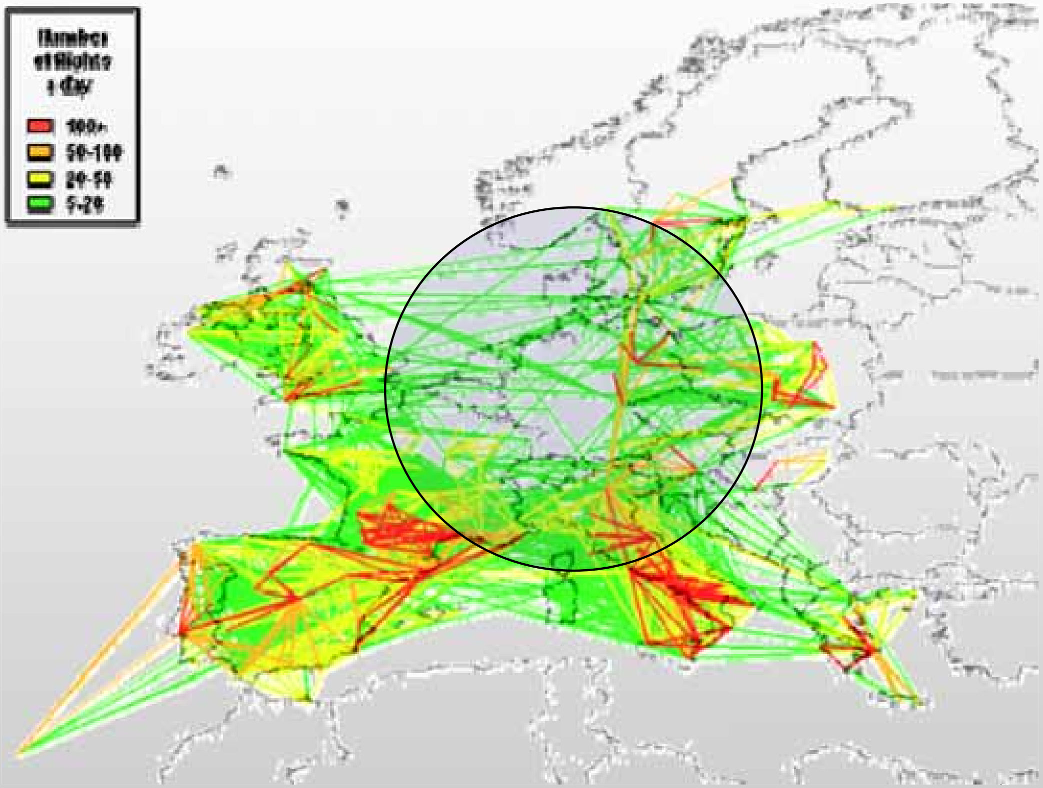
–An increase of 30% in the personal air transport cost would lead to:

- ***40% traffic decrease: 191 million Pax***
- ***65% flight decrease: 15 million flights***
- ***72% fleet decrease: 25 500 personal aircraft***

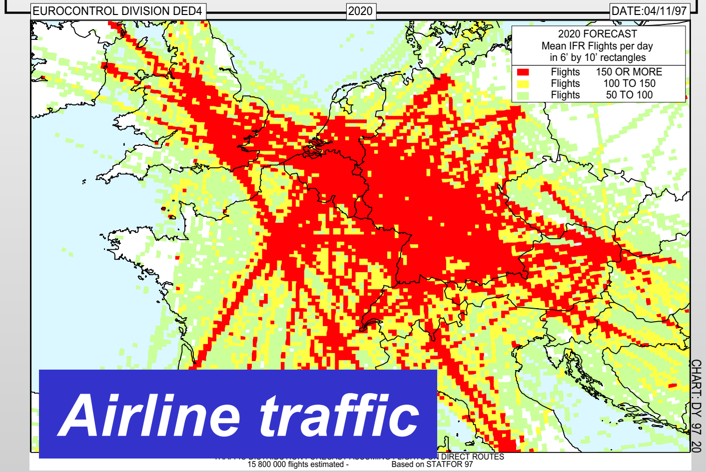


ATM impact assessment EPATS traffic integration

ATM

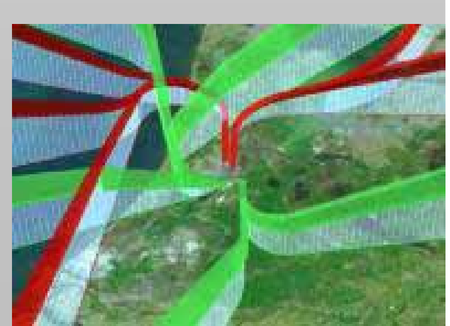


EPATS seems to be avoiding the current ECAC Core Area

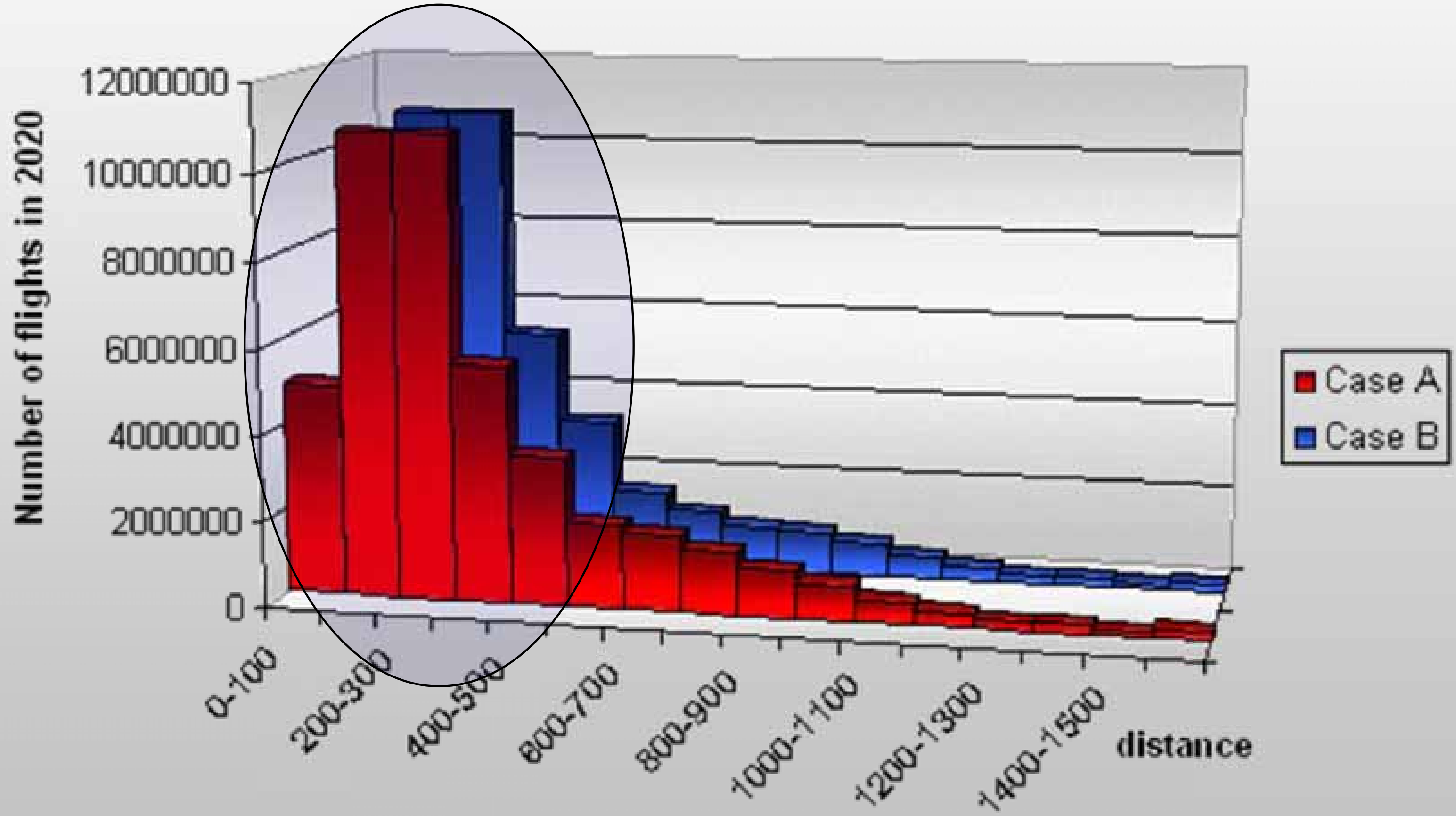


EPATS may be creating new dense/congested area and airports (mainly south of Europe but also England)

Will impact the TMA, mixed traffic (traditional ones + EPATS (IFR & VFR)



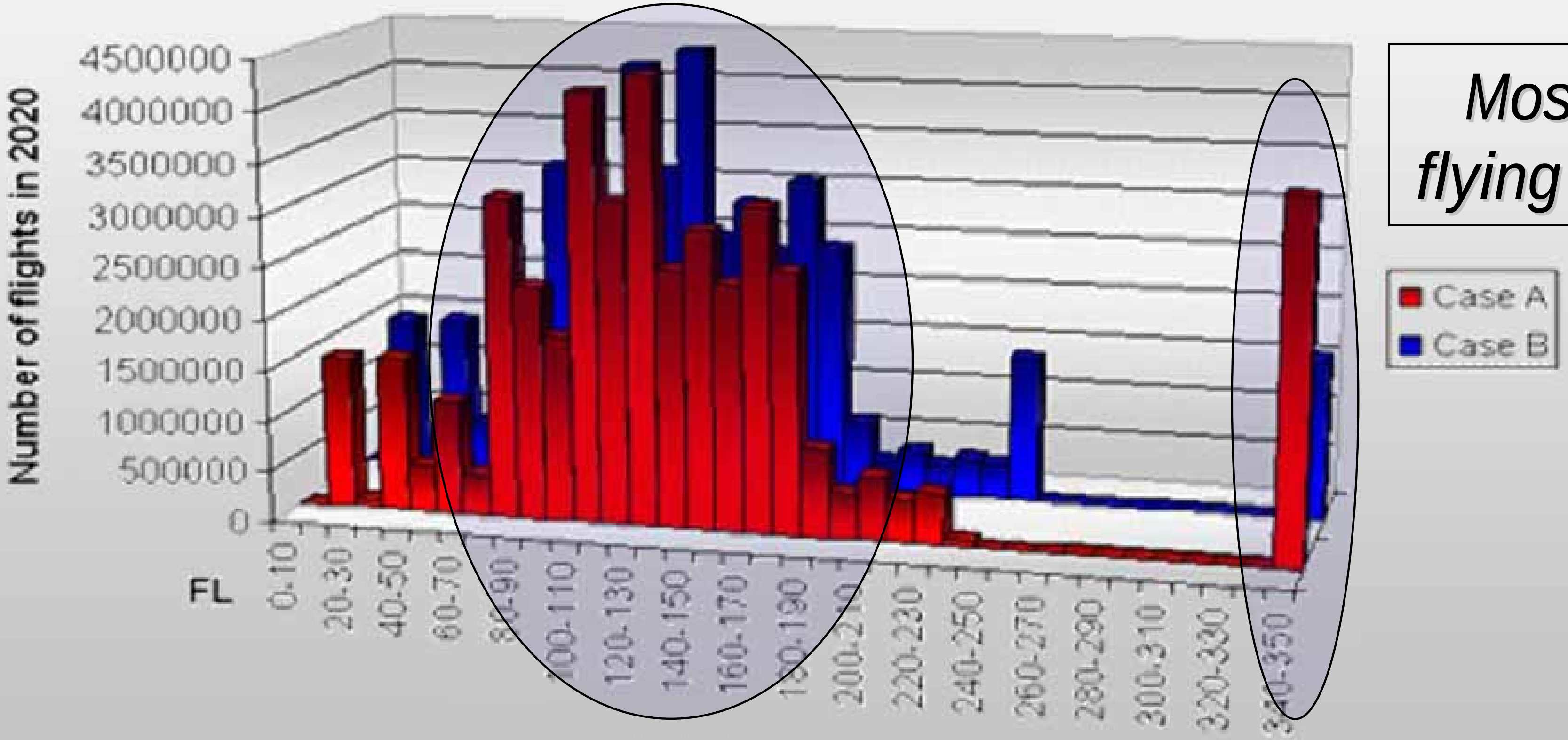
EPATS traffic distance distribution



Most of EPATS travel seems to be between 200 and 500 Kms

ATM impact assessment
EPATS traffic integration

EPATS cruising Flight Level distribution (standard distribution, not integrating ATM constraints)



Most of EPATS flying below FL190

System capacity (<u>severe challenge for SESAR)</u> to handle millions of additional EPATS IFR flights. SESAR Business Trajectory management for EPATS flight (IFR and VFR)?

EPATS R&D needs:

- **Single piloting** in un-managed and managed airspace (Safety - separation management and conflict avoidance - autonomous EPATS flight – Air Traffic Controller impact)
- **EPATS cockpit equipment** for supporting SESAR standard requirements
- **TMA operation** mixing EPATS and traditional flights
- **En-Route operation** mixing EPATS and traditional flights (Aircraft performances, managed airspace, Routing, separation management)

Environment and safety

The assumed 40 Million flights annually by EPATS aircraft would mean between 50 to 60 daily landings and take-offs on average for each European airport.

However these flights will not be equally distributed over all the airports and some airports may experience an increase of more than 3 in movements.

Further analysis is needed to fully understand the impact for each European airport.

- Many local airports are ***noise*** constraint and EPATS might become a problem quickly => Socio - economic impact
- VLJs replacing regular jets reduce the noise impact
- Single and twin piston engines and turboprops give better or comparable noise characteristics during approach (comp. to VLJ)
- Future EPATS aircraft should have **better noise characteristics** than the current generation of VLJ's and will be able to use CDA approach procedures and use noise abatement routes
- Engines should become more silent, higher efficiency, new propulsion techniques

Other technology needs

- **Gust alleviation** for small aircraft should be developed.

- **Deicing** needs attention.

- **Emissions** from jet aircraft should be lowered to the levels of modern piston and turbine engine aircraft.

- **Alternative fuels** should be investigated (Fuel cells, electric etc.)

European GA manufacturers capability

Estimation of EPATS Airplanes manufacturing potential capability
of GA manufacturers in Europe

Results of the survey: European GA manufacturers capability (annual output) is limited by EASA POA (A2).

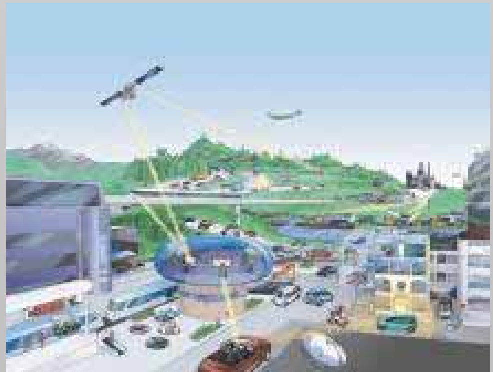
Results of rough estimation of EPATS Airplanes manufacturing potential capability of GA manufacturers in Europe:

Maximum 5300 airplanes / year,
More realistic number 3200 airplanes / year.
More airplanes per year – more employees needed.

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

On demand air taxi will require ***a new business model***

- Instant access via IT
- EPATS **transportation management** center
- On the spot **flight planning**
- **Regulatory** action
- Etc.

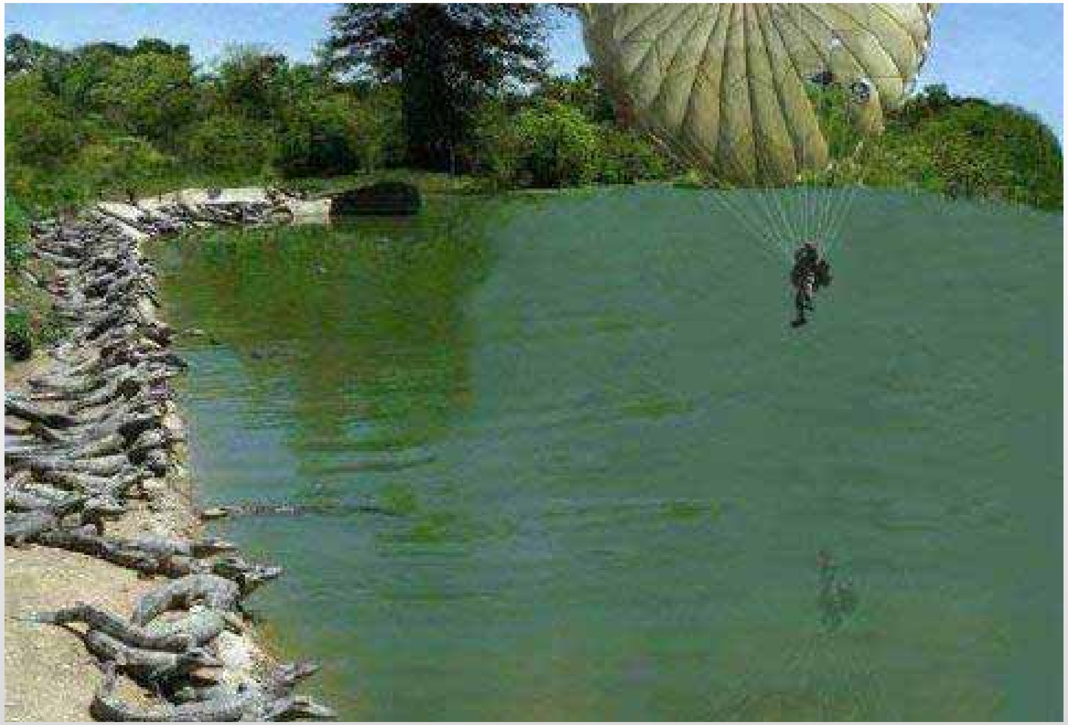


Experience with PATS in the US

- Several air taxi service companies were established in the USA.
- Most went **bankrupt** :
  - *Dayjet* using Eclipse (2007-2008)
  - *Point2point* using SR22 and DA42 (2005-2007)
  - *SATSair* using SR22 (2004-2009)
  - The same happened to European start-ups

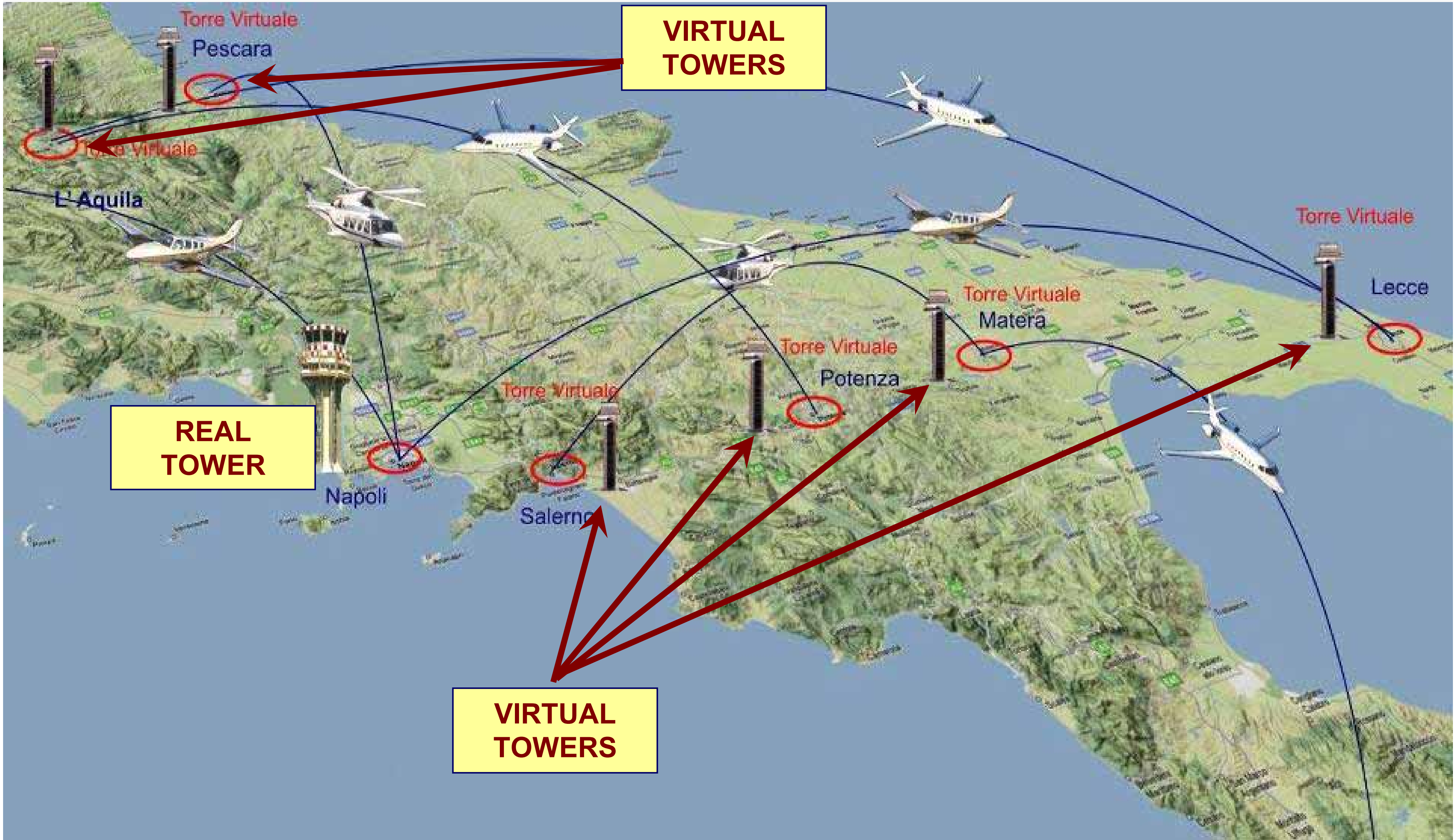
  Bankruptcy due to economic down turn, lack of money and inappropriate aircraft.

We first need an agreed vision where to go



Common Vision needed

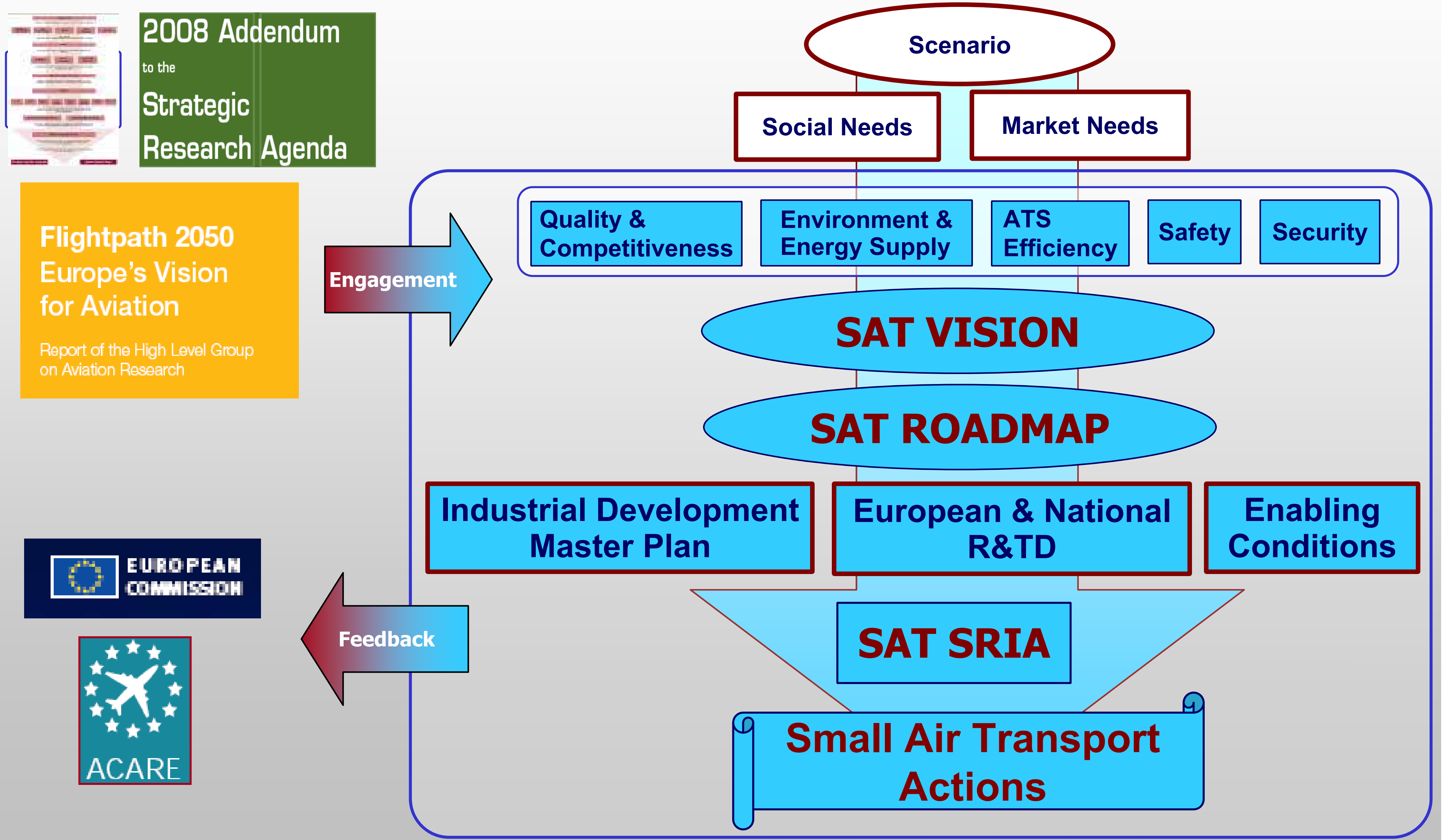
Small Aircraft Transport System

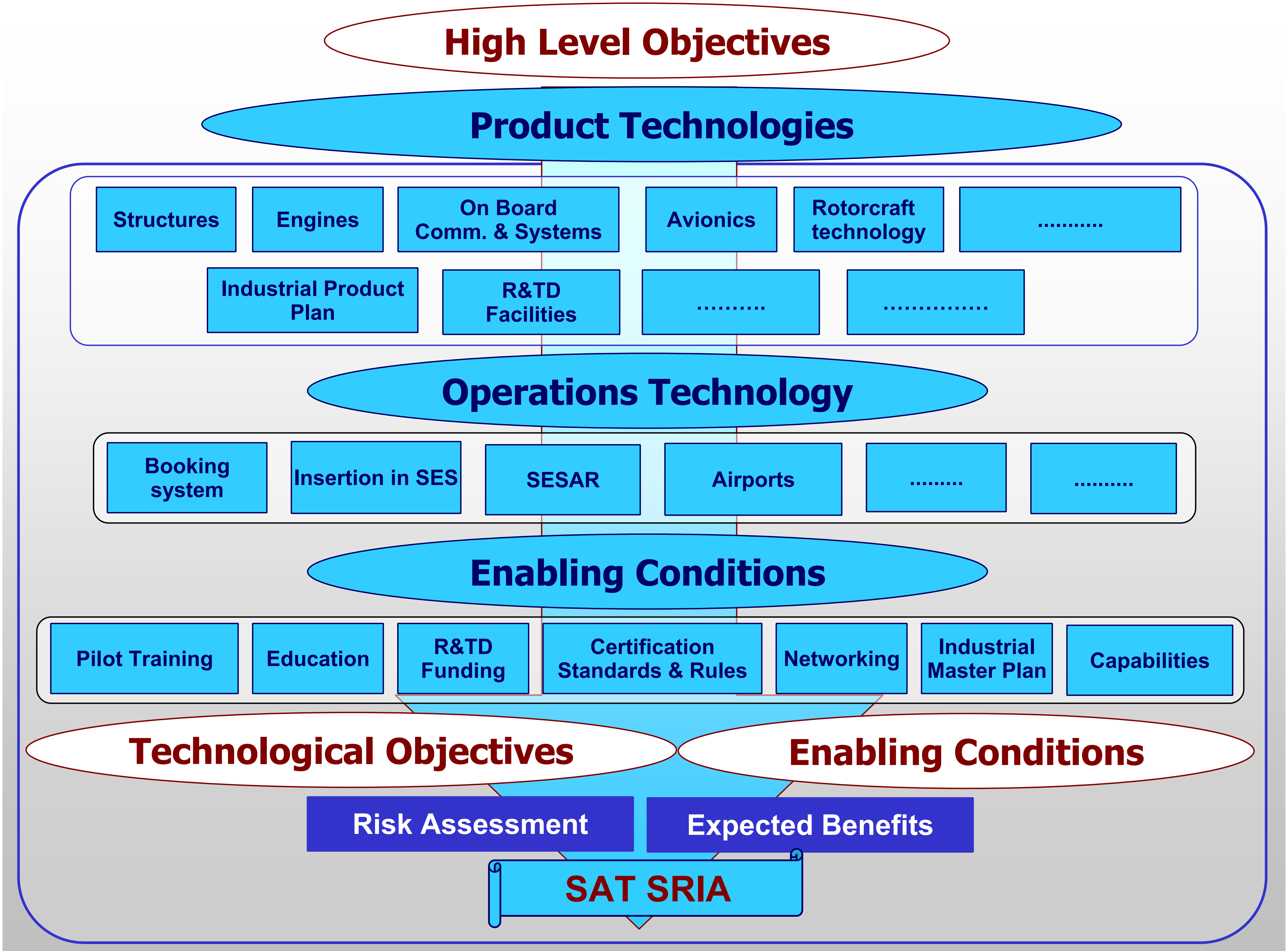


SATroadmap priorities

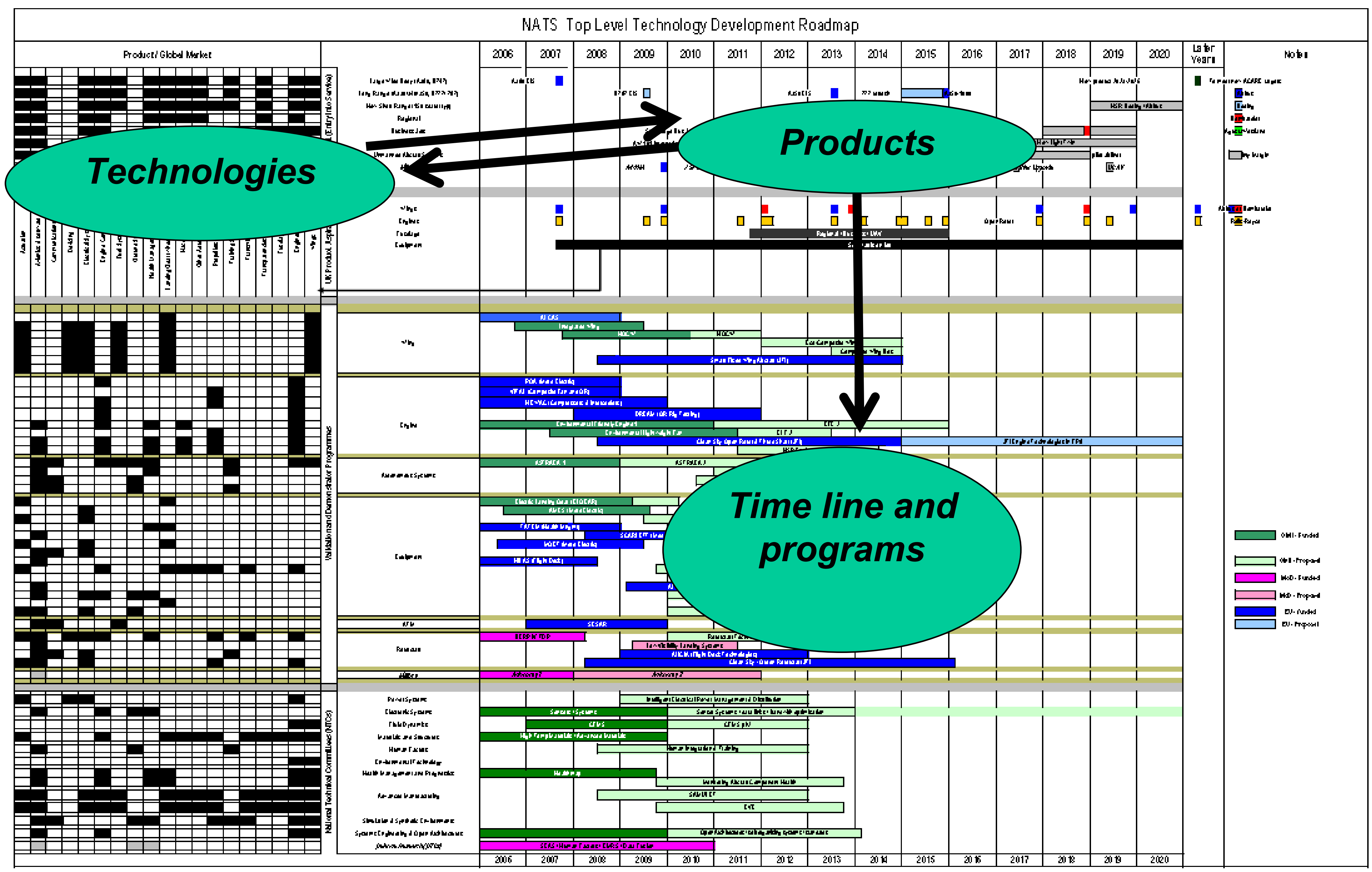
- Refinement of the demand model and conclusions for SATS.
- Functional requirements for a SAT system
- The business case for SAT
- The business models
- Future aircraft concepts and certification
- A stronger industrial base for SAT aircraft production
- A RTD Roadmap for:
  - A (network centric) booking system
  - Novel aircraft technologies (configurations, engines, avionics, cabin etc.)
  - Adaptation of airports and ATM
  - Crew training

Turning SAT mode into practice




High Level Objectives
Product Technologies
Structures
Engines
On Board Comm. & Systems
Avionics
Rotorcraft technology
....
Industrial Product Plan
R&TD Facilities
....
....
Operations Technology
Booking system
Insertion in SES
SESAR
Airports
....
....
Enabling Conditions
Pilot Training
Education
R&TD Funding
Certification Standards & Rules
Networking
Industrial Master Plan
Capabilities
Technological Objectives
Enabling Conditions
Risk Assessment
Expected Benefits
SAT SRIA

Ultimate product: Example NATS roadmap



Essential conclusions first: Vision

Question 1:

Do you agree with the following statement:

A small aircraft transportation system, based on small sized aircraft, operating on commercial scheduled or non-scheduled on demand flights from a standard airports and small airfields network, should be accepted as a component of the European (Air) transportation system

Essential conclusions first: Vision

Do you agree with the formulated goal:

The main goal of the small aircraft transportation system is to provide fast passenger transport service

- ***the needs of passengers along city pairs with low intensity traffic (also in Central Europe),***
- ***as well as the needs of remote regions with an underdeveloped transport infrastructure***
- ***for European business travel needs,***

thus enabling door to door travel between EU regions/ city pairs at a flying distance of up to 4 hours.

Essential conclusions first: Vision

Do you agree that this goal might be met by 2020 using currently existing aircraft, infrastructures and ICT mostly?

(Or to put it in an alternative way:
Do you think that aircraft, infrastructures and ICT need further development to enable a SAT system in 2020?)

Questions?

SAT-Rdmp Workshop,
Brussels, September 28, 2011

WP2:1 Small Air Transport Aircraft Demand

Isabelle Laplace, M3 Systems
Stefaan Ghijs, Fly Aeolus
Daniel Rohacs, University of Budapest

WP2:1 Small Air Transport Aircraft Demand

Context and objectives

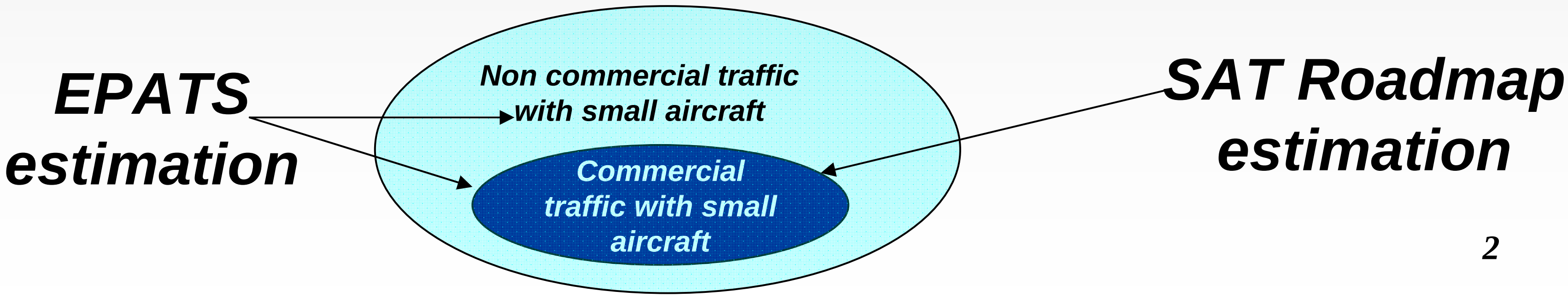
<u>WP context:</u>

•Gross estimation of the potential transfer of traffic to Personal Air transport made in the EPATS project (2008): 43 million flights in 2020 (commercial and non commercial flights with small aircraft)

•<u>In the project SAT-RDMP we focus on commercial flights</u> with small aircraft

<u>WP Objective:</u>

Estimation of the small air transport demand in 2030 for commercial purpose



How getting Small Air Transport demand estimation?

1. *Model building*
2. *Model validation for the base year 2010*
3. *Estimation results for 2030*
4. *Sensitivity analysis*

How getting Small Air Transport demand estimation?

1. *Model building*
2. *Model validation for the base year 2010*
3. *Estimation results for 2030*
4. *Sensitivity analysis*

Choice of the applicable demand model

•*State-Of-the-Art made between existing applicable demand model*

•*One method reveals the most relevant for estimating the small air transport aircraft demand:* ***The Generalized cost model,*** *based on the generalized cost maximisation principle*

- *Data available*
- *Estimation technically feasible within the specified time frame*
- *The model can be easily operated, maintained and validated*
- *Sensitivity analysis can be made*

Generalized cost model

Generalized cost model :

$$C_g = C_{monetary} + \sum C_{non\ monetary}$$

•Monetary: direct cost borne by the traveller (out of pocket cost)

•Non monetary: cost associated to the time spent in the travel (subjective cost)

•Main principle: a traveller will choose the transport mode that minimizes his/her generalized cost

Monetary cost

The direct cost of travel by transport mode groups:

• *The direct cost borne to access the transport mode (e.g. access cost to the airport):* **Caccess**

• *The direct cost borne for travelling with the transport mode (air fare, cost of car using, etc.):* **Ctransp**

• *The last direct cost borne to leave the transport mode and reach the final destination:* **Cegress**

$$C_{acces} + C_{transp} + C_{egress}$$

Non Monetary cost

The cost of time depends on:

- *The time spent in traveling*
- *The value that the traveller attributes to this time*

The travel time can be separated in:

- *The access time (access to transport terminal+time spent at terminal for procedures)* T**access**
- *The journey time* T**transp**
- *The time to reach the final destination* T**egress**
- *The additional time (breaks made in very long-distance trips performed by car)* T**add**

$$V_T.(T_{acces} + T_{transp} + T_{egress} + T_{add})$$

Improvements in the new model compared to the EPATS model

•Use of more accurate travel time between NUTS2 connections thanks to the use of *the ETIS* database (European Transport Policy InformationSystem) taking in consideration the available infrastructure

•Use of more accurate values of time:

- One specific value of time for each person traveling on a certain connection: *values of time are generated by a Monte carlo simulation based on a survey that investigated the annual income of international business travelers*
- Different values of time by segment of the entire door to door travel process (access time, waiting time, in vehicle travel time, Egress time) to take into account that people experience different parts of the travel process in a different way

•Use of information on service frequency: for commercial airlines and high-speed rail companies

Transport modes

Considered transport modes:

- *Car*
- *Commercial airlines*
- *High-speed railway companies*
- *Small air transport aircraft*

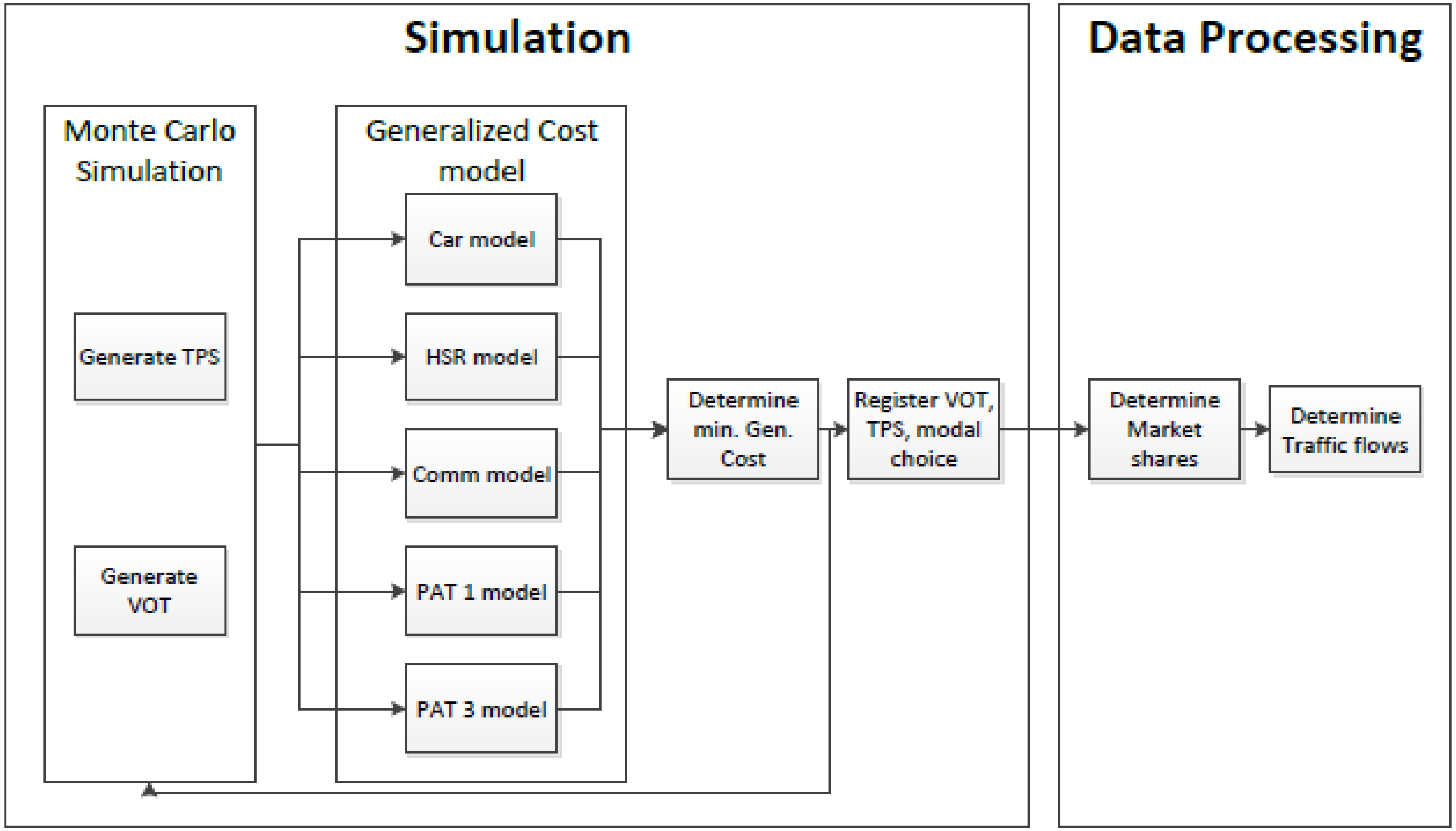
Three categories of small air transport aircraft:

- *Piston*
- *Turboprop*
- *Jet*

Data sources:

- *ETIS (European policy Transport information System)*
- *DATELINE*
- *UK survey on international business travellers*

New built model



How getting Small Air Transport demand estimation?

1. Model building
2. Model validation for the base year 2010
3. Estimation results for 2030
4. Sensitivity analysis

Demand estimation for 2010

In 2009, traffic of 239 000 commercial flights (source EUROCONTROL, *„Getting to the Point:Business Aviation in Europe", 2009*) with small aircraft

Estimation provided by the model for 2010 is:

209 000 commercial flights with small aircraft

⇒ Coherent estimation with known traffic estimations of small aircraft

How getting Small Air Transport demand estimation?

1. Model building
2. Model validation for the base year 2010
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Demand estimation for 2030

Assumptions made between 2010 and 2030:

- Fuel cost variation: +3.7% per year
- Car cost variation: multiplied by 1.39 between 2010 and 2030
- Commercial airlines fares variation: 1% per year
- High-speed rail fares variation: 1% per year
- Small aircraft cost variation: -20% between 2010 and 2030

Total demand estimation for 2020-2025 (EPATS)

For the 2020-2025 period EPATS estimated a total traffic of:

43 million commercial and non commercial flights with small aircraft

Yearly traffic growth of 5.4% between 2005 and 2025

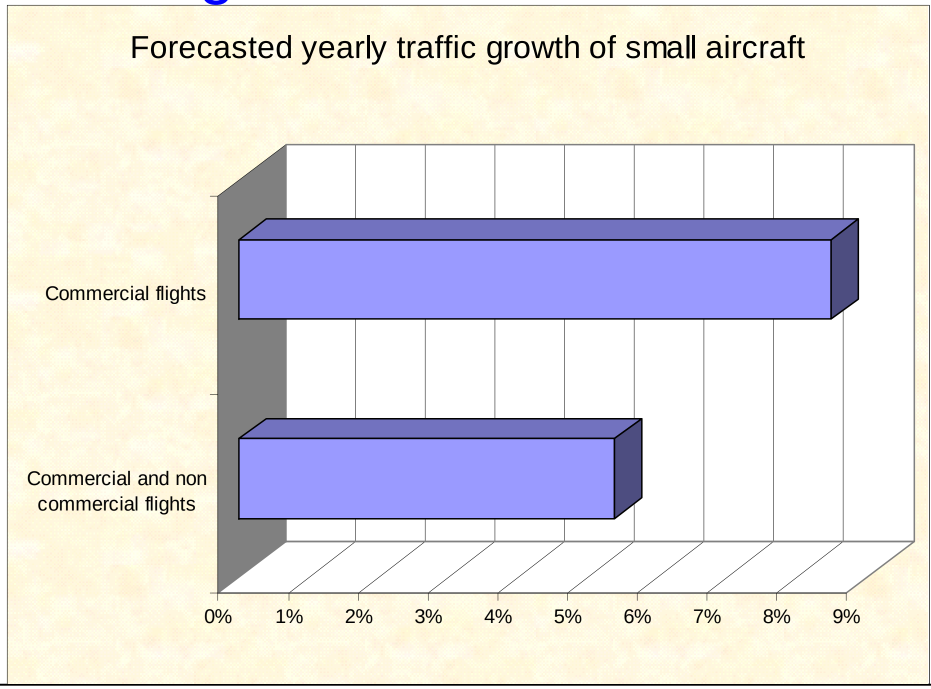
Coherent with the average traffic growth of 5% estimated by EUROCONTROL in „Business Aviation in Europe in 2010“

Demand estimation for commercial flights in 2030

Estimation provided by the model for 2030 is:

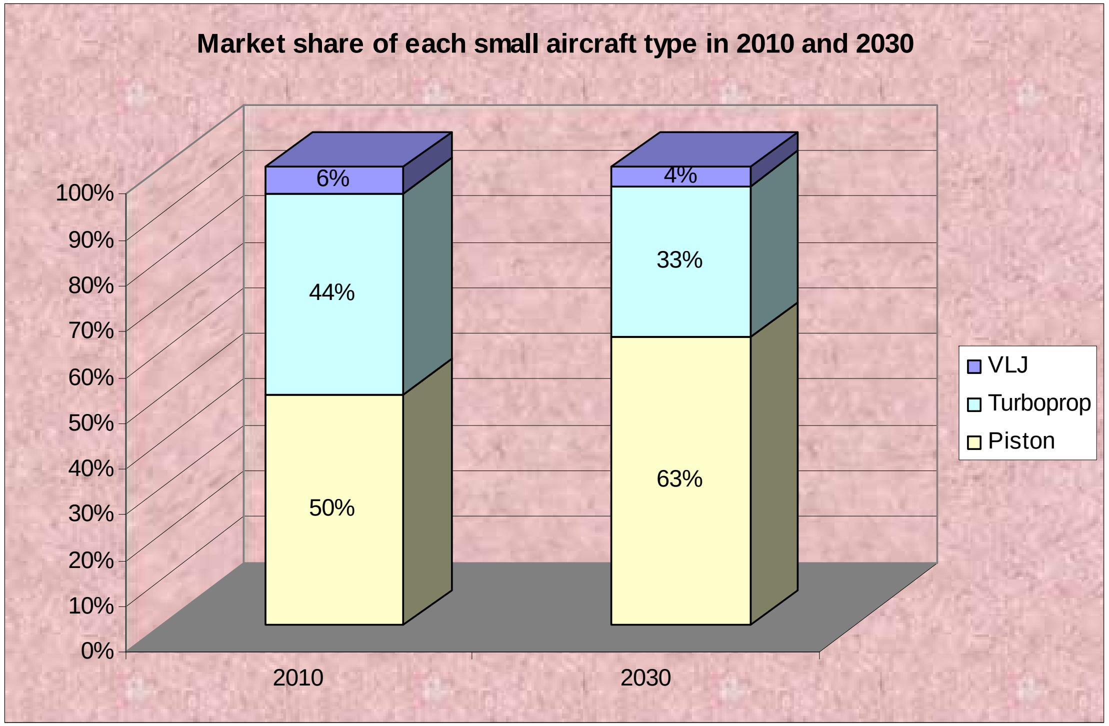
1.1 million commercial flights with small aircraft

Yearly traffic growth of 8,5% between 2010 and 2030



Demand estimation for commercial flights in 2030

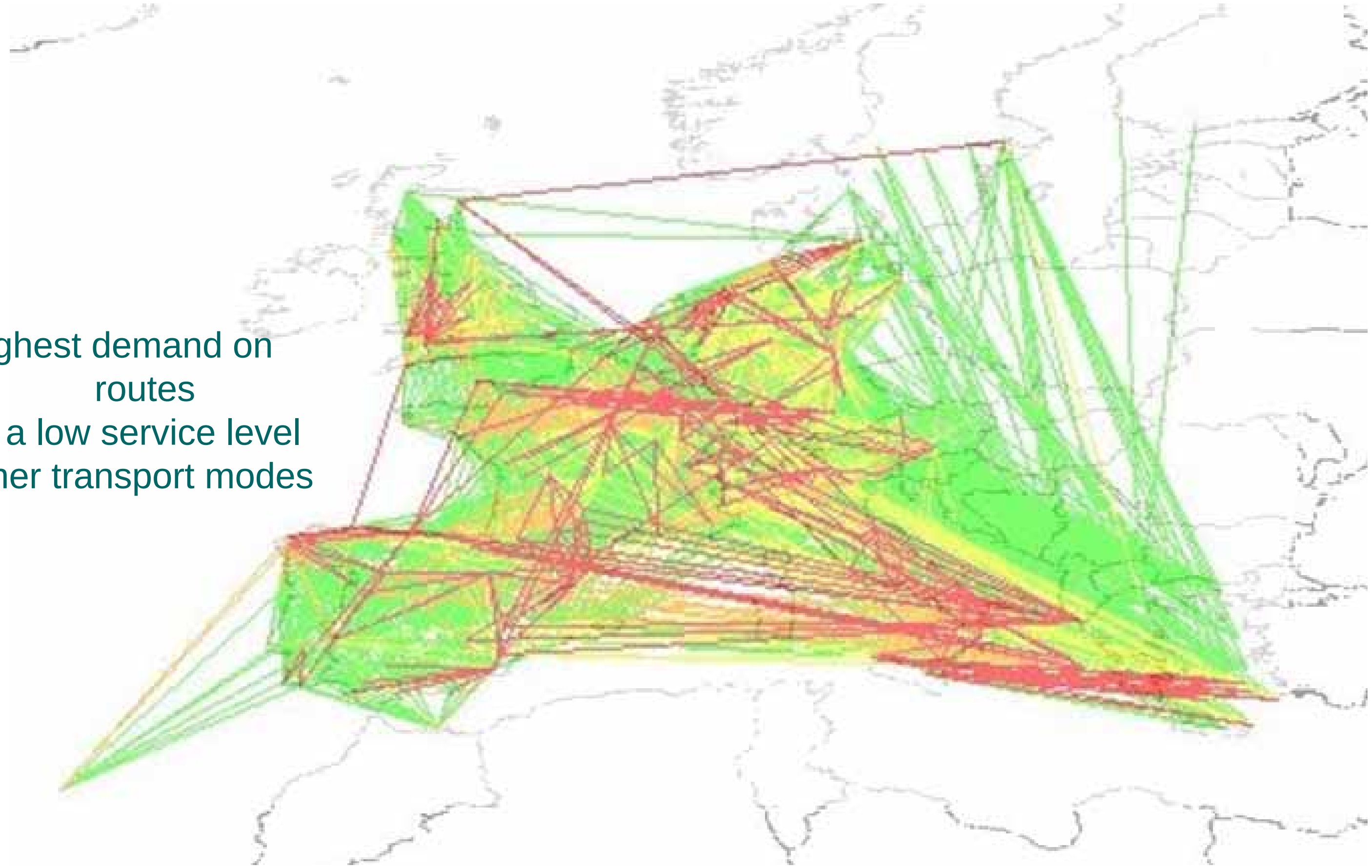
Increase of the Piston aircraft market share



WP2:1 Small Air Transport Aircraft Demand

Commercial personal aviation demand forecast by region

Green: 2-5, dark green: 5-1, orange: 12-25, red: 25+ flight / day



Highest demand on
routes
with a low service level
of other transport modes

How getting Small Air Transport demand estimation?

1. Model building
2. Model validation for the base year 2010
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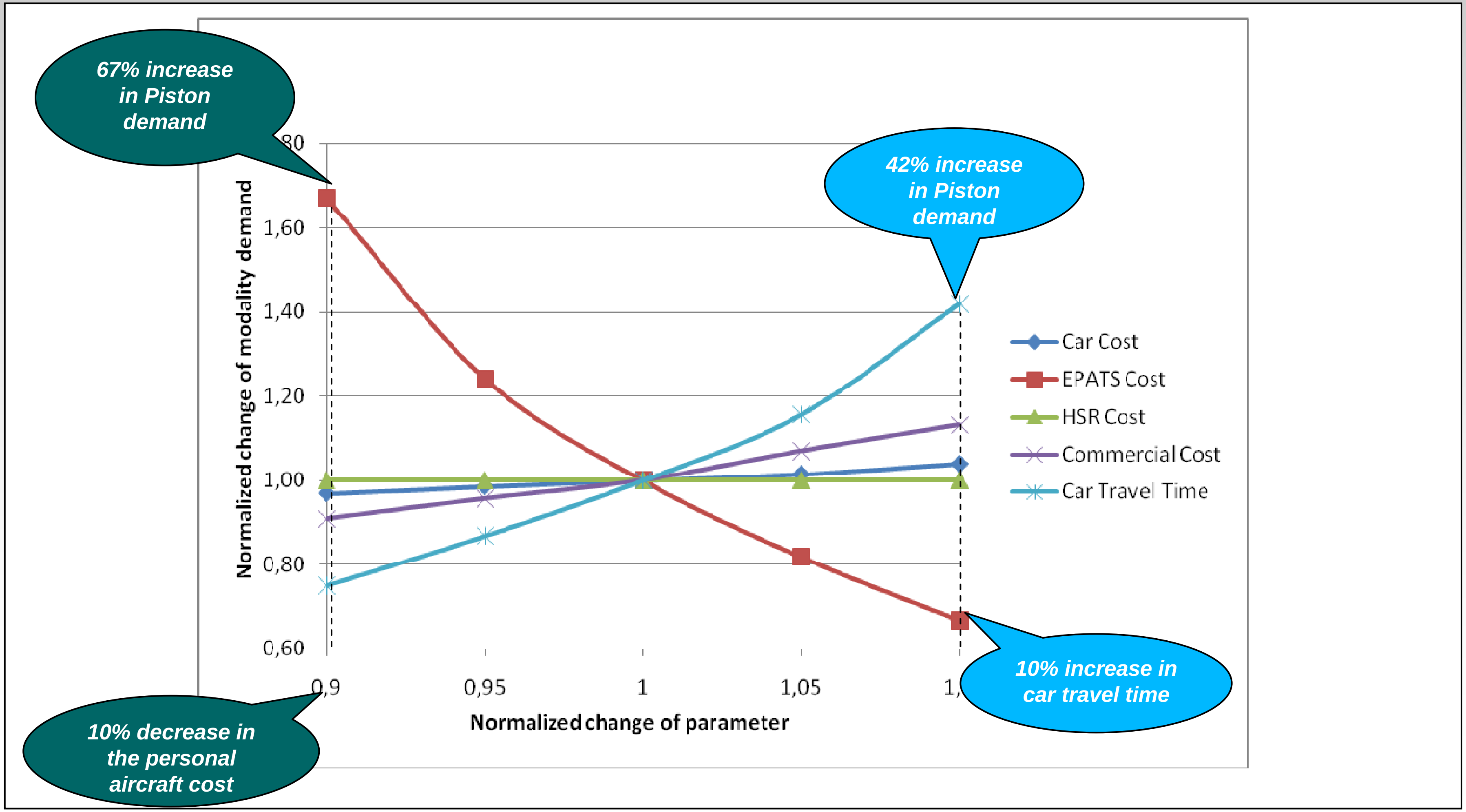
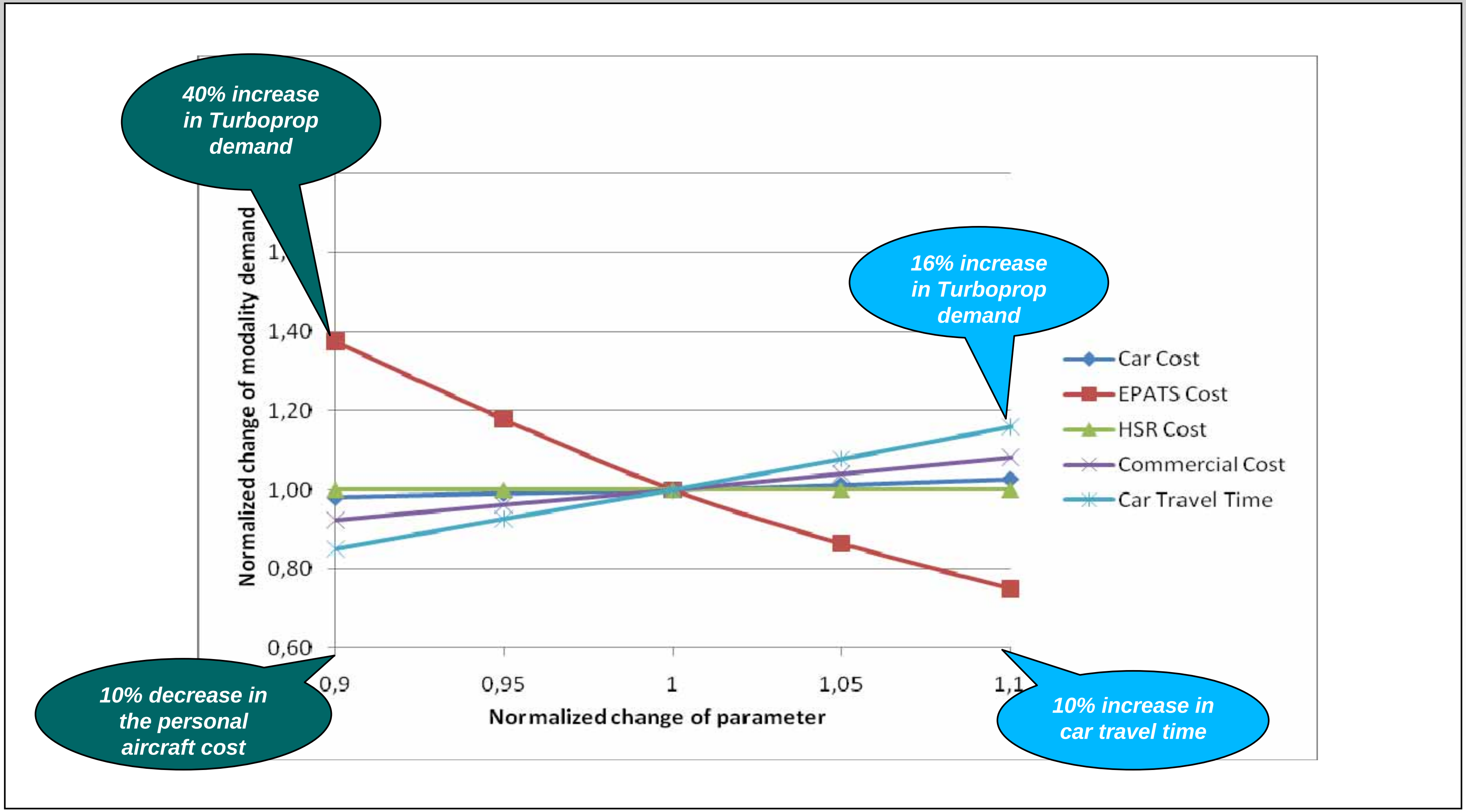
4. Sensitivity analysis

Piston aircraft demand sensitivity

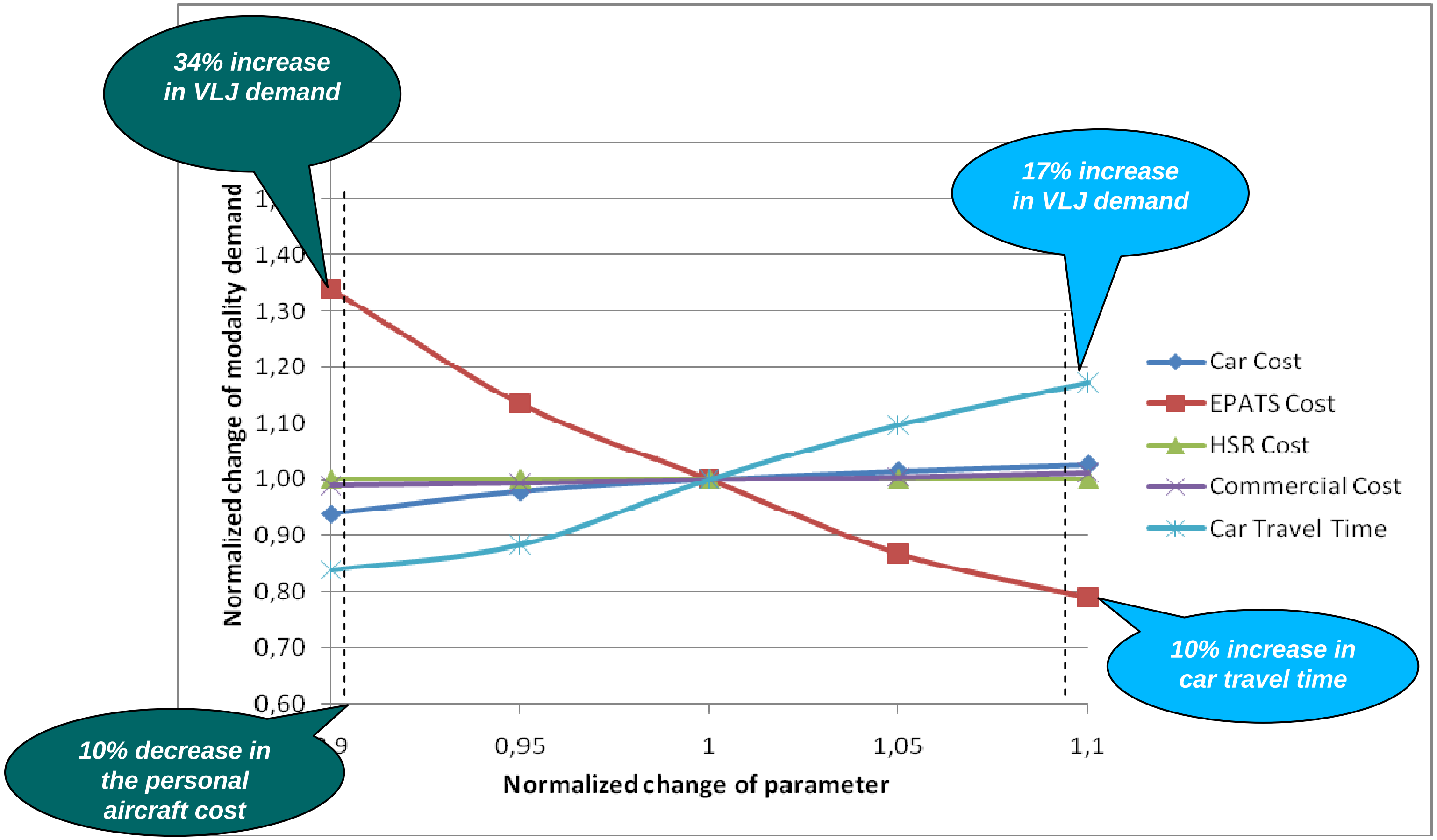


Turboprop aircraft demand sensitivity



WP2:1 Small Air Transport Aircraft Demand

Very Light Jet aircraft demand sensitivity



Concluding remarks

Features of future small air transport demand:

- Higher yearly growth rate for commercial flights (8% vs 5% for commercial and non commercial flights)
- Increase in the Piston aircraft market share (63% vs 50% in 2010)
- Highest demand on routes with a low service level of other transport modes
- High sensitivity of personal aircraft demand(especially for Piston aircraft) to:
  - changes in personal aircraft cost
  - Changes in car travel time (i.e. to road congestion)

Business Case with operational Characteristics (SAT-Rdmp, WP2)

Prof. dr. Ricky Curran
Vincent Schollaart, BSc.

28-09-2011

Small Air Transport – Roadmap, WP2

Overview

- SAT-Rdmp: WP2
- Research Question
- Research Methodology
- Main in- & output paramenters
- Business Cases
- Model
- Conclusion

SAT-Rdmp: WP2

Goals

- Define the **most profitable business case** for commercial Small Air Transport Operations
- Define the economic, environmental and safety **impact** of different business models
- Define the major influential **variables on the impact** parameters of each business model

Research Question

*How to **model** and find the **most profitable business case** for **personal air transport** in **Europe** in **2030**, starting from the demand forecast of the previous part (WP1) of the SAT-Rdmp, so that the **economic impact**, **safety** and **sustainability** are reflected in the output, which is **robust**, can be **validated** and is **implementable** into the next phases of the SAT-Rdmp project?*

Research Methodology

Why, How, What?

- I. Initial research
  - SAT-Rdmp WP1, Eurocontrol, Air taxis, WP2 requirements...
- II. Business cases development
  - Developing a new business case (A. van der Star), GISSCIO protocol (R. Janssen)...
- III. Model construction
  - Development of an aircraft routing system (K. Wils), Simulating air taxi networks (P. Bonnefoy)...
- IV. Model application
- V. Evaluation and validation of the results

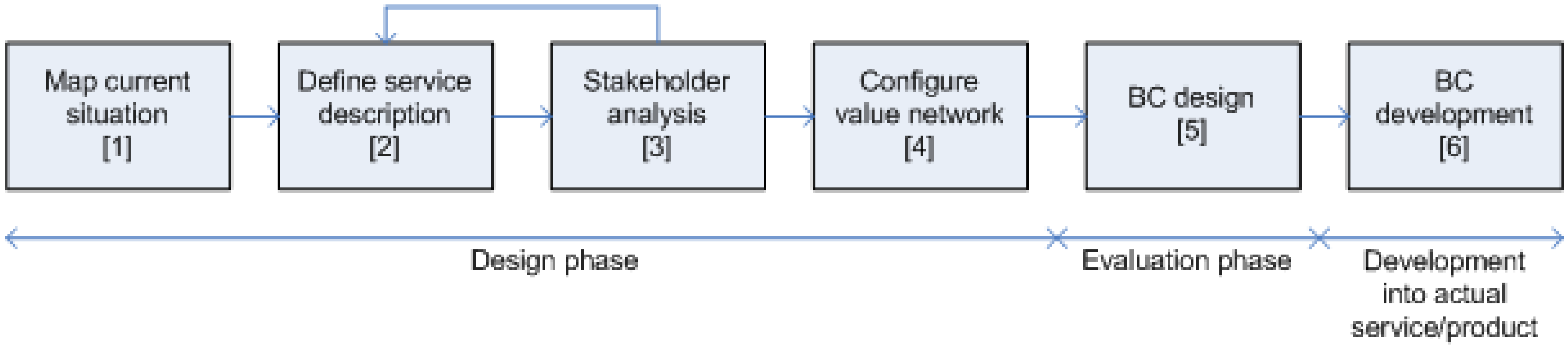
Input parameters

- Operations region
  - Europe, focus on region/country/airports
- Aircraft
  - Single vs. multiple types, leasing vs. buying, operational (cost) factors (maintenance, crew, hangar, Flight Hours/year…)
- Fare Structure
  - Ticket per aircraft/seat/(round) trip, on demand vs. semi on demand, dynamic pricing
- In flight accessories and attachments
  - Low cost vs. luxury flights
- Flight route determination
  - Influence of Air Traffic Control (ATC) or (un)controlled airspace, optimizing systems and routes, weather influence…

Output parameters

- Profitability
  - Revenue estimation, profit margin estimation, yield management...
- Economic impact
  - Compared to (other) transportation means (QSI)
- Safety impact
  - Risk assessment of single engine aircraft (J. Bradley)
- Environmental impact
  - Emission model (D. Rohacs)
- Other important factors
  - Direct operating cost, annual utilization rate, load factor, energy efficiency facto

Business Cases
Development



- Detail [2]: Define service description
  - Service
    - Detail: Target group, context of use, primary value proposition, previous experiences, raters, effort, service
  - Technology design
  - Organization design
  - Finance design

Business Cases

Development example: I. 100% Piston

- Service description
  - Target group: 63% piston market, range efficiency, low cost PAT
  - Context of use: Dense market (avoid empty flights, time)
  - Primary value: Low ticket price (plane sharing) + short travel time
  - Previous experience: Imagine Air, Fly Aeolus (Cirrus SR-22), SATSair (flight operations optimization system)
  - Rates: Low cost, dynamic pricing, plane sharing
  - Effort: Keep effort customer low
- Technology
  - Aircraft, safety impact, environmental impact...
- Organisation
- Finance

Business Cases

I. 100% Piston

- Demand WP1 (target group): 63% piston market
- Aircraft: Cirrus SR 22 (fleet size variable, leasing)
  - Max. Distance: 800km

- Market focus: Spain (25% of European demand, 88% domestic, keep empty flights limited)
- Service (on demand, plane sharing, in flight accessories limited, low cost)
- Vertical integration (marketing, maintenance, cleaning, ground support...)

Business Cases

II. 63% piston, 33% turbofan, 4% VLJ

- Demand WP1: 63% piston market, 33% turbofan, 4% VLJ
- Aircraft: Mixed fleet (fleet size variable, leasing)
  - Wider range (up to 2100km)
- Market focus: Spain + chance of broadening to France, Italy (2/3 of PAT market, keep empty flights limited)
- Service (on demand, in flight accessories, ‘Frequent Flyer Program’...)
- Vertical integration (marketing, maintenance, cleaning, ground support...)

Business Cases

III. 100% VLJ

- Eurocontrol demand forecast: VLJ favorable
- Cessna Citation Mustang (fleet size variable, leasing)
  - Max. Distance: 2100km
- Market focus: Spain + chance of broadening to France, Italy (2/3 of PAT market, keep empty flights limited)
- Service (on demand, in flight accessories, 'Frequent Flyer Program'...)
  - More expensive, yet faster, more luxury and wider range
- Vertical integration (marketing, maintenance, cleaning, ground support...)

Business Cases

IV. Combination piston, VLJ

- Demand WP1: 63% piston market
  + Eurocontrol: VLJ favorable

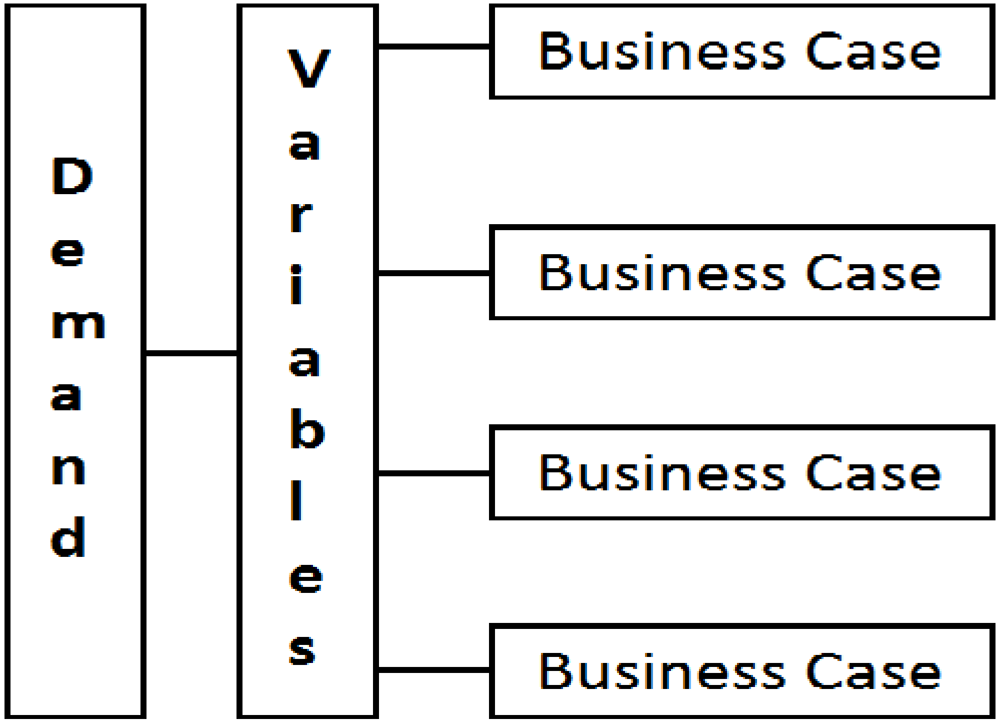
- Aircraft: Mixed fleet (fleet size variable, leasing)
  - Wider range (up to 2100km), yet low cost also possible

- Market focus: Spain + chance of broadening to France, Italy (2/3 of PAT market, keep empty flights limited)

- Service (on demand, in flight accessories or low cost, ‘Frequent Flyer Program’...)

- Vertical integration (marketing, maintenance, cleaning, ground support...)

Model


Demand
Variables
Business Case
Business Case
Business Case
Business Case

Conclusion

- Four business cases, 2030
  - 100% piston
  - 63% piston, 33% turbofan, 4% VLJ
  - 100%VLJ
  - Combination piston, VLJ

- Model
  - Benchmarking

Questions?

Common Vision Workshop
on
Small Aircraft Transport (SAT) Mode

Future Aircraft Concepts

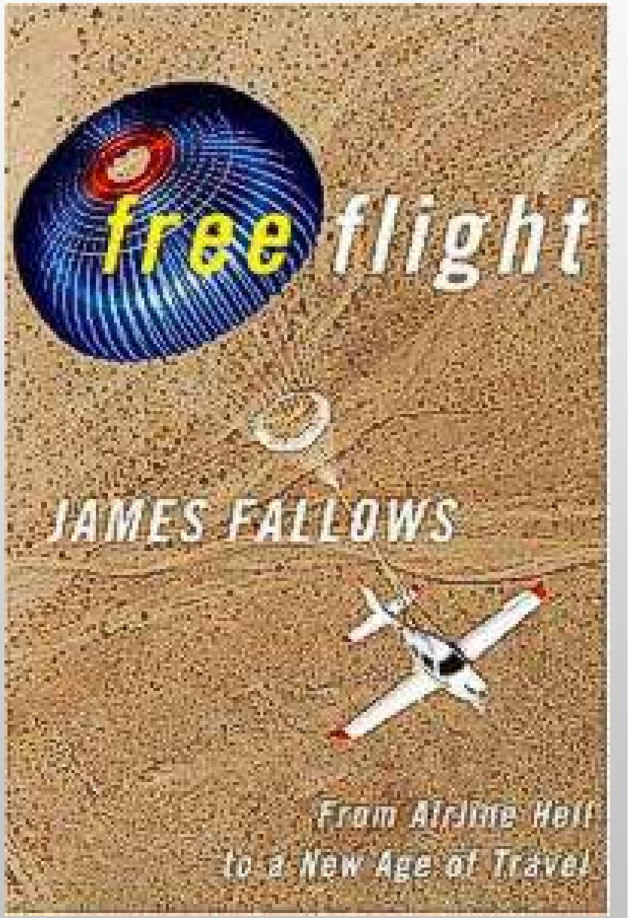
(Business, GA and Small Transport Aircraft)

A. Cozzolino (Piaggio Aero)

Brussels, September 28, 2011

The GA enthusiasts

- Written in 2002 by aviation enthusiast it attempts to make a convincing arguments on GA efficient way for travel
- Fallows presents his case for how future GA planes could make point-to-point travel to smaller airports in the U.S
- Fallows describes two programs :
  - New-generation light planes, the SR-20, by Cirrus Design Corporation
  - The development of the revolutionary Eclipse Aviation light jet



Ten year later results: Cirrus Last Option

- Cirrus Aircraft has led sales of four-place light aircraft for nine consecutive years, delivering nearly 5,000 new piston-engine composite airplanes

- In February 2011, due to the little interest of American investors Cirrus was sold for US$ 210M to China Aviation Industry General Aircraft (CAIGA), a subsidiary of Aviation Industry Corporation in order to finance production

- Without this sale, Cirrus was fundamentally bankrupt

Ten year later results: Eclipse Failure

- After a loss of well over $1 billion on November 2008 the bankrupt of Eclipse Aviation was declared and only 260 aircraft were delivered

- A disaster of this size has many causes, but the most fundamental was a fantasy about the economics of designing, building and supporting airplanes.

- The failure of Eclipse has shown how much differences exist from a concept of way to travel to the real execution.

Free Flight Concept is still valid ?

- In today's hectic world, flexible transportation is ever more important and GA (from piston engine aircraft to sophisticated Business jet) offer the answer to the this request.
- This future is based on new technology and new rules that makes flying easier and more comfortable and more reliable and safer.
- So what are we doing in order to achieve these goals?

Technology

- Most of the avionic technology are available and it allow to delivery 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 GA product are depending on efficient less expensive aircraft power plant.

GA needs not only Technology (1)

- Analyzing the **effect of LSA regulation on sport aircraft** more than 30 new manufacturer entry in the market
  - The GA need a new **simplified CS/FAR23 rules for certification**
  - EASA raised the issue of a new concept for regulation of non complex aircraft, used in non- commercial activities

- **Liability insurance expense:** for general aviation is eight times greater per dollar of sales than for all other aviation markets despite the product liability is now limited to the first 18 years of an aircraft's or parts lifetime, the lawyers are finding ways to prosecute lawsuits anyway

GA needs not only Technology (2)

- **Pilot training:** The accident analysis suggests that the majority are caused by pilot error. This impose to look at how training is done and how it can be improved with may be increasing the number of flight hours

- **Airport & Aerospace accessibility:** Despite efforts, the number of public-use small airports continues to decline and the air traffic management is not getting benefit by the ADS-B technology due to its cost (still too expensive for GA application)

Future of GA aircraft products
The Single Engine Jet

- Many companies are attempted to develop Single Engine Jet GA aircraft for personal transportation (Cirrus, Diamond, Piper, etc.)

- Apart from the enthusiastic view of having an high performance a/c for GA, flying high altitude and high speed aircraft is posing a lot of challenges to the aircraft R&D and pilot training.

Future of GA aircraft products
The Single Engine Turboprop

- We will continue to see the dominance of single engine turboprop replacing the old twin piston engines aircraft. Currently the market is dominated by Pilatus, Cessna, Piper and Socata
- The market segment was challenged by many companies (Aero Vodochody IBIS, Comp Air 12, Vulcan Air etc) with low success.

Future of GA aircraft products

The Light Twin

- The light twin engine market seems to have a glimmer of life, but prices are still flat
- People that need a twin (flight schools) are driven by a low acquisition price

Future of GA aircraft products
The Very Light Twin Jet

- There were about 17 participants in various stages of development: currently only Embraer and Cessna brought new models to production and Honda is following (3rd Q 2012)
- The VLJ aircraft are filling the gap between market driven by owner pilot and professional business aviation

Future of GA aircraft products

The Ultra Long Range Business Jet

- The globalization of the economy is pushing up the market need for to business travels on long distances. This is well recognized by big Business jet players (Gulfstream, Bombardier, Dassault)

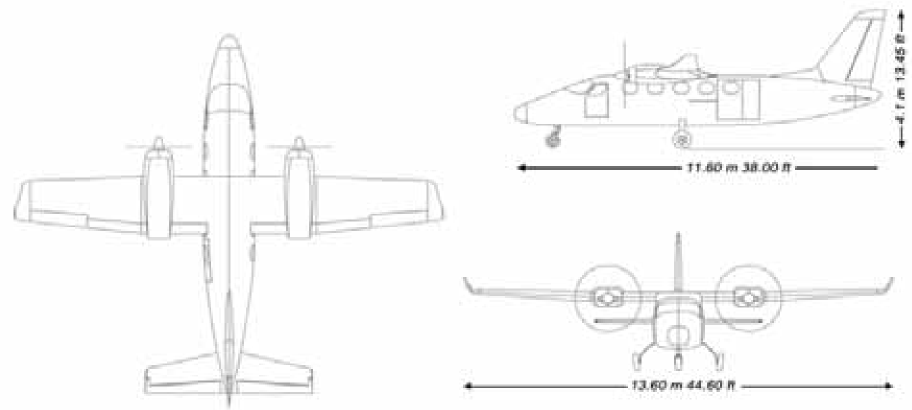
Future of GA aircraft products

The Small Aircraft Commercial Transport

CapeAir Study Case

- Cape Air has served Island-markets with a focus on leisure travel since 1989 and is experienced with the unique transportation needs of Island communities
- With a fleet of two ATR-42s and sixty-two Cessna 402s, Cape Air flies more than 600,000 passengers annually with up to 600 non-stop flights per day and 130,000 flight operations each year
- In November 2010 Cape Air issued an RFP to replace the aged fleet of Cessna 402

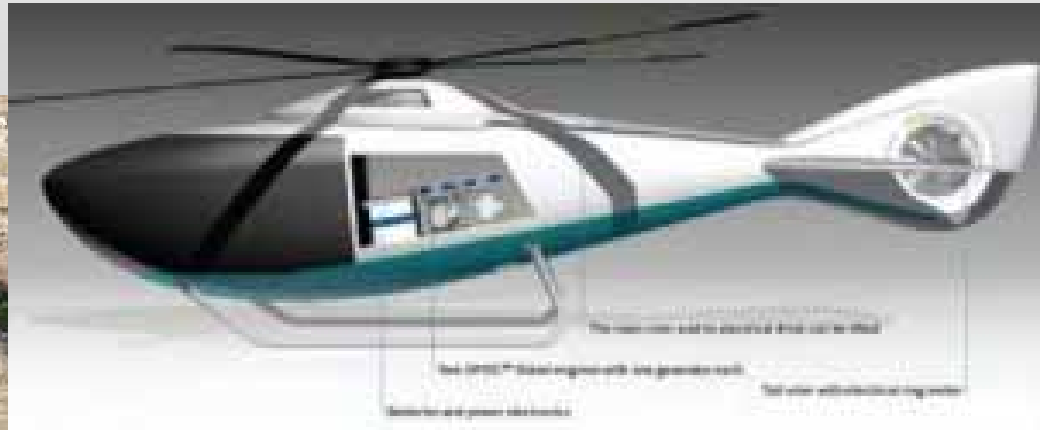
The Small Aircraft Transport
The Tecnam Answer for CapeAir RFP



- Designed to reduce the acquisition and operating cost with high level of reliability, this 9-10 seats a/c will use updated Lycoming 350Hp piston engines and fixed landing gear

Future of light Helicopters

- Innovation is the key to the helicopter industry's future health and small manufacturers of light helicopter need this more than the others
- Powered by new propulsion turbo-shaft or diesel engine this new products can be commercialized at very competitive prices



Conclusions

- GA aircraft is a transportation tool and, ranging from light single piston engine up to sophisticated business jet, have got the potential to service within a flexible transportation system (SATS) answering to medium and long term needs
- Technology has to be focused on reducing pilot workload and improve safety without increasing the acquisition cost
- New concept and new configuration are exotic but the real need are affordability and reliability of GA products.

END

Content

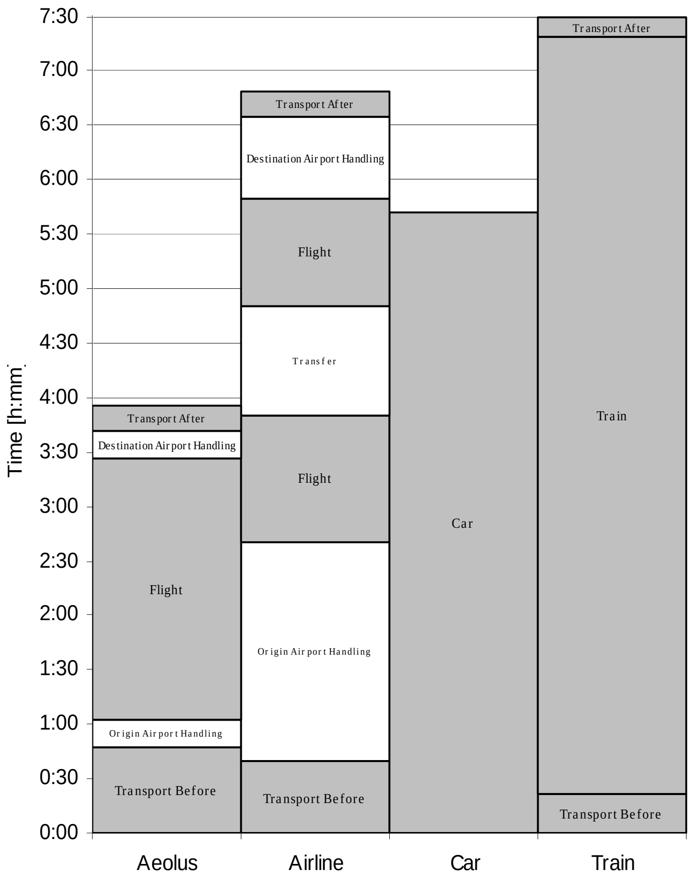
- Fly Aeolus' Product
- Fly Aeolus' Added Value
- Fly Aeolus' Service Area
- Process
- Reservation system
- Front & Back office

"I take it you've never used an air taxi before."

Fly Aeolus offers affordable, on-demand, reliable, door-to-door private flights; according to the customers' itinerary.

- Unique, high volume fleet
- Lean and mean operations (demand=supply)
- Point-to-point network (anticipated demand)
- Small aircrafts gives access to low traffic airports
- Overcapacity of comfortable and safe Cirrus SR22
- Fractional Ownership Program

Fly Aeolus' added value



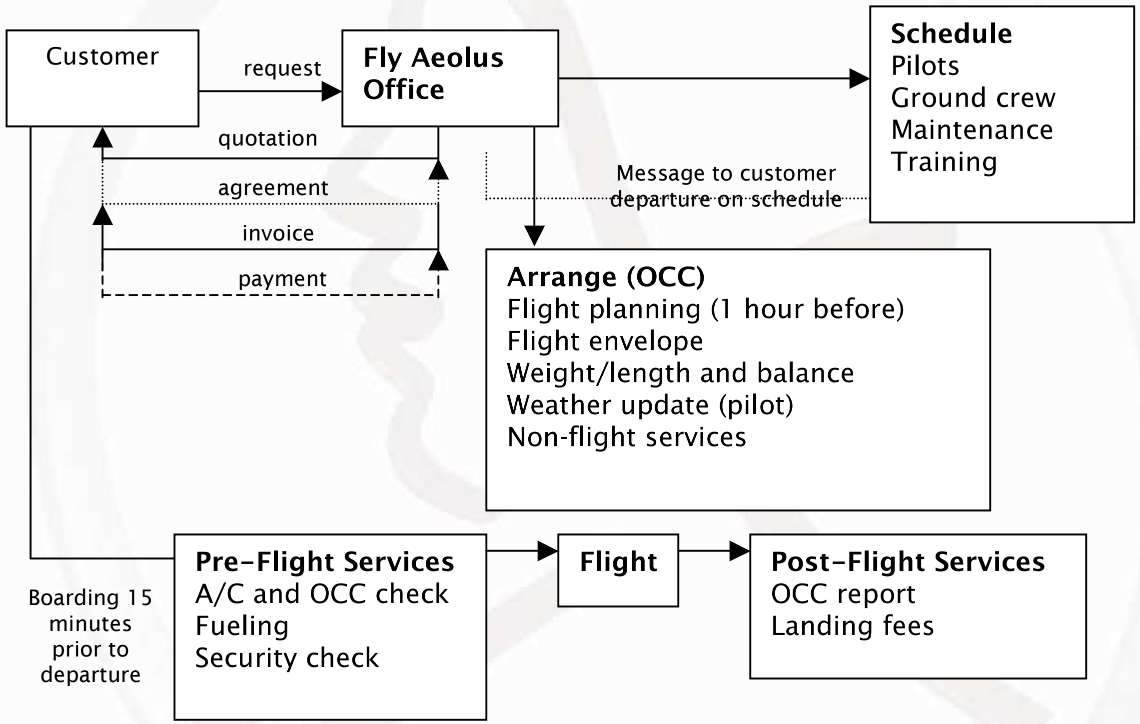
- Time-efficiency is rated before price and comfort
- 75% wants to book through internet
- Fly Aeolus saves business travelers 50% of total travel time
- Fly Aeolus offers its services at the lowest price

Fly Aeolus' service area

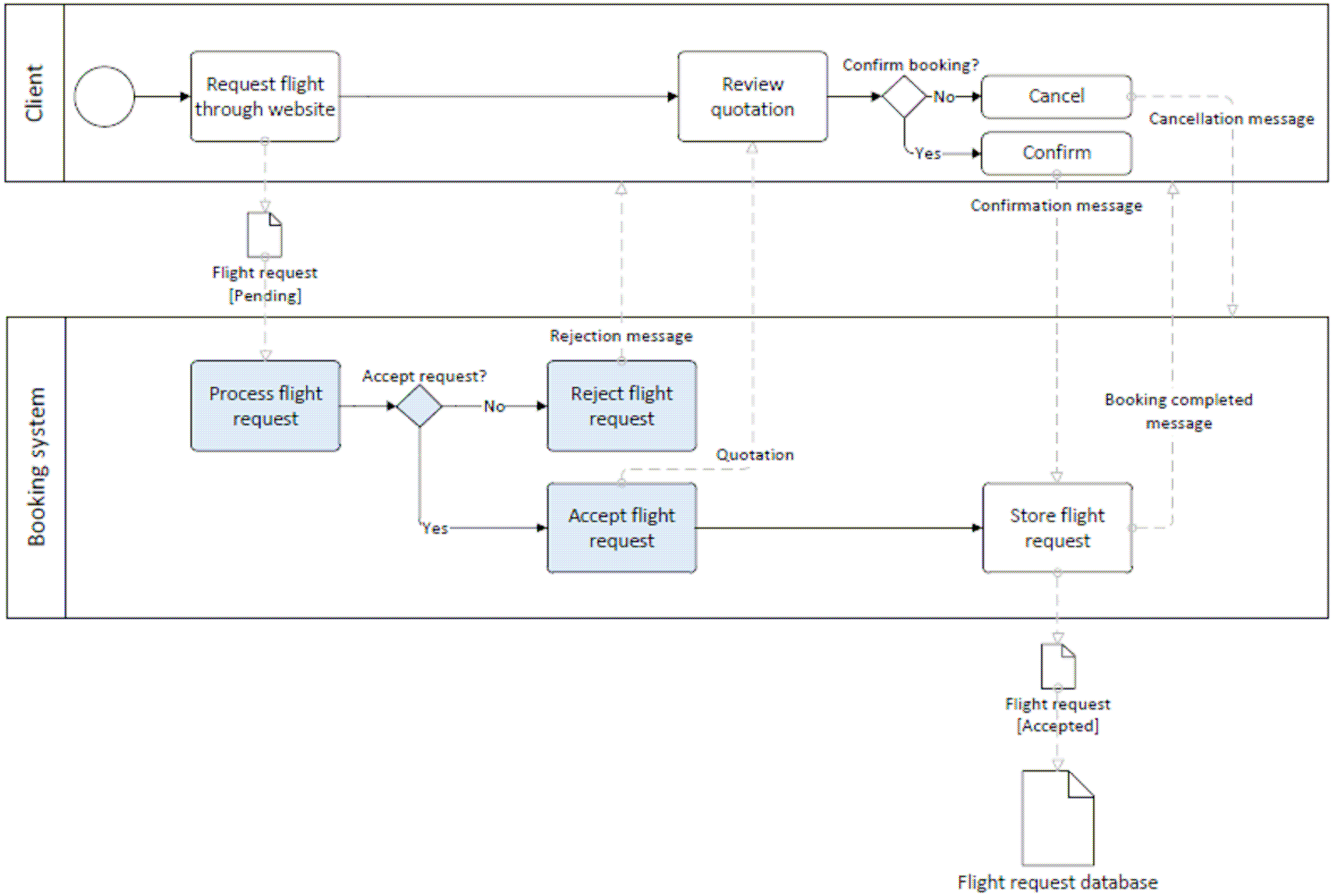
Fly Aeolus‘ service area includes most countries in North-West Europe

- Access to 1200 low traffic airports
- When you want, where you want!
- 20 minutes of check-in time

How does its work? From request, to flying your own personal aircraft



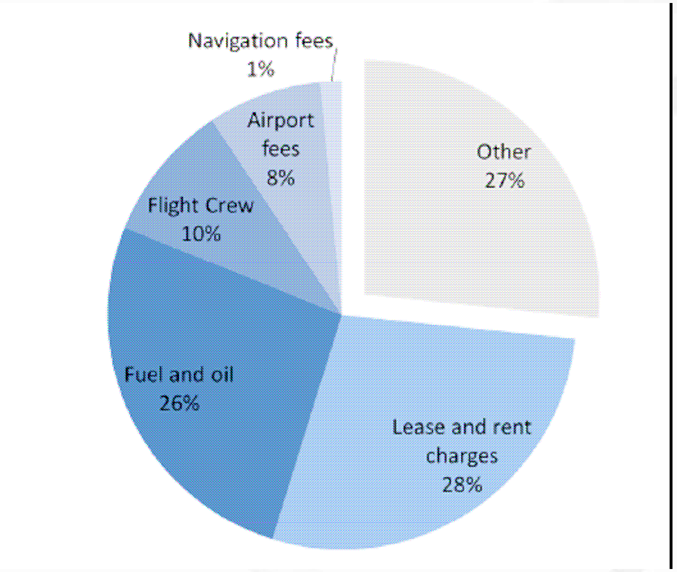
Booking system

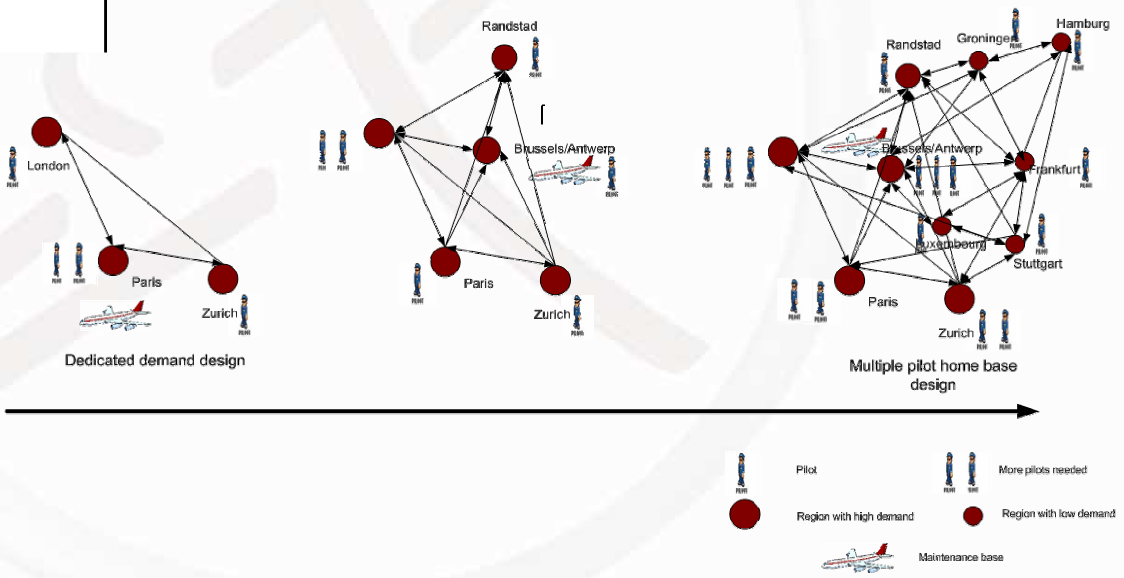


- Flexibility of search criteria
- Dynamic results and filtering
- Route analysis tools
- Instant confirmation
- Seamless e-commerce payment
- Ancillary services
- Account personalization
- CRM
- Connection with other systems
- Leverage third party sales

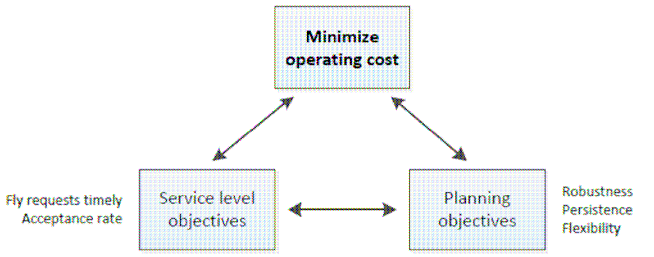
Source: Slipstream

The challenge





Back office



Fly Aeolus' aircraft routing problem

Main objective

Create an aircraft routing plan that covers all flight legs while minimizing variable DOC

Flight legs
- Departure airport
- Date & time of departure
- Arrival airport
- Number of passengers
- Part of coupled request? (Y/N)

Operational requirements
- Aircraft maintenance limit
- Aircraft availability
- Fuel feasibility
- Owner requirements
- Crew duty limits

Aircraft (SR22's)
- Home base
- Lease cost per Hobbs hour
- Fuel and maintenance status
- Availability information

Variable direct operating cost (DOC)
- Variable aircraft cost
- Airport charges
- ATS fees
- Fuel cost
- Variable pilot cost

Secondary objectives
- Robustness
- Persistence
- Flexibility

Scope

72 hour planning horizon

Book now!

Aeolus

www.flyaeolus.com

Enabling Conditions for Operations: pilot availability, SES, level of automations

Cl. Le Tallec

Common Vision Workshop for Small Aircraft Transport Mode, Brussels, 28th Sept 2011

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Pilot availability

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Which issues?

COST

Small aircraft transport = low number of passengers per aircraft

Low number of passengers per aircraft = overall cost of the trip to be divided by a small number:

- **Pilot salary**
- Ground personnel salary
- Air vehicle cost
- Energy cost
- Airport / airfield taxes

Which issues?

LOGISTICS

Pilot Flight Time, Rest, and Fatigue

- Small aircraft transport = high number of short legs

- Flight requests may be concentrated early in the morning and late in the evening

➡ How to organize pilots flight time and rest time?

Which issues?

LOGISTICS

Pilot Flight Time, Rest, and Fatigue

FAA: a pilot is not allowed to accept, nor is an airline allowed to assign, a flight if the pilot has not has at least eight continuous hours of rest during the 24-hour period

- The pilot needs to be able to look back in any preceding 24-hour period and find that he/she has had an opportunity for at least eight hours of rest
- If a pilot's actual rest is less than nine hours in the 24-hour period, the next rest period must be lengthened to provide for the appropriate compensatory rest

Which issues?

HUMAN RESSOURCES

Pilot selection, education and training

Selection - The “right profile” for a pilot will depend on:

- The automation level of the aircraft
- The service that will be provided to him/her:
  - Technical about the aircraft
  - Logistics for the preparation of the flight (airspace, weather, etc.)

Education and training

- To be defined according to the overall system definition … it takes time to educate and train humans!

Single European Sky
Sky to be used for what purpose?

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Politics: what is going to happen in Europe?

SES for long haul flights : no alternative

The Guardian, Monday 18 April 2011
« EU could ground short-haul flights in favour of high-speed rail »
« Transport plan aims to reduce carbon emissions from sector by 60% over next 40 years »

"At Heathrow there are no new runways, but we desperately need to increase capacity and you can do this if you reduce short-haul flight connections," said Kallas. The commissioner added in an interview with the Guardian that the UK should look at the example of Spain, where high-speed rail has hit demand on a previously popular flight corridor.

Politics: what is going to happen in Europe?

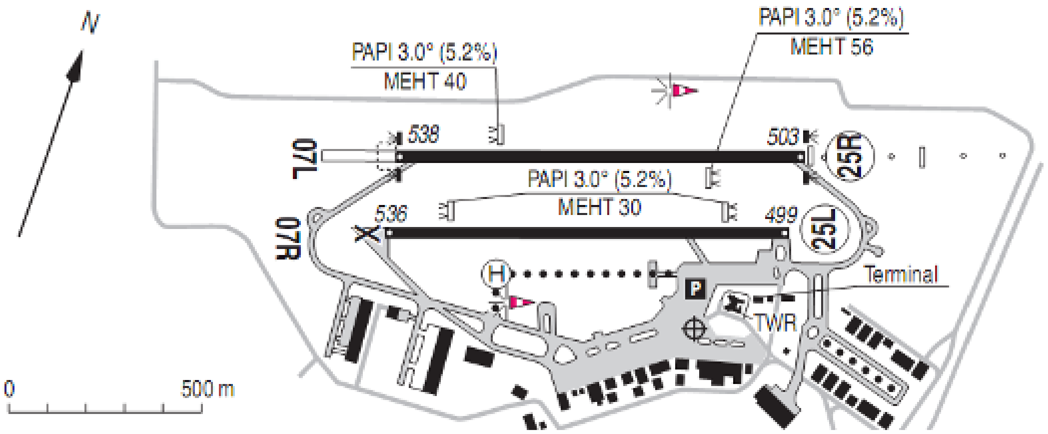
PATS using smaller airfields?

Short haul flights are often used as a first leg for a connections with long haul flights:

- Efficient ground transport to be set up between small and large airports

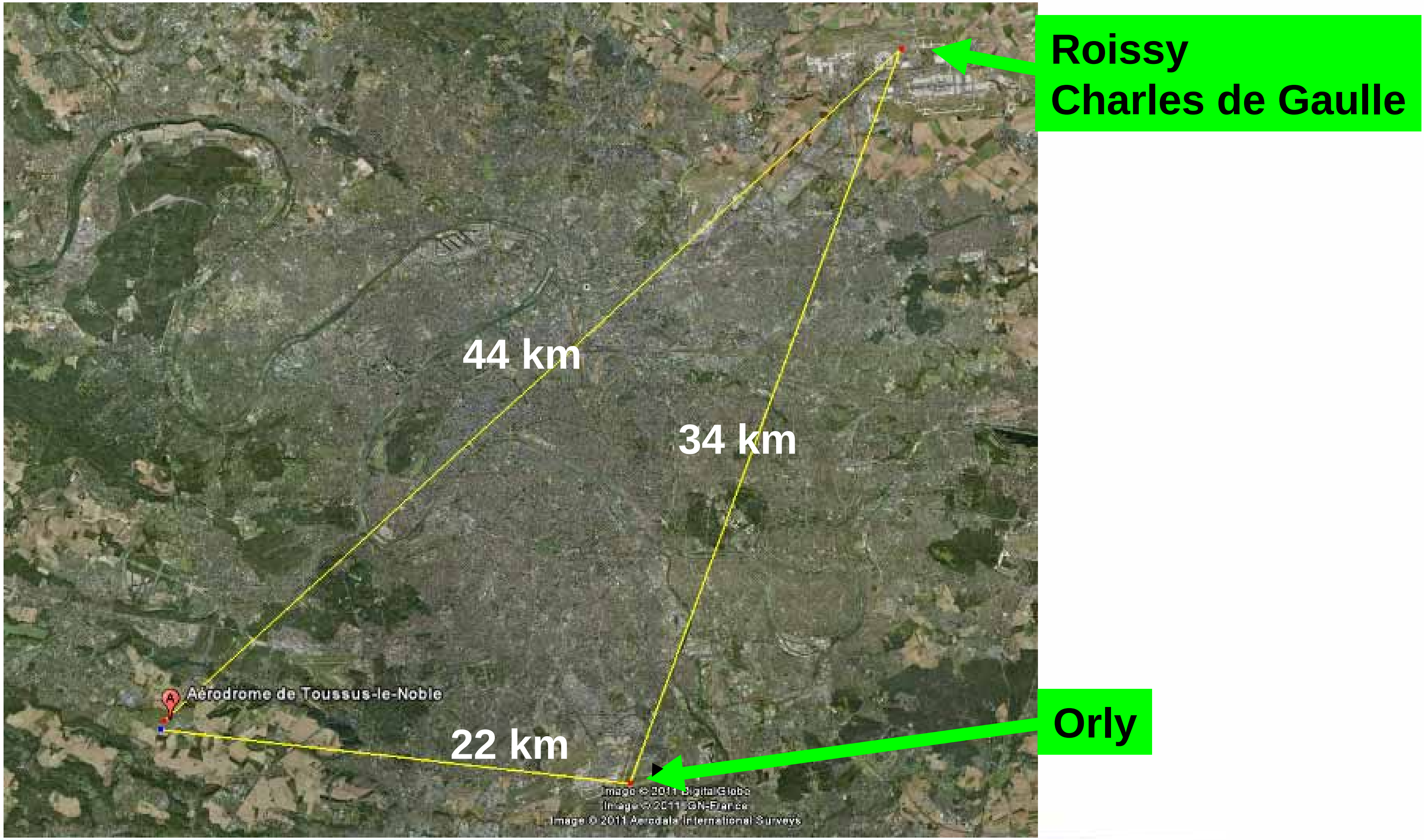
Small airport neighborhood residents not ready to accept additional nuisance…

Let's consider Toussus le Noble near Paris



Politics: what is going to happen in Europe?

Toussus le Noble: ideally situated!



Politics: what is going to happen in Europe?

Toussus le Noble

Journal officiel de la République française, **10 août 2011**

- Airport closed for all traffic equipped with internal combustion engine on Sunday and public holidays between 12:00 and 15:00 (from 1th April to 30th September)
- Traffic limited to VFR flights of Toussus based aircraft from 6 AM to 7 AM
- Traffic limited to Toussus based aircraft when no ATC

Environment
and
Levels of automation

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Which issues?

1. For cost reason, it would be nice to have pilots able to operate several aircraft
2. For logistics reason, it would be efficient to enable air vehicles to fly without anybody on board to be relocated to another airfield
3. For environment purpose, aircraft should be “emission less” and “noiseless”…

Is it reasonable to propose a Small Aircraft Transport Mode with the current technologies and organizations?

Which solutions?

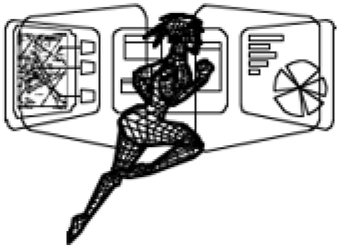
- Electrically powered aircraft
- Highly automated SAT with automated aircraft
- “Ground Pilots” have only to monitor what the aircraft are doing and to make decisions in case the vehicles do not behave as desired
- Several pilots are “operating” several aircraft simultaneously from a remote pilot station
- Situation awareness must enable detection of any derivation from expected behavior

The PPlane project’s primary conclusions tend to promote this long term solution

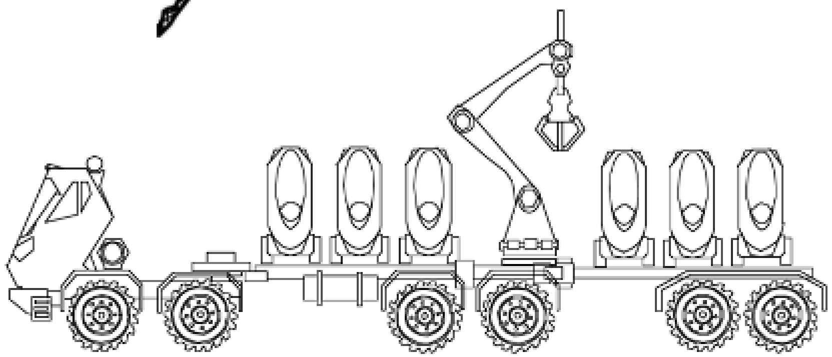
Which solutions? - NASA view

On Demand Mobility Key Components

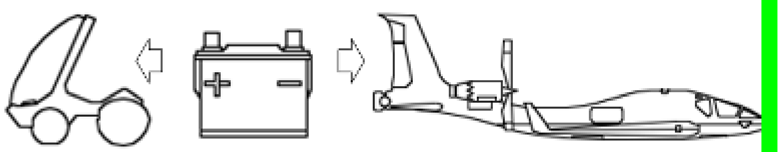
34



1. Absorb most work related daily mobility demand with low environment and resource impact virtual/telepresence technologies. Provides margin for INCREASED air travel and enables Zip Cars to meet short range demand.



2. Expand Zip Car concept to electric, custom-sized vehicles that can be delivered anywhere any time. Eliminate 2nd car ownership requirements. Reduce global manufacturing demand of resources. Provides margin for INCREASED air travel.



3. Expand Zip Car Concept to Electric, Autonomous, On-Demand GA aircraft & local airports. Meets historical driver/Millennials need for flexibility, and increased effective speed. Electric Propulsion Provides margin for INCREASED air travel.

Yuri Gawdiak May 14, 2010

Which solutions? - NASA view

Needed Changes - **NextGen Level 6** plus:

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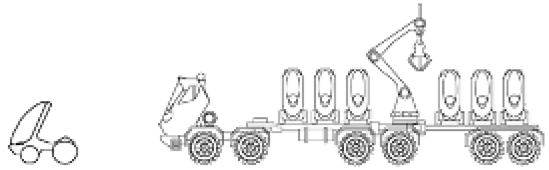
Irrational Daily Traffic Congestion

Large scale 80% Telepresence for work.

Zip Car

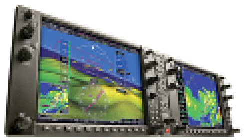


On demand, all electric, custom sized vehicles delivered door to door. Reduces world's significant (200%*) excess capacity of surface vehicles. Lead the World by helping Civilization sidestep unsustainable consumption and thereby preventing a possible Global Resource/Environmental Crisis

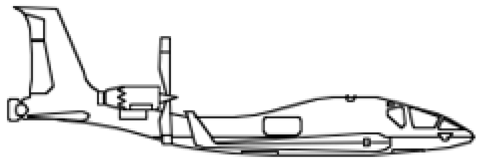
Autonomous Electric Zip GA

Yuneec e340 Electric Airplanes

Adv. GA Autopilots



Global Hawk/Adv Sensors



On demand, Electric, 1-4 passenger custom sized autonomous, sense & avoid aircraft. Meet historic trend of greater flexibility & shorter travel time at affordable costs. Use of parachutes for added safety.

* BTS data for 2007 (at http://www.bts.gov/publications/pocket_guide_to_transportation/2010/pdf/entire.pdf, pages 17 and 19) show an average of 1.58 passengers per car (Excess capacity 5 – 1.58 = 3.42. 3.42/1.58 = 216%

ONERA

No conclusions, only questions…

- How long will it take to set up a Small Aircraft Transport mode based on current technologies?

- Once it is mature, will it still be socially acceptable?
  - Energy consumption
  - Environmental footprint

- How to deal with these issues in SAT Rdmp?

Regulatory Difficulties and Emerging Needs for Regulations

Jiri DUDA, Head of Office of Airworthiness

Small Aircraft Transportation System

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 population,	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.

Small Aircraft Transportation System - regulation framework

- Certification Specification
- Operation requirements
- Licensing- aircraft crew and maintenance staff
- Airports
- Air Traffic Management (ATM)

Small Aircraft Transportation System - regulation framework

Certification Specification

Current core regulations

- CS-23 Amdt. 2 and FAR Part 23, Amdt. 23-59
- Significant standard differences already analyzed

Appeal to Common Vision Workshop stakeholders

- Do you thing CS-23 or FAR Part 23 need significant change?
- Do you thing regulations needs additional requirements for avionics?

Small Aircraft Transportation System - regulation framework

Operation requirements

Current core regulations

- EU-OPS vs. FAR Part 135
- Differences already analyzed

Appeal to Common Vision Workshop stakeholders

- Do you thing EU needs special regulation for on-demand operation?
- Since 2012 all AOC holders to have a 'Management System' which delivers safety management throughout its organization.
  Do you thing current SMS requirements could be manageable for small operators?

Small Aircraft Transportation System - regulation framework

Licensing- aircraft crew and maintenance staff

- **Current core regulations**
  - Part 66, Part 147 for maintenance staff
  - FCL requirements for flying staff

- **Appeal to Common Vision Workshop stakeholders**
  - Do you thing SAT system needs „lighter“ requirements for maintenance staff?

Small Aircraft Transportation System - regulation framework

Airport

Current core regulations

- ICAO requirements and EU directives

Appeal to Common Vision Workshop stakeholders

- Do you thing local airport intended for SAT system needs some mitigation against curent aiports requirements with assuring same level of safety for operators and passengers?

Small Aircraft Transportation System - regulation framework

Air Traffic Management (ATM)

Current core regulations

- ICAO requirements and EU directives

Appeal to Common Vision Workshop stakeholders

- Do you thing SESAR program should include SAT system needs?

THANK YOU FOR YOUR ATTENTION

ANY QUESTION?

Common Vision Workshop
on
Small Aircraft Transport (SAT) System

Approach and Working Group Creation

Brussels, September 28, 2011

Marcello Amato
CIRA Scpa

Ad de Graaff
AD Cuenta

Workshop Approach

- A Discussion Paper was distributed
- Key elements of a vision for a SAT System have been presented in the morning to set-up the scenario
- Two Parallel Session will take place to openly collect views and opinions on key elements of the SAT Vision
- Preliminary Collection of results from Parallel Sessions
- Panel Discussion on three Pivotal Questions
- SAT-Roadmap next steps

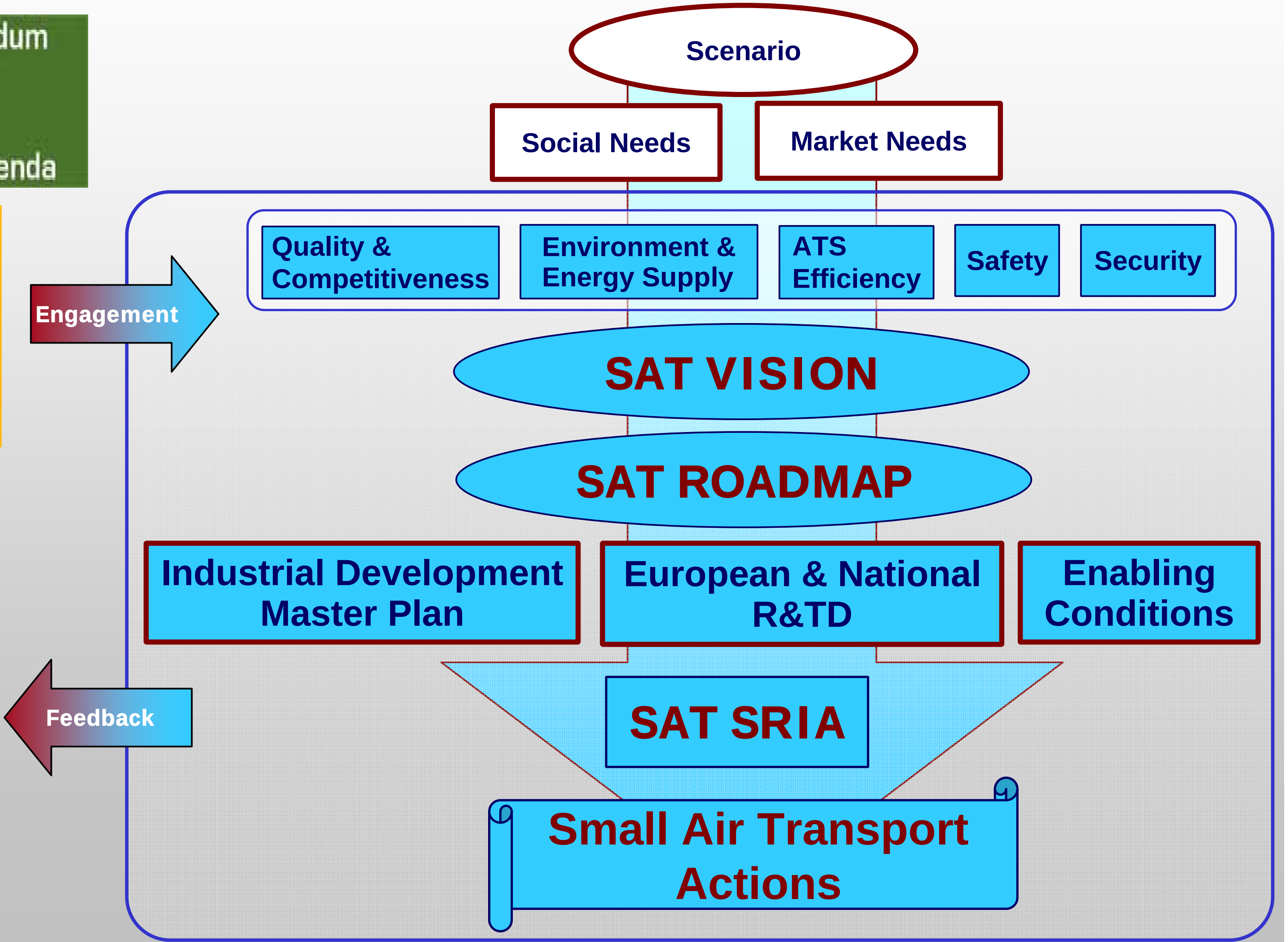
Turning SAT mode into practice

2008 Addendum
to the
Strategic
Research Agenda

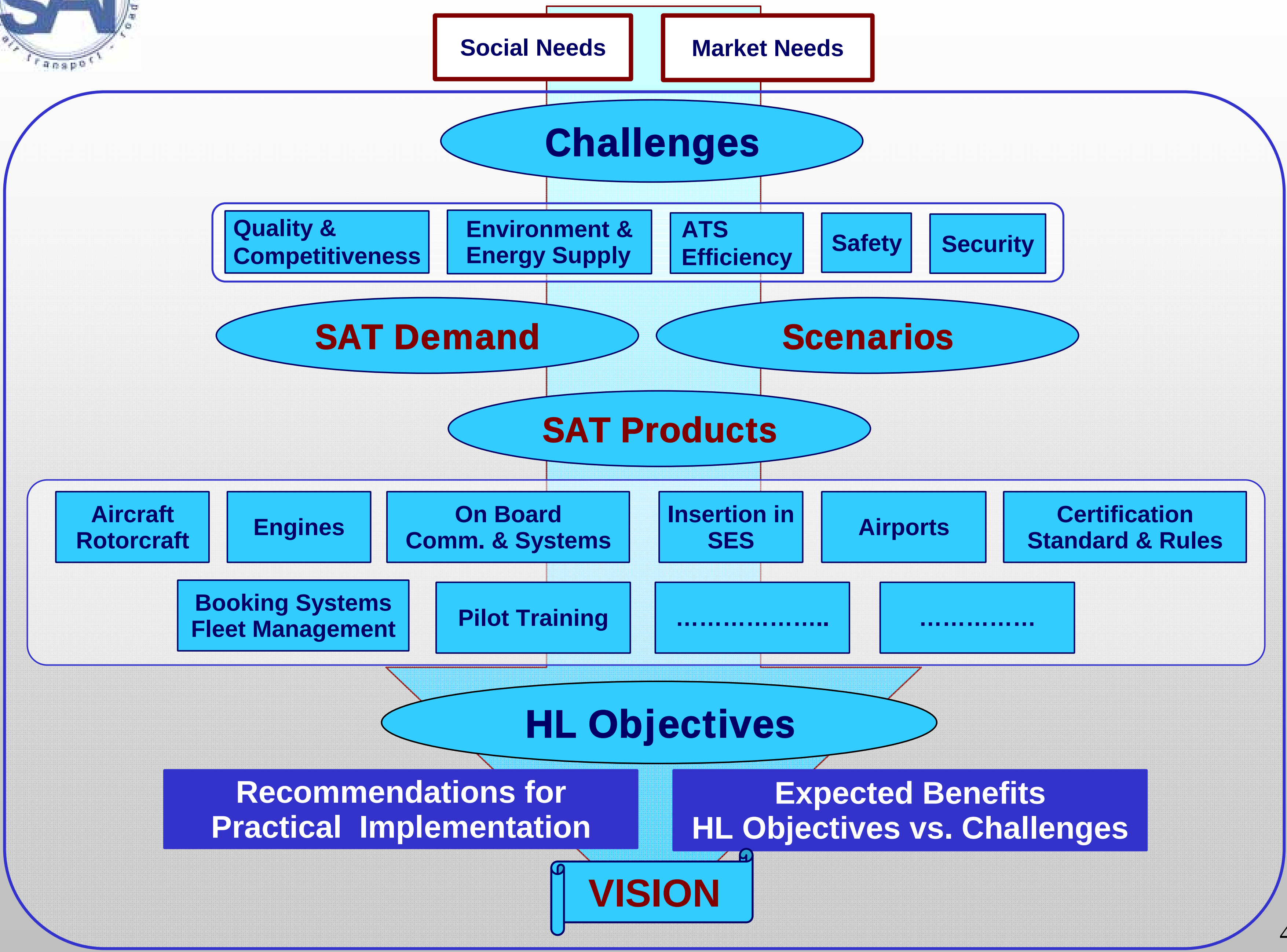
Flightpath 2050
Europe's Vision for Aviation
Report of the High Level Group on Aviation Research

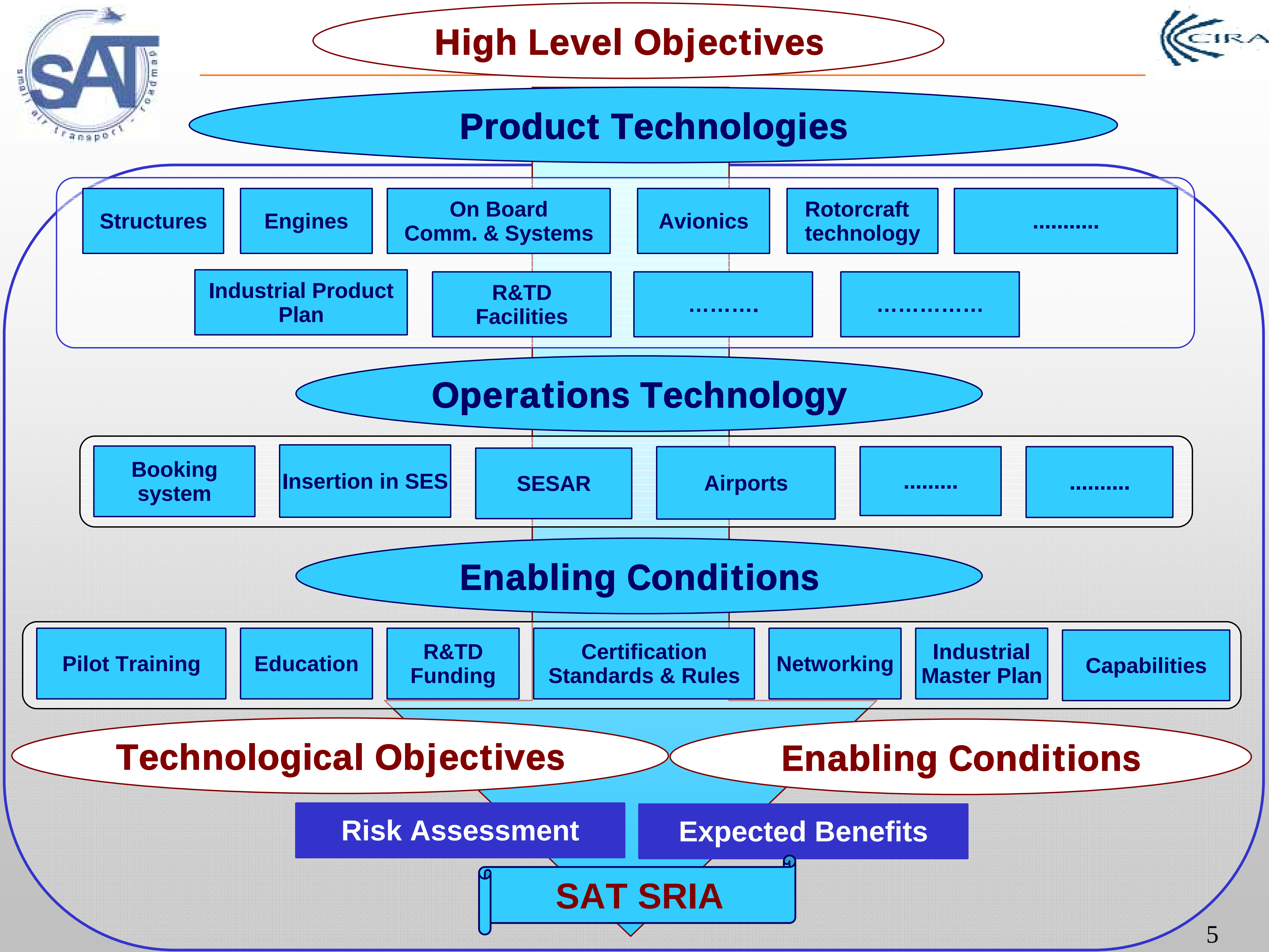
EUROPEAN COMMISSION

ACARE



SAT Common Vision




High Level Objectives
Product Technologies
Structures
Engines
On Board Comm. & Systems
Avionics
Rotorcraft technology
....
Industrial Product Plan
R&TD Facilities
……….
……………
Operations Technology
Booking system
Insertion in SES
SESAR
Airports
....
....
Enabling Conditions
Pilot Training
Education
R&TD Funding
Certification Standards & Rules
Networking
Industrial Master Plan
Capabilities
Technological Objectives
Enabling Conditions
Risk Assessment
Expected Benefits
SAT SRIA

SAT Common Vision

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.

Activities for SAT Vision to be discussed in the Parallel Sessions

- **Main characteristics of future Small Aircraft Transport System**
- **SAT sectors and products where Europe wants to excel**
  - characteristics of new environmentally friendly and efficient aircraft and systems
- **When products are needed in the market ?**
- **High Level Objectives for SAT Products**

	Parallel Sessions with two Working Groups	
	Parallel Sessions WG – 1	
13:30	❖ **Target Products & Technologies** o Piston engine A/C - 9 seats or fewer – MTOW up to 5670 kg, o Turboprop A/C - 19 seats or less - MTOW 8618 kg o Jet A/C - 11 seats or less – MTOW up to 7600 kg ❖ **HLO for Product Technologies** ❖ **Enabling Conditions for Product Technologies** o R&TD infrastructures o Certification, Standards and Rules o Industrial Master Plan o Funding ❖ **Product Technologies HLO vs Challenges**	WG – 1 lead by A. de Graaff (AD Cuenta) M. Amato (CIRA)
15:30	**Coffee Break (15:30 - 15:45)**	

	Parallel Sessions WG – 2	
13:30	❖ Target Operation, System Concepts and Technologies o Booking system o Fleet Management o ATM and SES o Airports o Automation level for SAT and operation modes ❖ HLO for Operation Technologies ❖ Enabling Conditions for Operations Technologies o Pilot Training o Insertion in SES o Certification, Standards and Rules o R&TD funding ❖ Operation Technologies HLO vs Challenges	WG – 2 lead by T. Henley (Consulting) S. Ghijs (Fly Aeolus)
15:30	Coffee Break (15:30 - 15:45)	

WG1 **WG2**

	Preliminary Results Collection	
15:45	Product Technologies and Enabling Conditions Product Technologies HLO vs Challenges	WG-1 Leader A. de Graaff (AD Cuenta)
16:00	Operation Technologies - Enabling Conditions Operation Technologies HLO vs Challenges	WG-2 Leader T. Henley (Consulting)

SAT Common Vision

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

Small Aircraft Transport 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”)
- **the needs of European business travel**

SAT Common Vision

Challenges (examples)

Quality & Competitiveness	Environment & Energy Supply	ATS Efficiency	Safety	Security

- To provide a new affordable, accessible, energy efficient and environmentally friendly component of Air Transport System (ATS).
- To offer a lager choice for transportation through the increasing use of small aircraft serving small airports
- To facilitate the access to transport for a large number of communities in a cost effective way. To satisfy the needs of transportation in regions where transport networks (especially surface transport) are underdeveloped.
- To create additional mobility (door-to-door/point-to-point) for the European citizens.
- To stimulate a co-modal approach for the European transport system.
- To improve the energy efficiency of transport according to the European Energy Strategy for Transport.

SAT Roadmap

❖ **Products Technologies (examples to be detailed)**

- small fixed wing aircraft (GA, Commuters, …..)
- small helicopters
- business aircraft
- ……

❖ **Operations Technology**

- Network Centric booking system and fleet management
- aero-taxi
- regular routes by small aircraft and commuters
- use of small and local airports
- use of aerodromes (grass airfield, sea and lakes),
- inter-modal traffic: airline – small airplane – car.

SAT Common Vision

High Level Objectives
(examples)

Products \ Challenges		Quality & Competitiveness	Environment & Energy Supply	ATS Efficiency	Safety	Security
SAT PRODUCTS	*Small Fixed Wing Aircraft (4 – 8 seats)*	New design methodologies	Development of innovative materials and production processes		All weather Operations	
	Engine	New design methodologies	Hydrogen engine		Fault Tolerant Design	
	xxxxx			xxxx		

Technological Objectives (examples)
Small Fixed Wing Aircraft

Tech. Objectives / HLO		Technical Objectives: Low Noise Low Emission Configuration	Out of autoclave production	Low energy low weight Ice Protection	Low Cost Manufacturing	Crash-worthiness
HLO	New design methodologies	❖		❖	❖	
HLO	Development of innovative materials and production processes	❖	❖	❖	❖	❖
HLO	All Weather Operations			❖		

SAT Common Vision - Technology Roadmap

Technological Objectives vs Challenges (examples)
Small Fixed Wing Aircraft

Technical Objectives \ Challenges		Challenges: Quality & Competitiveness	Environment & Energy Supply	ATS Efficiency	Safety	Security
TO	Low Noise Low Emission Configuration	✹	✹			
TO	Out of autoclave production	✹	✹		✹	
TO	Low energy low weight Ice Protection	✹			✹	

❖ Creation of Working Groups

o Target Products & Technologies

- **Moderator** : A. de Graaff (AD Cuenta)
- **Rapporteur**: M. Amato (CIRA)

o Target Operation, System Concepts and Technologies

- **Moderator :** T. Henley (Consulting)
- **Rapporteur:** S. Ghijs (Fly Aeolus)

Common Vision Workshop
on
Small Aircraft Transport (SAT) System

PANEL DISCUSSION

Brussels, September 28, 2011

Moderated by

Krzysztof PIWEK, Institute of Aviation

SEVENTH FRAMEWORK PROGRAMME

Workshop Approach

- A Discussion Paper was distributed
- Key elements of a vision for a SAT System was presented in the morning to set-up the scenario
- Two Parallel Session took place in the afternoon to openly collect views and opinions on key elements of the SAT Vision
- Preliminary Collection of results from Parallel Sessions
- Panel Discussion on three Pivotal Questions
- SAT-Roadmap next steps

Three Pivotal Questions

Do you agree with the following statements ?

1 "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"

Three Pivotal Questions

Do you agree with the following statements ?

2 "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?

Three Pivotal Questions

Do you agree with the following statements ?

3 Do you agree that this goals might be met by 2020 using mostly currently existing aircraft, infrastructure and available ICT?

Common Vision Workshop
on
Small Aircraft Transport (SAT) System

Next Steps

Brussels, September 28, 2011

Ad de Graaff
AD Cuenta

Marcello Amato
CIRA Scpa

NEXT STEPS

Event and Objective	What	Who	When
COMMON VISION Workshop Common Vision Discussion Roadmap process start-up	1. Challenges 2. European Demand, Scenarios and Business Models 3. High Level Objectives 4. Start-up Discussion on SAT Products, Enabling Technologies, Enabling Conditions	RTD Community, Airlines, Airtaxi EC, ACARE ASD, EREA Manufacturers EGAMA	Sept 2011

- **Analysis of the workshops results and consolidation in a report**

SAT Roadmap

Approach

- ❖ **A roadmap can be based on expected technology developments** and the corresponding TRL levels.
  Let us name this approach as **bottom up**.
- ❖ **A roadmap can also be based on market demand and the required products and services** that can satisfy this demand.
  Let us name this approach **top down**

In SAT-Rdmap the top down approach has been adopted to define the roadmap for the future

SAT Roadmap

Activities for SAT ROADMAP

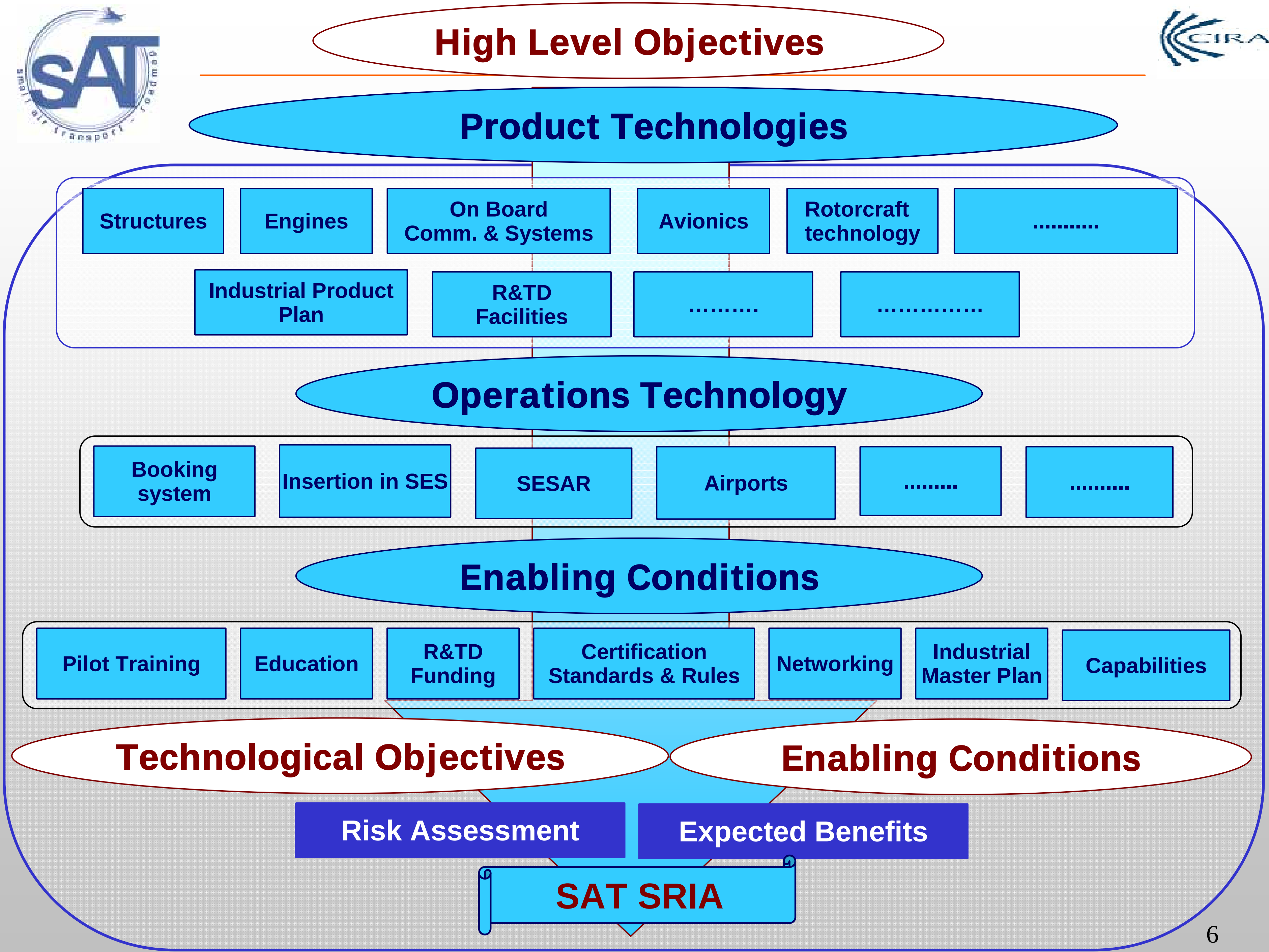
- **Technologies needed** for these **products** and an industrial master plan for SAT products

- **System requirements for enabling operations**; **for example**:
  - the booking system that will connect passengers to service providers,
  - actions to adapt airports to small aircraft operations,
  - integrate small aircraft in the future European ATM system,
  - demonstration activities

- **Enablers**; **for example**:
  - certification, standardisation and rules,
  - crew training issues related Small Air Transport aircraft,
  - R&TD funding

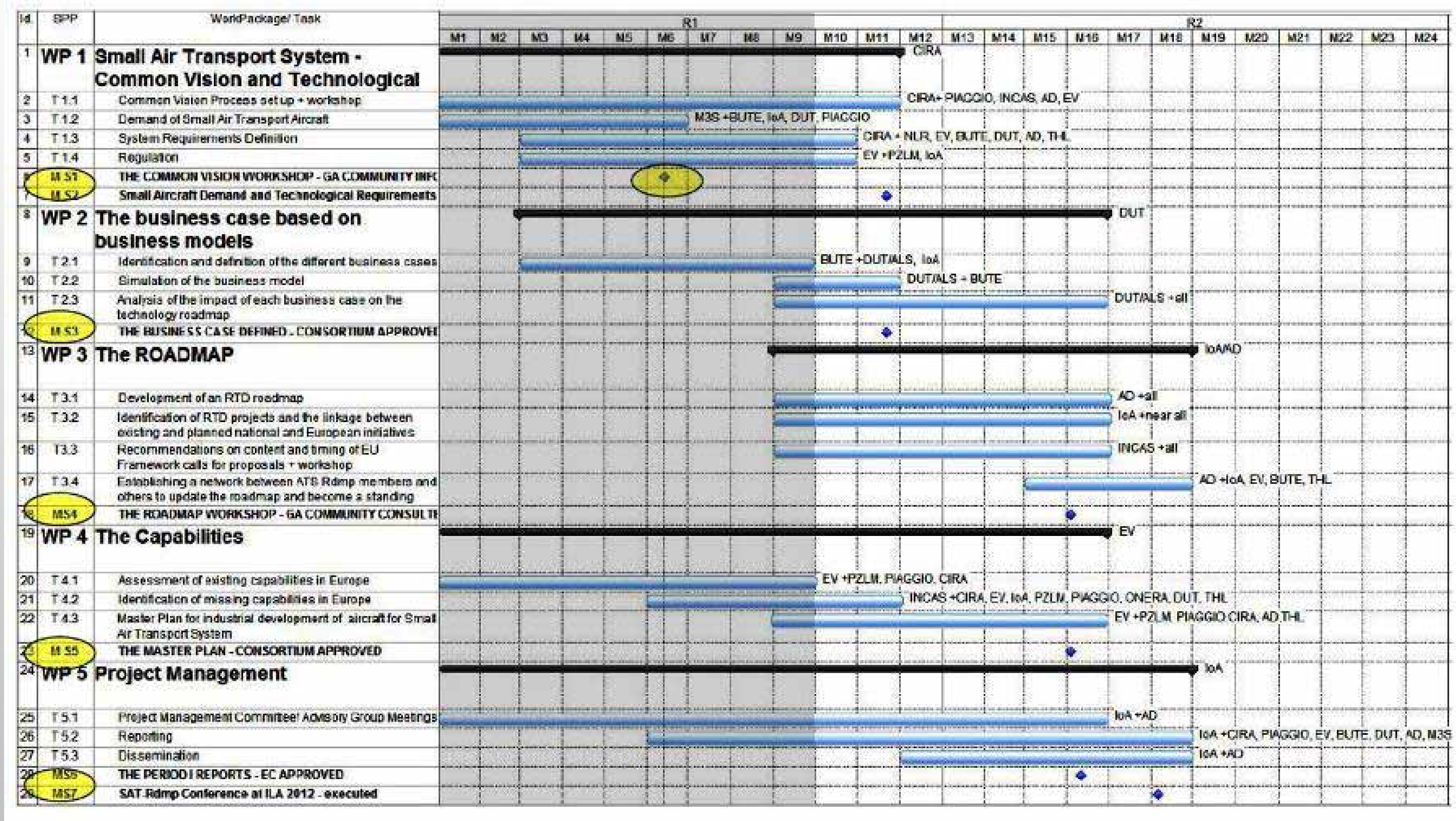
SAT Roadmap

Event and Objective	What	Who	When
ROADMAP Workshop Common Vision Presentation Roadmap Discussion	1. The Capabilities 2. The Enabling Technologies and Conditions 3. Priorities 4. Master Plan for development of Small Air Transport Aircraft 5. Recommendations on content and timing of EU Framework calls	RTD Community, Airlines, Airtaxi EC, ACARE ASD, EREA Manufacturers EGAMA	April 2012
SAT-RDMP Conference	1. Synthesis of Small Air Transport Common Vision and Roadmap	General Aviation Community, Public	ILA Airshow 2012


High Level Objectives
Product Technologies
Structures
Engines
On Board Comm. & Systems
Avionics
Rotorcraft technology
....
Industrial Product Plan
R&TD Facilities
....
....
Operations Technology
Booking system
Insertion in SES
SESAR
Airports
....
....
Enabling Conditions
Pilot Training
Education
R&TD Funding
Certification Standards & Rules
Networking
Industrial Master Plan
Capabilities
Technological Objectives
Enabling Conditions
Risk Assessment
Expected Benefits
SAT SRIA

SAT Roadmap

Gantt chart



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