Project no: ASA6-CT-2006-044549

Project acronym: EPATS

Project title: European Personal Air Transportation System STUDY

Instrument: Specific Support Action

Thematic Priority: Integrating and Strengthening the European Research Area

Deliverable reference number and title:

D5.6 ILA Air Show Conference

Organization name of lead contractor for this deliverable: **Ad Cuenta (Ad Cuenta)**

Date of report preparation: June 19, 2008	Date of report issue: June 27, 2008
Deliverable: D5.6 ILA Air Show Conference	Version/Status: **V1** (draft: a,b,c; final: 0,1,2,3)

Approval Status (date, signature)			
Author(s)	WP Manager	Technical Manager	Project Coordinator
A. de Graaff agreed – e-mail 30.06.08 W. Miksa (IoA) .... B. Dziugieł (IoA)	....	....	....

Project coordinator name: Krzysztof PIWEK	Start date of project: Jan 1, 2007
Project coordinator organization name: INSTITUTE of AVIATION	Duration: 18 month

Project funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Table of contents:

1. CONFERENCE OBJECTIVES

Main objective of the conference was to present EPATS concept to wider audience, representatives of the European industry and Aviation related institutions.

2. ILA AIR SHOW CONFERENCE

2.1 Date and location

Date: 28th May 2008

Location: ILA Air Show

Address: Germany, Berlin, Schoenefeld airport, ILA Exhibition grounds, Conference Center, Hall 4, Room DELTA

2.2 Organizer and meeting

Organizer: AD Cuenta, Prins Pieter Christiaanhof 1, 1171 LL Badhoevedorp, The Netherlands

Title of Meeting: "Personal Air Transport in Europe and opportunities for a revival of the small aircraft manufacturers"

Meeting Agenda: see attachment no 1

2.3 List of attendants

EPATS EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

EPATS CONFERENCE

May 28th , 2008
ILA Berlin, Hall 4, Meeting room DELTA
BERLIN, GERMANY

"Personal Air Transportation in Europe and opportunities for a revival of the small aircraft manufacturers"

LIST OF MEMBERS

No	Name, Prename	~~Title~~ email	Company	Signature
1	MACIEJ MACZKA	M.A.	IoA	
2	AD DE GRAAFF	Drs / adgraaff@hetnet.nl	AD Cuenta	
3	Rohács J.	rohacs@rht.bme.hu	Budapest Univ of Tech	
4	MARC BROCHARD	marc.brochard@eurocontrol.int	EUROCONTROL	
5	Andrzej MAJKA	andemajk@prz.edu.pl	Rzeszow University of Technology	
6	Krzysztof PIWEK	khp@ilot.edu.pl	IoA	
7	ADAM PIEKARA	apiekara@rarr.rzeszow.pl	Rzeszow Agency of Regional Development	
8	Witold MIRSKI	wmirski@meil.pw.edu.pl	Warsaw University of Technology	
9	Alfred BARON	Institute of Aviation – baron@ilot.edu.pl	IoA	
10	Wojciech Miksa	Institute of Aviation – miksa@ilot.edu.pl		
11	Andrzej Iwaniuk	andiw@ilot.edu.pl	Institute of Aviation	
12	Nils-Viktor Sorge	Nils.sorge@manage-magazin.de	manage-magazin.de	
13	Bartosz Dzwiąga	bartosz.dzwiaga@ilot.edu.pl	Institute of Aviation	
14	MOROZOV IGOR	MOROZOV@GOSNIIAS.RU	DEPUTY DIRECTOR	
15	Puzlovikov Dmitry	dimonep@ciam.ru	CIAM	

EPATS EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

EPATS CONFERENCE

May 28th , 2008
ILA Berlin, Hall 4, Meeting room DELTA
BERLIN, GERMANY

No	Name, Prename	Title / email	Company	Signature
16	Postmanke Jerzy	Ph.D	PZL Mielec, Poland	
17	Gumowski Włodzimierz	IoA	Institute of Aviation Poland	
18	VAN SCHAIK, FRANS	DR. schaik@nlr.nl	NLR AMSTERDAM	
19	WILLEMS, MICHEL	Dr.	MOBILITAS BELGIUM	
20	VAN GENT, Ronald	Ir. RONALD.VANGENT@TNO.NL	TNO, NETHERLANDS	
21	BERKOUWER, WALTER	ir W.R.BERKOUWER@TUDelft.nl	TUD, Netherlands	
22	Anaskiewicz, Piotr	ENG.	IoA, Poland	
23	POKORSKI, MICHAŁ	eng.	IoA POLAND	
24	Malcolm Murphy	MR.	DayJet Corporation	
25	BRUCE J. HOLMES	DR	DAYJET CORPORATION	
26	DUMONT FRANCK	MR	SMA	
27	Wołejsza Zbigniew	Dr eng	Institute of Aviation, Poland	
28				
29				
30				
31				
32				
33				
34				

3. EPATS BACKGROUND

The EPATS (European Personal Air Transportation System) focuses on the future Highly Customer Oriented, Time and Cost Efficient Air Transport System. It fills a niche between Surface and Scheduled Air Transport. Future mobility cannot be satisfied only through investments in hub and spoke, or rail - and highway systems.

This future EPATS system will provide a wide choice of transportation modes - and **the wider use of small aircraft, served by small airports, to create access to more communities in less time.**
The goal of the EPATS proposal is to demonstrate the needs and potential of small aircraft business development and to propose recommendations for the introduction of this new European Air Transportation System in the context of the European Research Areas.

The EPATS project addresses the following issues:

- The potential new market for personal aviation up to 2020.
- The potential impact of this new way of transport on the European ATM, and airport infrastructures, as well as the environmental, safety and security issues involved.
- The EPATS general specification and R&D Roadmap

EPATS fills a niche between Surface and Scheduled Air Transport and is an alternative choice mainly for long travel by car. The European Personal Air Transportation System is tailored to the personal needs, preference and resources of the population and is adapted to serve European & National Intercity low-density passenger flow, which can not be profitably served by current Regional Airline neither by High Speed Train.

4. CONFERENCE PROCEEDINGS

ILA Air Show conference took place in Berlin in June 28, 2008 at Berlin Shoenefeld.
The moderator - Mr. Adriaan de Graaff from Ad Cuenta - welcomed all the attendants of the Conference. He noted that several years ago everybody was saying that small aircraft transportation is for the US only. The European Commission was willing to spend some money on the EPATS study.

4.1.1. *First Presentation* "Welcome to the EPATS project"

was done by Project Coordinator Mr. **Krzysztof Piwek**. (see attachment no 2)
Main ideas of presentation:

Main objective was:
To present EPATS project
Main presented topics were:

- Project objectives
- EPATS vision summary
- Consortium overview
- Conference agenda

4.1.2. *Second Presentation* "The European airports: Accessibility and suitability"

was done by Mr. **Andrzej Majka**. (see attachment no 3)
Main ideas of presentation:

Main objective was:
To present airport accessibility in Europe
Main conclusions were:
Europe is an area with unique features favoring development of regional passenger air transportation system:

- it has about 1,270 airports and 1,300 landing fields, which means that for the most densely populated regions there is one airport per 2850 km^2 (one landing field per 1200 km^2), and 390 000 inhabitants per one airport (170 000 inhabitants per one landing field),
- in the most densely populated regions, the nearest airport lies within a distance of less than 40 km for more than 95 % of population (within less than 20 km for 60 % of population),
- for most European cities, the nearest airport is located within 15 km (90 % of cities),
- there are many airports in the vicinity of the greatest European cities (not fewer than 10 airports within 50 km radius of each city) – passengers can freely choose the most suitable airport,
- a large part of the European population (potential passengers) live close to airports – approximately 1 mln inhabitants within 40 km radius of aerodromes,
- most European airports have sufficient technical conditions for being utilized for normal operational purposes by GA aircrafts (other landing fields should be modernized).

4.1.3. *Third Presentation* "The Challenge of Mobility in Europe"

was done by Mr. **Maciej Mączka**. (see attachment no 4)

Main ideas of presentation:

Main objective was:
To present EPATS compared to other modes of transport

Main conclusions were:
- Europe needs a new, supplementary mode of transport
- A mode that is harmonized with general trends (door-to-door, multimodality, energy efficiency, environmentally friendly)
- A mode that will give us a new tool to manage the challenge of mobility

4.1.4. *Fourth Presentation "*The demand for personal air transport in Europe*"*

was done by Ms. **Isabelle Laplace**. (see attachment no 5)
Main ideas of presentation:

Main objectives was:
To determine potential transfer of traffic from existing transport modes to personal air transport in 2020

Main results were:
- <u>Transferred traffic to personal air transport in 2020</u>: 3% of the total European traffic
- 90 000 personal aircraft, 40 million flight movements
- 25 500 personal aircraft if their operating cost increases by 30% (fuel cost, taxes, SESAR requirements, etc.)

Discussion:
Mr. Walter Berkouwen of Delft Technical University asked Ms. Laplace to explain the situation in France. Ms. Laplace said that high speed train is not available in all of France and there was a lot of business traffic served by cars, and most of transfer of traffic to EPATS was assumed to come from car traffic. Mr. de Graaff added that the project had been investigating only business traffic, not leisure traffic. Mr. de Graaff noted that in the study, certain types of aircraft: pistons, turboprops and jets ad been related to distance of travel, while some reports in the US indicate that jets were used on even shorter distances. Mr. Bruce Holmes from DayJet talked about some interesting market dynamic, they had been experiencing. When they compared DayJet to another peer company – SATSair operating piston Cirrus SR-22, it turned out that DayJet had been providing service at distances about 400 km at less expense due to higher jet's speed.

4.1.5. *Fifth Presentation "EPATS – WP3 D3.1 ATM General Requirements & relative issues to be solved. First findings"*

was done by Mr. **Marc Brochard**. (see attachment no 6)
Main ideas of presentation:

Main objective:
Identification and description of the issues to be solved in order to be able to accommodate expected EPATS traffic in the European ATM system.

Main results:
- SESAR will not handle more than 14 Millions of EPATS IFR flights in managed airspace in 2020 – other EPATS flight will be VFR
- 60% of EPATS flights will be lower than FL100 – more likely in SESAR un-managed airspace

- EPATS flights will be highly geographically distributed but might have to merge with traditional traffic only in dense area (managed airspace) and TMA's.

Main delivered items in reporting period are:

- "D3.1 EPATS ATM General requirements & related issues to be solved" Document Number EPATS_WP3_ATM impact_V1.0

EPATS R&D needs:

- **SESAR Airspace design** for IFR and VFR vs managed and un-managed airspace (vertical (FL) and geographical design – dynamic and morphing)
- **SESAR Business Trajectory** management for EPATS flight (IFR and VFR?) and EPATS FL allocation (including flight planning and trajectory negotiation and SWIM issues)
- **SESAR and VFR** flights
- **Single piloting** in un-managed and managed airspace (Safety - separation management and conflict avoidance - autonomous EPATS flight)
- **TMA operation** mixing EPATS and traditional flights (AMAN, DMAN, SIDs, STARs, CDA concept, Aircraft performances)
- **En-Route operation** mixing EPATS and traditional flights (Aircraft performances, managed airspace, Routing, separation management)
- EPATS detailed quick simulation for EPATS traffic assessment: Safety, flight efficiency, cost, effective capacity, delay – need more EPATS data

Discussion:

Mr. de Graaff asked Mr. Holmes about the experience in the US. Mr. Holmes said there were many common findings in Mr. Brochard's work like average trip length or average altitude, but he could only say how they attempted to solve ATM issues in the US. Just that week a Memorandum of Understanding between DayJet, State of Florida and FAA was to be signed to implement a certain set up. They aimed at expanding airspace outside traditional, radar surveyed, large airport airspace. DayJet aircraft were to be equipped with RNP.3 capability. Florida is anticipated to be a learning ground to try the solutions. Another technology, to be implemented, is ADS-B spacing. FAA will take advantage of that technology and trials are to be carried out the next year. He believes that those technologies would save a lot of fuel and will allow to manage noise. Next technology identified was SWIM. Business is interested in SWIM which allowes rapid flight planning. Planning could be done in minutes instead of hours. Finally, radios capable of transmitting data compatible with internet protocols: Voice-Over-Internet, xml, xtml, http, and so on – common protocols allow to manage the fleet real time. Putting these technologies together allows for enormous fuel savings, and capacity of airspace might turn out to be bigger than ever imagined. The Europeans were invited to watch what was done in the US, initially in Florida and help the US which may benefit both sides.

4.1.6. ***Sixth Presentation "***European Air Transportation System: Safety and Environment***"***

was done by Mr. Frans J. van Shaik (see attachment no 7)

Main ideas of presentation:

Main issues studied were:

- Aircraft manufacturing and certification
- Flight operations
- Environment
- Training and qualification

- Airport and Air Traffic Control
- Safety programs and
- Safety oversight

Main conclusions:

- Better EPATS statistics and forecasts needed
- EPATS will come quietly, so prepare!
- Better SESAR for EPATS
- Single pilot Resource Management / Safety/ Environment studies needed

4.1.7. *Seventh Presentation "*WP4: Missions Requirement for EPATS Aircraft.*"*

was done by Mr. **Michał Pokorski**. (see attachment no 8)
Main ideas of presentation:

Main objective was:

- To set up mission requirements for EPATS aircraft as a result of transportation needs.
- Identification of problems to solve in order to fulfill EPATS aircraft missions.

Main results:

- Goal: Higher affordability of personal air transport is REAL.
- Aircraft that fit to the needs:
  - range, size, comfort etc.
- Turbo-props and Pistons are
  the most suitable for short distances.

4.1.8. *Eighth Presentation "*European GA manufacturers capabilities.*"*

was done by Mr. **Janusz Pietruszka**. (see attachment no 9)
Main ideas of presentation:

Main objective was:
To present European GA manufacturers production capabilities
Main conclusions:

- Maximum production rate is 5300 airplanes / year,
- More realistic number 3200 airplanes / year. Maximum cpacity may grow to 10.000 aircraft per year.
- On GA market there is strong competition between US and European manufacturers (note: European products are sold in the USA, too),
- Changes observed in EC policy according to GA may influence growth of European GA manufacturer's capabilities,
- Long term US Dollar to Euro exchange ratio may drive economy of European GA manufacturers.

4.1.9. *Ninth Presentation "*Vision of EPATS business strategy.*"*

was done by Mr. **Joszef Rohacs**. (see attachment no 10)
Main ideas of presentation:

Main objective was:
To present EPATS business strategy
Main conclusions:

- EPATS implementation needs investigations and investments in :

  - Development of Interactive Transport Service Network
  - Organization of regional EPATS Carriers
  - Development of EPATS aircraft technologies and production
  - Development of Pilot Training Base
  - Unification and adaptation of legal issues and the certification according to the new requirements of EPATS
- Studies results clearly show, that comparing the social benefits resulting from EPATS implementation and the cost involved for its realization, the benefits outbalance the required contribution.

Mr. Piwek said he was proud to present the project and that he believed the concept of personal air transportation would come true. The Europe should take part in manufacturing the aircraft, not leave all to the Americans or Brazil.
Mr. Piwek thanked the Moderator – Mr. de Graaff. He said that the project should be continued, the EC had been proposed to continue the study and all are invited to participate in a number of workshops associated with the project. Mr. de Graaff thanked all th attendants to the conference.

5. CONCLUSIONS

- Europe is an area with unique features favoring development of regional passenger air transportation system.
- Europe needs a new, supplementary mode of transport.
- Better EPATS statistics and forecasts needed.
- Transferred traffic to personal air transport in 2020: 3% of the total European traffic.
- Turbo-props and Pistons are the most suitable from the point of view of affordability.
- Maximum production rate is 5300 airplanes / year.
- EPATS implementation needs investigations and investments.
- Studies results clearly show, that comparing the social benefits resulting from EPATS implementation and the cost involved for its realization, the benefits outbalance the required contribution.

6. ATTACHMENTS

6.1. Attachment no 1 - Conference Agenda

"Personal Air Transportation in Europe and opportunities for a revival of the small aircraft manufacturers"

ILA Berlin, Hall 4, Meeting room DELTA on 28 May 2008 from 14:00 until 17:00

14.00 **Welcome to EPATS (European Personal Air Transportation System)**
Krzysztof Piwek, Maciej Mączka (IoA)

14.15 **The European airports: Accessibility and suitability** Andrzej Majka (RzUoT)
- A total overview of all European airports
- Accessibility of airports

14.30 **The challenge of mobility in Europe** Maciej Mączka (IoA)
- Traffic patterns in Europe
- Modal split

14.45 **The demand for personal air transport in Europe** Isabelle Laplace (M3S)
- Methodology to estimate the modal shift from cars to air travel
- Assumptions for personal air transportation aircraft types
- Estimates of number of aircraft movements, of aircraft required and of distribution between aircraft types

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15.10 **Impact of EPATS aircraft on the European ATM system** Marc Brochard (EEC)

15.20 **Impact of EPATS on safety and environment** Frans van Schaik (NLR)

15.40 **EPATS aircraft and required aircraft characteristics** Michał Pokorski (IoA)

16.00 **EPATS manufacturing capabilities in Europe** Janusz Pietruszka (PZL M)

16.20 **Vision of EPATS business strategy** Jozsef Rohacs (BUTE)/ Alfred Baron (IoA)

16.40 **General discussion** Adriaan de Graaff (Ad Cuenta)

17.00 **End of EPATS session**

6.2. Attachment no 2 – First Presentation "Welcome to the EPATS project"
- done by Project Coordinator Krzysztof Piwek

6.3. Attachment no 3 – Second Presentation "The European airports: Accessibility and suitability"
- done by Mr. Andrzej Majka

6.4. Attachment no 4 – Third Presentation "The Challenge of Mobility in Europe"
- done by Mr. Maciej Mączka

6.5. Attachment no 5 – Fourth Presentation "The demand for personal air transport in Europe"
- done by Ms. Isabelle Laplace

6.6. Attachment no 6 – Fifth Presentation "EPATS – WP3 D3.1 ATM General Requirements & relative issues to be solved. First findings"
- done by Mr. Marc Brochard

6.7. Attachment no 7 – Sixth Presentation "European Air Transportation System: Safety and Environment."
- done by Mr. Frans van Shaik

6.8. Attachment no 8 – Seventh Presentation "WP4: Missions Requirement for EPATS Aircraft."
- done by Mr. Michał Pokorski

6.9. Attachment no 9 – Eighth Presentation "European GA manufacturers capabilities."
- done by Mr. Janusz Pietruszka

6.10. Attachment no 10 – Ninth Presentation "Vision of EPATS business strategy."
- done by Mr. Jozsef Rohacs and Mr. Alfred Baron

6.11. Attachment no 11 – EPATS Consortium: "Comments to SESAR definition phase from EPATS project perspective", Warsaw, May 2008.

6.12. Attachment no 12 – EPATS Consortium: "EPATS project synopsis – SESAR"

6.13. Attachment no 13 – EPATS Consortium "EPATS vision 2020 and aircraft mission requirements", Warsaw May 2008.

6.14. Attachment no 14 – Isabelle Laplace: "The demand for personal air transport in Europe", M3 systems.

6.15. Attachment no 15 – Maciej Mączka: "The Challenge of mobility in Europe", Institute of Aviation, Poland 2008.

6.16. Attachment no 16 – EPATS Consortium: "Mobility is essential in Europe".

Document Change Log:

Version	Author /Organisation	Date of Release	Description of the release	Modifications (sections affected and relevant information)
V1	AD Cuenta	30/6/08	Adjustments	all

Document Distribution List:

Number	Company	Company's short name	Company's Country	Name of the Company's Project Manager	Marking
1	Institute of Aviation	IoA	Poland	Piwek	X
2	EUROCONTROL	EEC	France	Brochard	X
3	M3 SYSTEMS	M3S	France	Laplace	X
4	Stichting Nationaal Lucht-en Ruimtevaartlaboratorium	NLR	The Netherlands	Schaik	X
5	Polskie Zakłady Lotnicze Sp z o.o.	PZL M	Poland	Pietruszka	X
6	Rzeszow University of Technology	RzUoT	Poland	Majka	X
7	WSK "PZL-RZESZÓW"	PZL Rz	Poland	Gnot	X
8	Budapest University of Technology and Economics	BUTE	Hungary	Rohacs	X
9	Windrose Air Jetcharter GmbH	WINDROSE	Germany	Walkowiak	X
10	AD CUENTA B.V.	AD CUENTA	The Netherlands	de Graaff	X
11	EUROPEAN COMMISSION	EC RD	Europe	Stoltz-Douchet	X

EPATS Conference

ILA, Berlin, May 28, 2008

"Personal Air Transportation in Europe and opportunities for a revival of the small aircraft manufacturers"

Welcome to the EPATS Project

Krzysztof PIWEK,
EPATS STUDY Project Coordinator,
Institute of Aviation, Poland

WHAT IS EPATS ?

EUROPEAN	Born and operated in Europe
INTERREGIONAL	Links all European Regions (NUTS 2, NUTS 3)
INTERACTIVE	Links all actors (Customers – Providers) in real time by network
DAILY-ROUND-TRIP	High-speed and point-to-point connection lead to high daily radius of action
AFFORDABLE	Accessibility to small airports and low generalized cost trip make the system affordable
SAFE	New aircraft, operational and air traffic management technologies makes the system safe.
PERSONALIZED	Adjust aircraft fleet and operations to passengers flow and population personal needs
AIR – FREE-FLIGHT	Automated Air Traffic Management in Single European Sky ATM environment (SESAR project)
TRANSPORTATION SYSTEM	

Is it possible to replace car trips on a distance longer than 300 km

by personal aircraft ?

EPATS study answers „YES”

Due to:

- ➢High density Airports Network
- ➢New ATM Technology
- ➢Technically Advanced Aircraft
- ➢European Synergy Possibility
- ➢Increasing Mobility and Social Needs

6th Framework Programme
1.4 Aeronautics and Space

AERONAUTICS SPECIFIC SUPPORT ACTI
Proposal

Proposal Title:

EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM STUDY

- EPATS -

Institute of Aviation
Eurocontrol Experimental Center
M3Systems
National Aerospace Laboratory
Polskie Zakłady Lotnicze sp. z o.o. w Mielcu
Rzeszow University of Technology
WSK PZL Rzeszów S.A.
Budapest University of Technology & Economy
Windrose Air JetCarter GmbH

Warsaw, March 2006

EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

EPATS - STUDY

Project Status Overview

WP or Task N°: EPATS STUDY Project	Reporting WP or Task Leader **Consortium EPATS**
Objective	•State of art European Personal Aviation, •Market potential of PA, assumption to Impact, Missions, Roadmap •Start to create EPATS Community
Major Results	•Important workshops: • EPATS Expert in EUROCONTROL Bretigny; •VLJ in EUROCONTROL Brussels •CESAR/EPATS meeting •SESAR/EPATS meeting •EPATS Data Base - defined •EPATS EPATS Demand 2020 – defined •EPATS Impacts – defined •EPATS Missions Requirements for EPATS aircraft - defined •EPATS Roadmap – Vison - done
Delivered items	Deliverable Reports – 11 (completed 6, closed 3, draft 2) Technical Reports – 12 (closed 9, draft 3) EPATS SSA – total 45 man months – 280 KEuro
Major delays?	No detrimental delays; project on time
Next actions?	next proposal for FP7 – according workprogramme 2008 - done

- What is accessibility and suitability of European airports?
- How big is a Transportation GAP for European regions with poor accessibility?
- What could be potential transfer of traffic from Road, Trains, Airlines to the EPATS?

- How to integrate EPATS traffic with future ATM projected by SESAR?
- What will be impact on Airports, Environment and Safety?

- How to define Affordable Personal Air Transport? Missions Requirements for EPATS Aircraft? Innovative Technologies?
- What will be impact on European GA Industry capabilities?

- What should be business models to make all those reasonable?
- What should be Roadmap and recommended R&TD for next Frame Programs and Strategic Research Agendas?

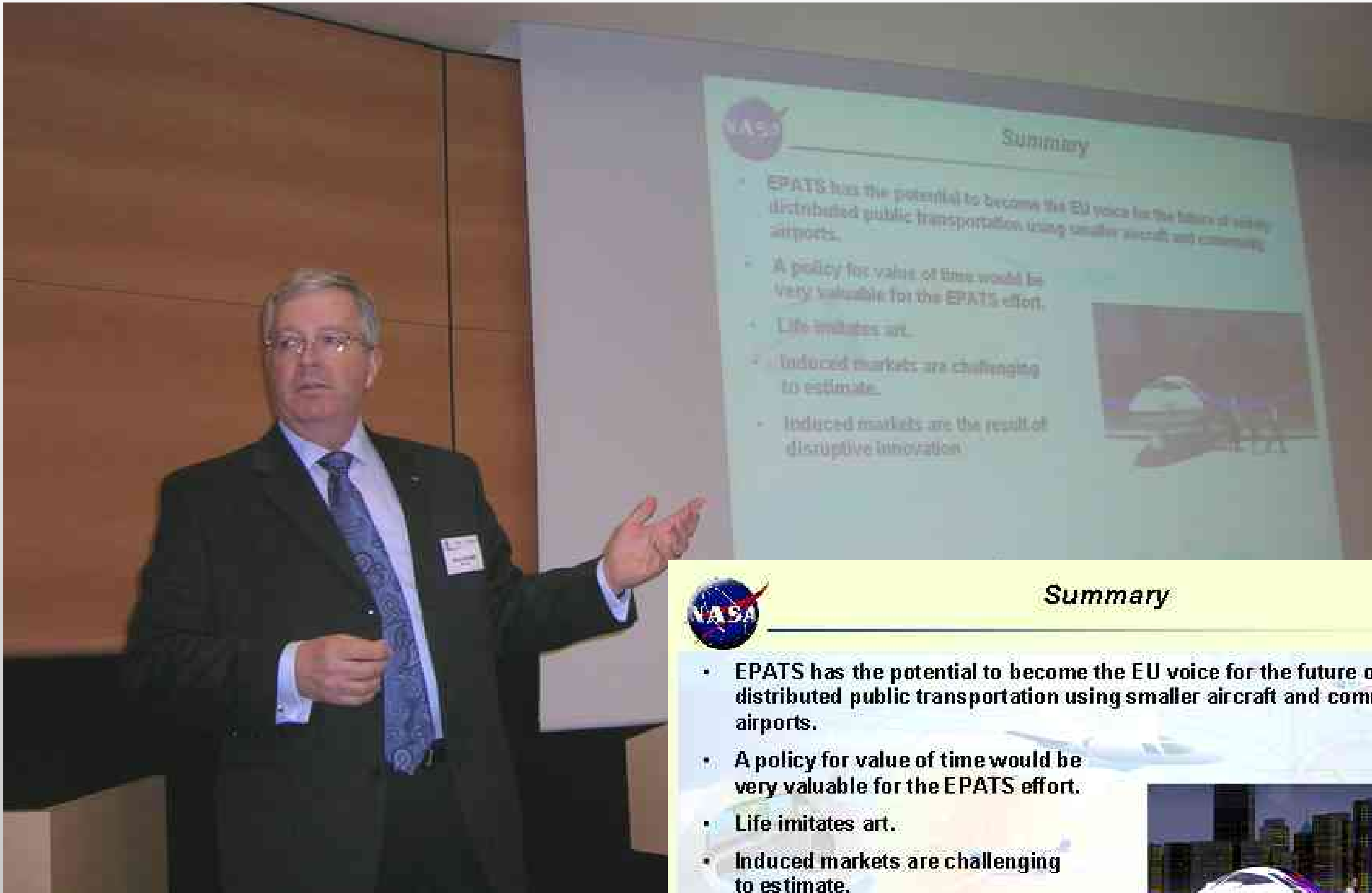
Conclusions

Small aircraft transport system creates real **added value for EU** by:

- keeping **energy efficiency** and harmonizing use of transport modes,
- giving travelers a **free choice** of **transport mode** - according to their need, and limited by their time value.

More **synergy** is needed – among fundamental European projects (i.e. SESAR) and European GA

Personal Aviation – Cooperation & Synergy



Summary

- EPATS has the potential to become the EU voice for the future of widely distributed public transportation using smaller aircraft and community airports.
- A policy for value of time would be very valuable for the EPATS effort.
- Life imitates art.
- Induced markets are challenging to estimate.
- Induced markets are the result of disruptive innovation

The European airports: Accessibility and suitability

Andrzej MAJKA

Rzeszow University of Technology, Poland

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

European Union

Area 4,324,782 km²

Population 497,198,740

Population density 114

Member states 27

EPATS range of operation

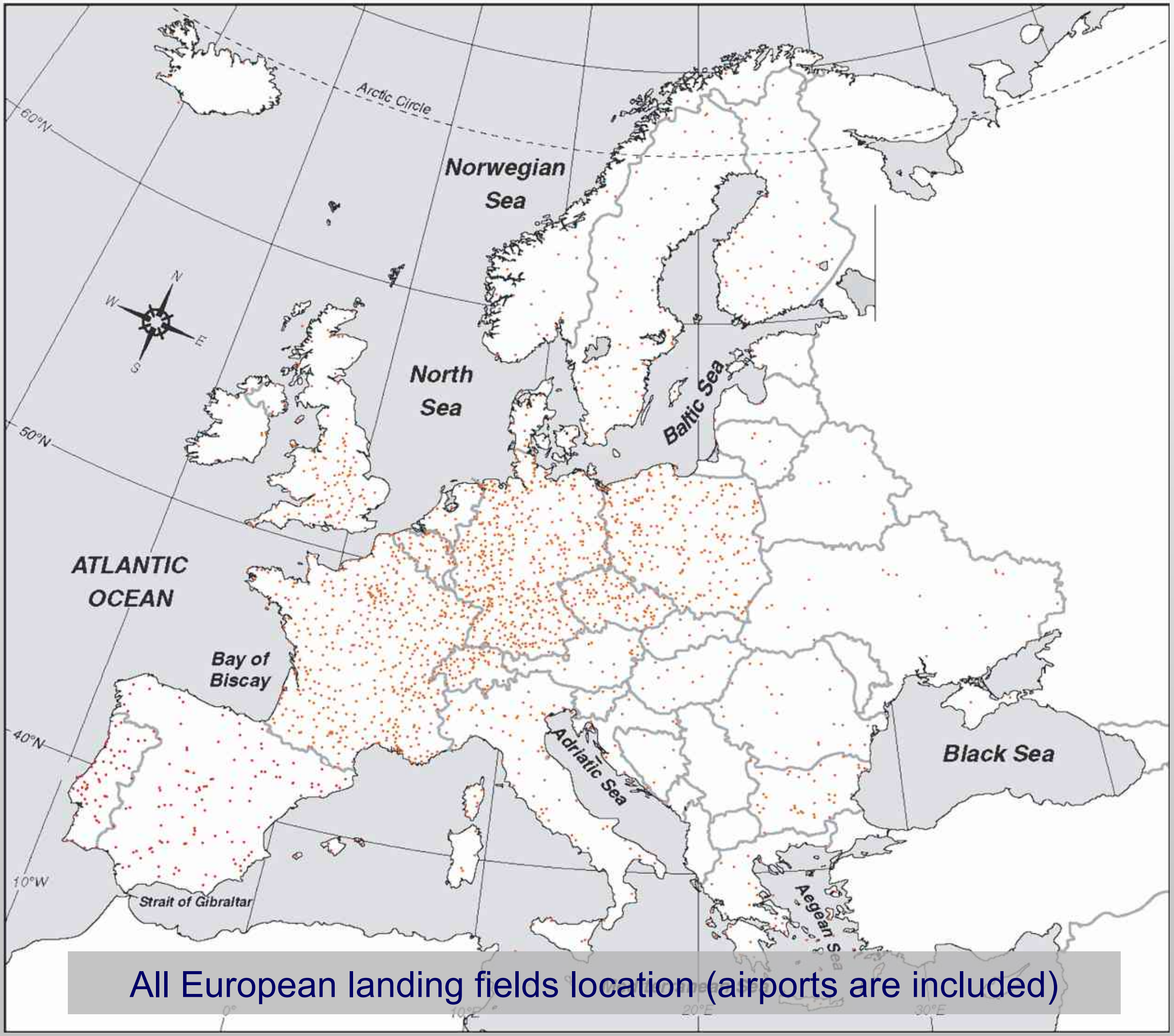
1270 airports
(which have ICAO code)

in 34 European countries

All European airports location

1300 landing fields
(airstrips)

in 34 European countries



All European landing fields location (airports are included)

A total overview of all European airports

2570 airports and landing fields

43 main passenger airports

(large and medium Hubs)

450 Primary airports

(commercial service airports)

1336 with paved runways

737 IFR airports

A total overview of all European airports

1,270 airports and 1,300 landing fields

One airport per 2850 km^2

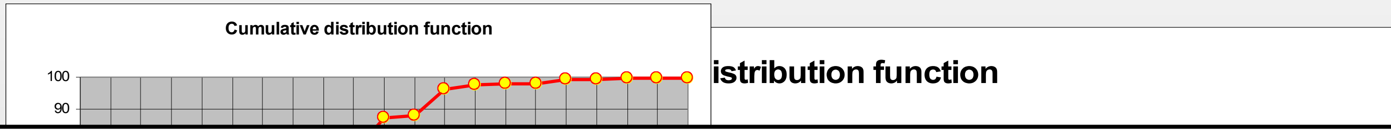
390 000 inhabitants per one airport

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

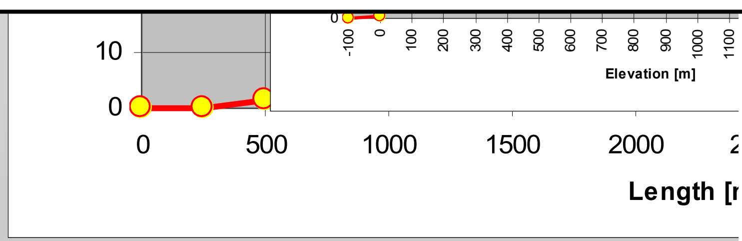
EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

Accessibility and suitability of the European airports

All European airports runways length



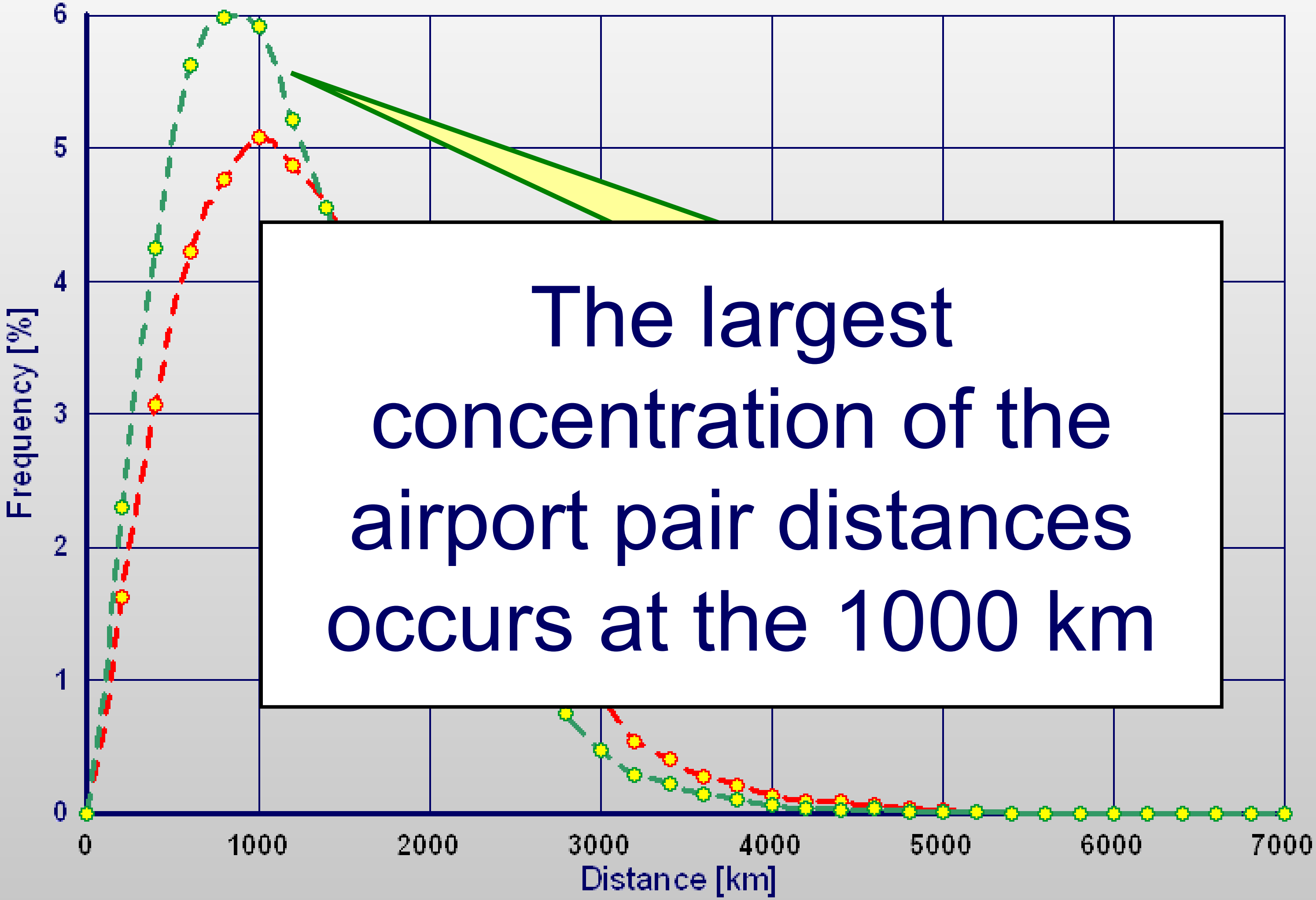
Most European airports have sufficient technical conditions for being utilized for normal operational purposes by EPATS airplanes



	Name	ICAO ID	Latitude	Longitude	Elevation	Runway ID	Length	Width	Surface
1.	AALEN HEIDENHEIM ELCHINGEN	EDPA	48.77783	10.26467	584	09R/27L	950	30	GRASS
					584	09L/27R	950	25	ASPHALT
2.	ALLENDORF EDER	EDFQ	51.03488	8.680839	355	11/29	1240	30	ASPHALT
3.	ALLSTEDT	EDBT	51.3805	11.44667	284	07/25	1200	30	CONCRETE
4.	ALTENBURG NOBITZ	EDAC	50.98182	12.50636	195	04/22	2235	45	CONCRETE
5.	ANKLAM	EDCA	53.8327	13.66913	5	09/27	1000	20	ASPHALT
					5	09R/27L	900	40	GRASS
6.	ARNSBERG MENDEN	EDLA	51.48333	7.899333	242	05/23	920	20	ASPHALT
7.	AUGSBURG	EDMA	48.42516	10.93176	462	07/25	1280	30	ASPHALT
					462	07L/25R	1013	30	GRASS

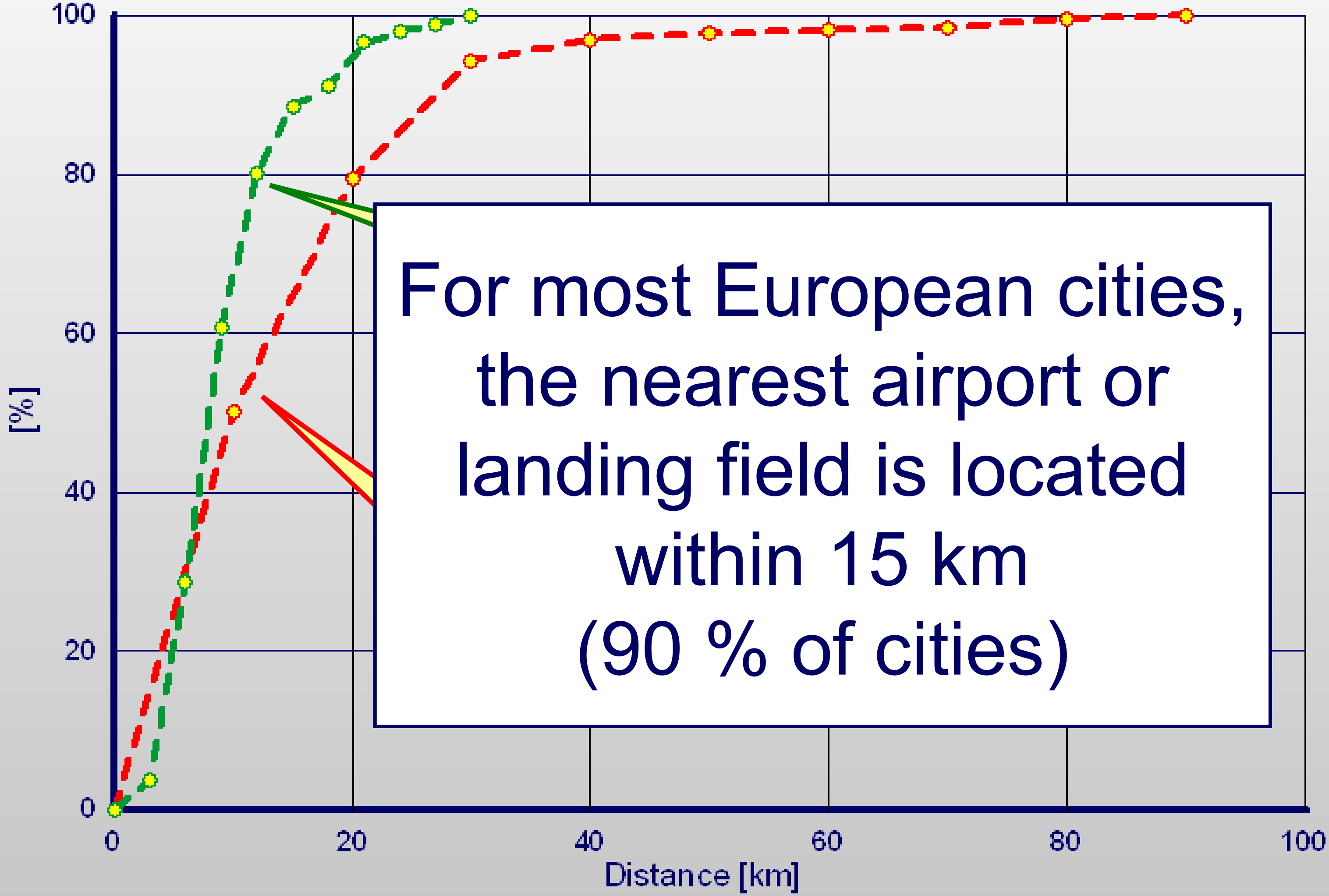
European airports characteristics

European airports distances



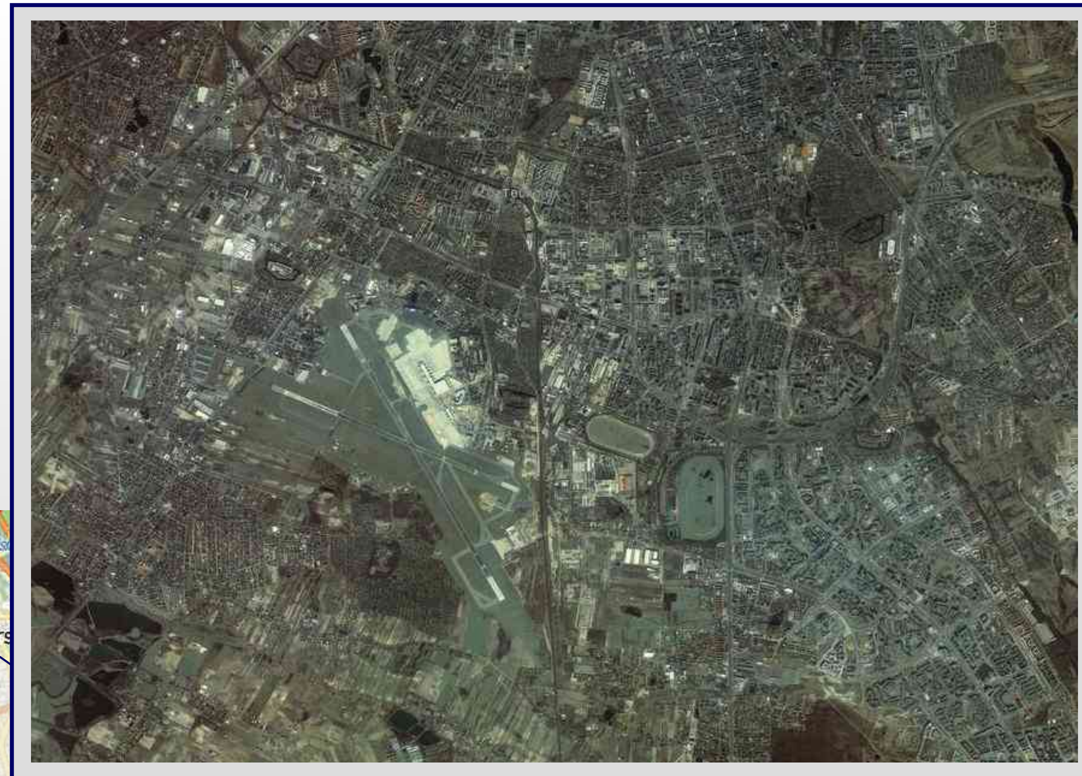
Distribution of distances between airports

City distance to the nearest airport

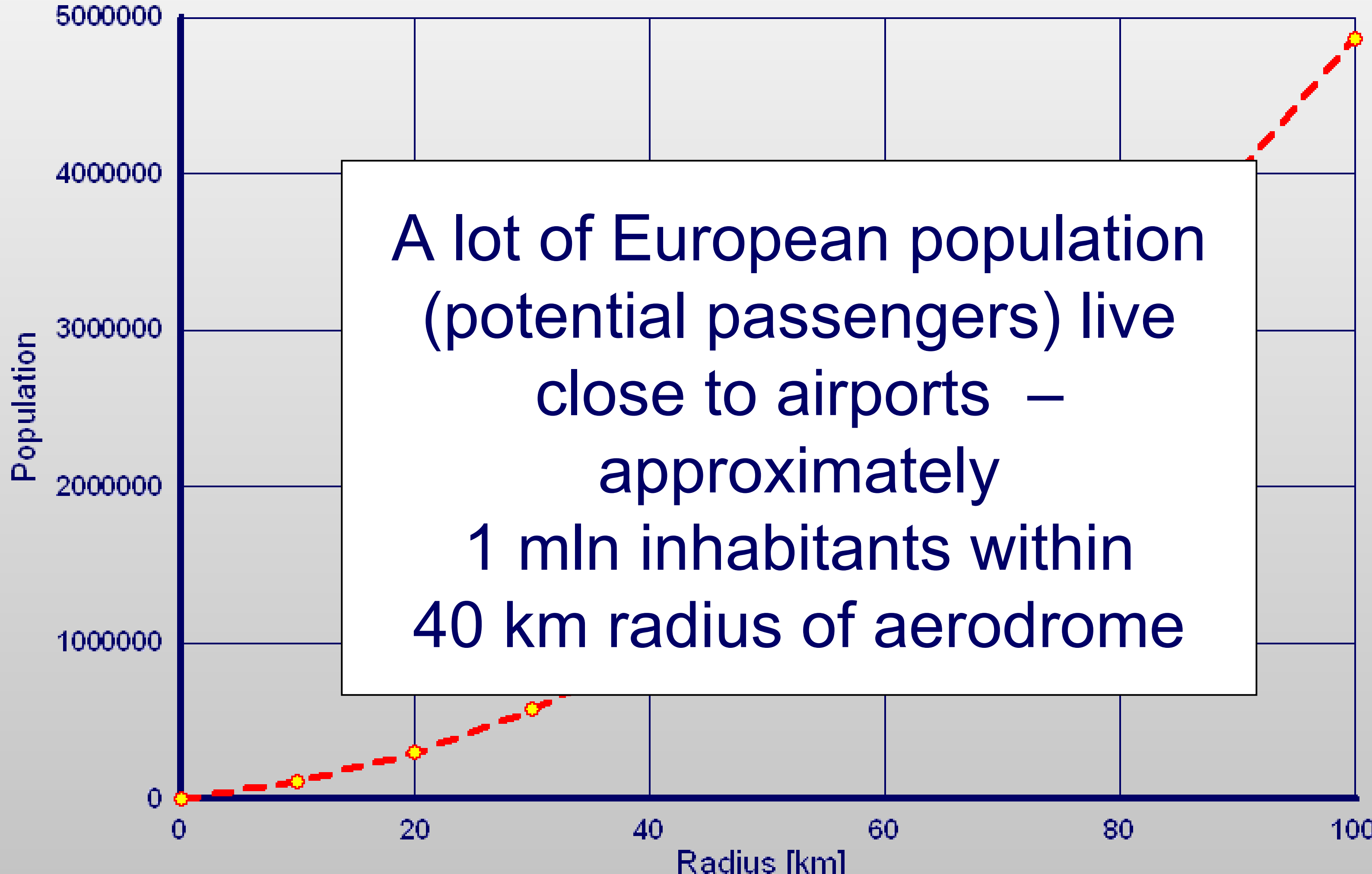


For main European cities

Population within particular radius of airport

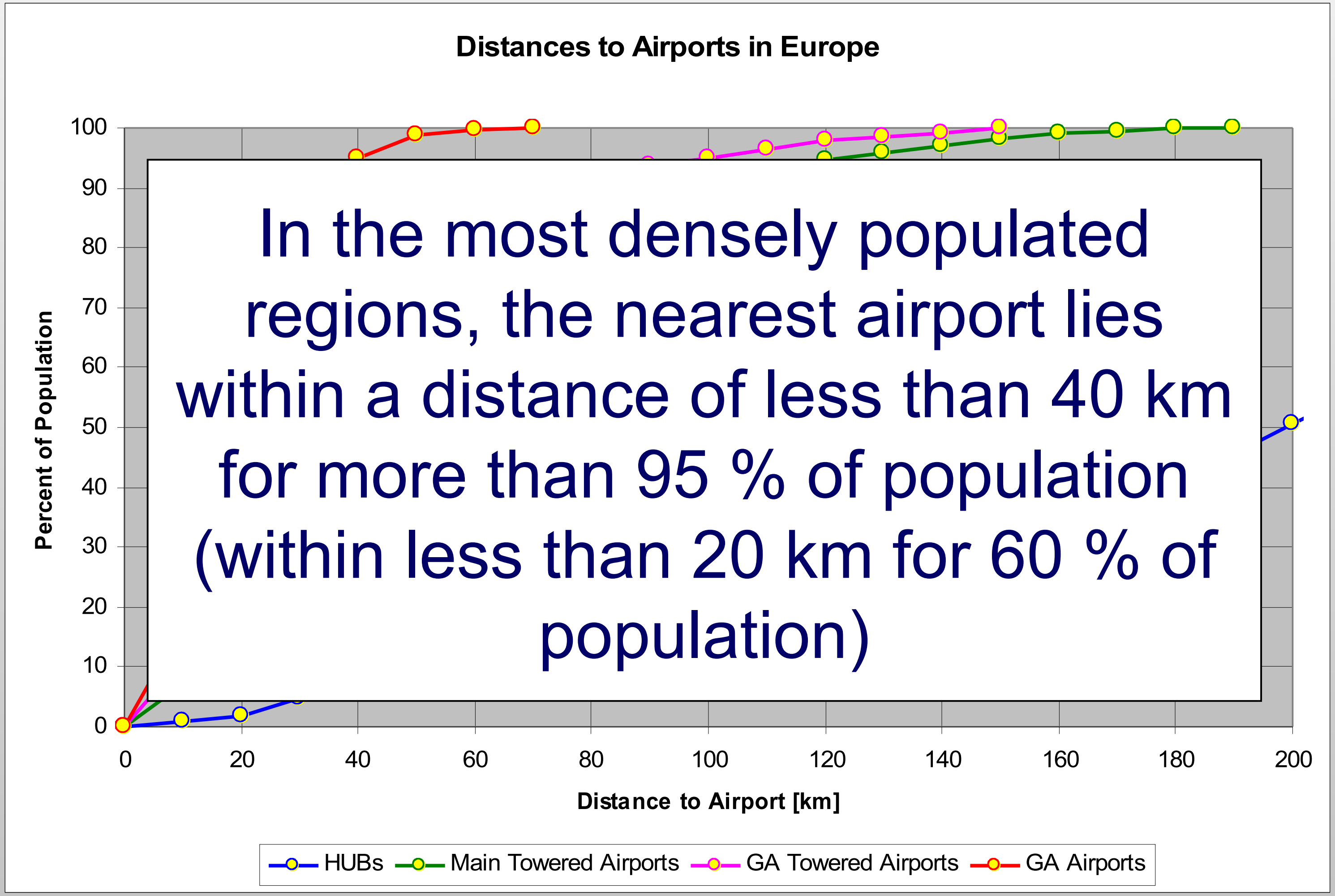


Population within particular radius of airport



A lot of European population (potential passengers) live close to airports – approximately
1 mln inhabitants within
40 km radius of aerodrome

Population within particular radius of aerodrome



Contact:

- Department of Aircrafts and Aircraft Engines
  Faculty of Mechanical Engineering and Aeronautics
  Rzeszow University of Technology
- Address:
  ul. Powstancow Warszawy 8
  35-959 Rzeszow, POLAND
- phone: +48 17 865 1604
  mobile: +48 602 441 977
- web: www.prz.edu.pl/ksisl
- e-mail: andemajk@prz.edu.pl








Thank You for your attention

EPATS Conference

ILA, Berlin, May 28, 2008

"Personal Air Transportation in Europe and opportunities for a revival of the small aircraft manufacturers"

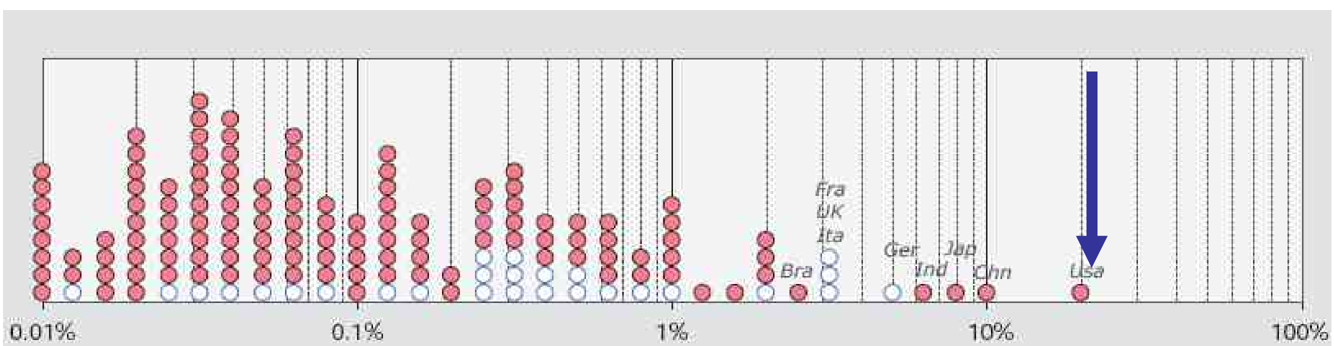
The Challenge of Mobility in Europe

Maciej Mączka,

Institute of Aviation, Poland

European globalised economy

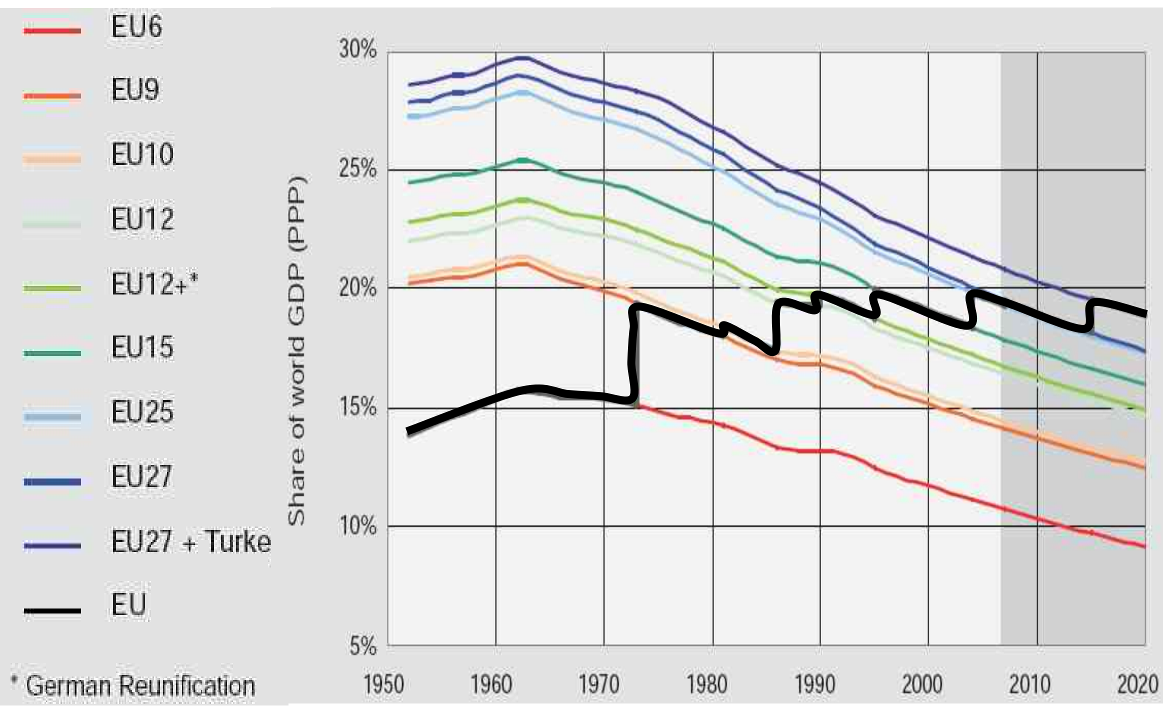
- Economy indicator: Gross Domestic Product (PPP)
- Year: 2008
- European Union (27 countries)
- Estimated at 13 -14 trillion US dollars



ESPON 2007

IMF 2007

- **Good:** Thousands of advanced services firms
- **Bad:** EU share of World GDP increases thanks to integration, not the economy growth



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EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

Economy gets better under certain circumstances among which a good

TRANSPORTATION SYSTEM

is one of the most important

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Transport networks

CAR

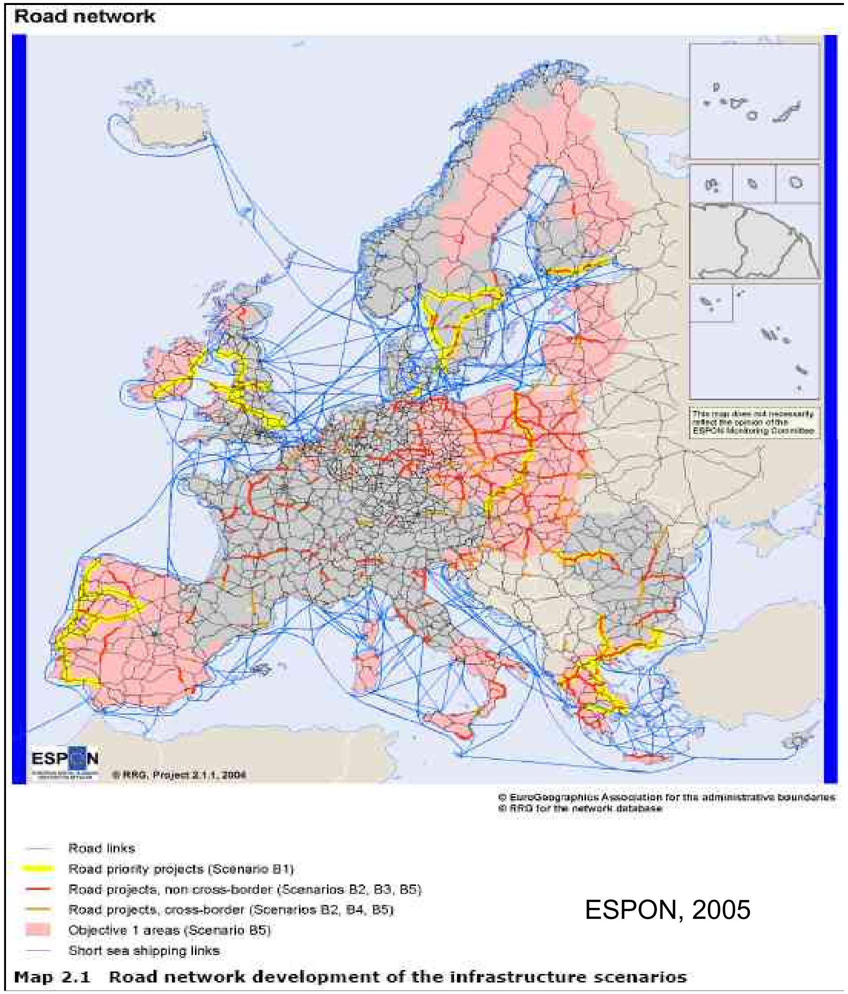
- 215 389 000 cars in EU25

- **+5 million cars/year**

- 4 820 000 km of roads
- 58 100 km of motorways

- **+1 million km/10years**

EUROSTAT for 2004



ESPON, 2005

Transport networks

TRAIN

50 000 railcars in EU25

- 3000 rail cars/year

200 000 km of railway lines

Construction of HST

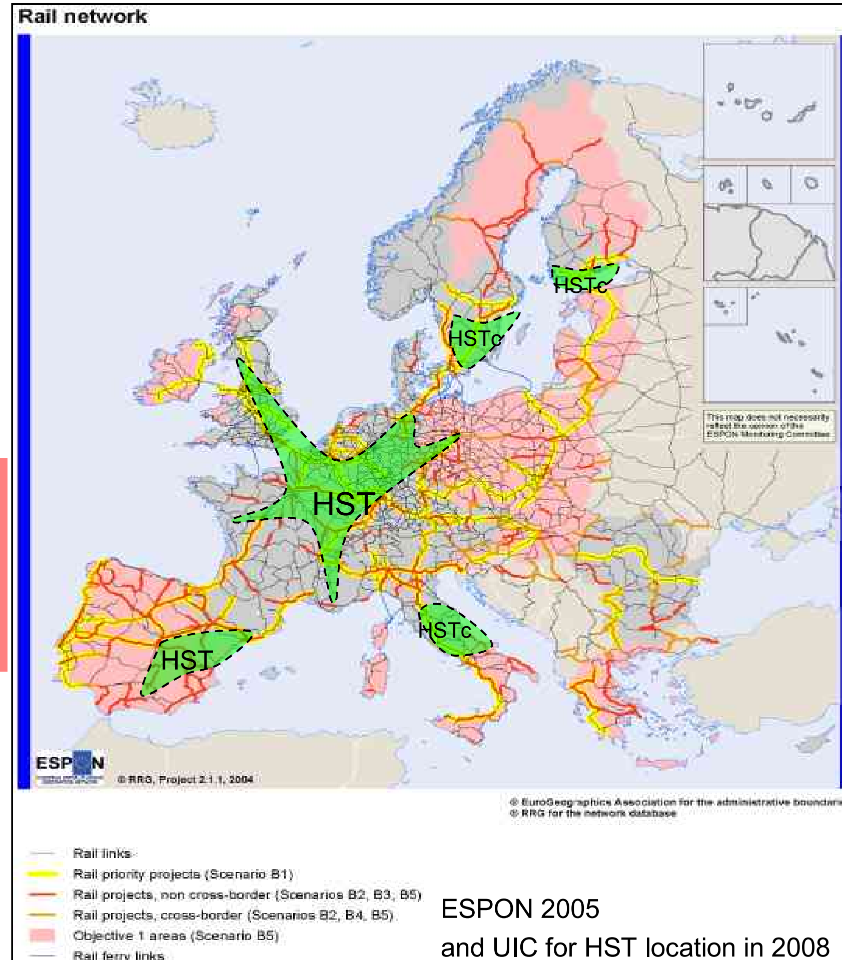
1km = 27 000 000 €

5566 km* of High Speed Train (HST)

3474 km* under construction

EUROSTAT for 2003

* UIC in 2008



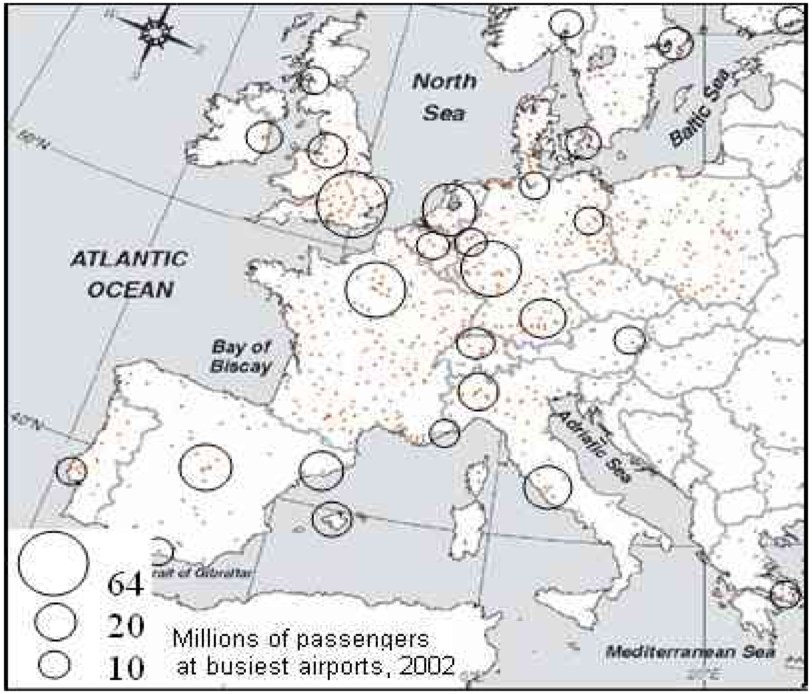
ESPON 2005

and UIC for HST location in 2008

Map 2.2 Rail network development of the infrastructure scenarios

Transport networks

AIR



EPATS 2008

5000 aircraft of commercial fleet

10 000 000 flights (IFR)

2570 airports and landing fields

85% of traffic CONCENTRATED at 43 large airports (HUBs)

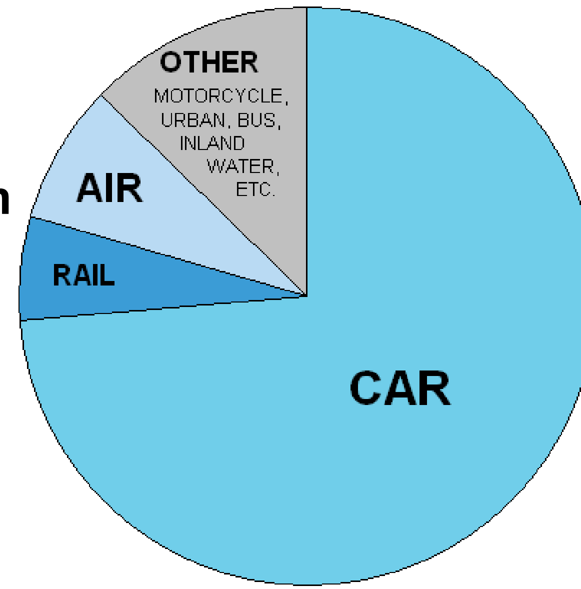
EUROSTAT 2007

EUROCONTROL 2007

Volume of passenger-kilometers

• Road transport (**4,1 trillions pkm***;
share: 86%; dynamics: +17,7%**)

• Train transport (**0,3 trillions pkm**
share: 6%; dynamics: +8,6%**)

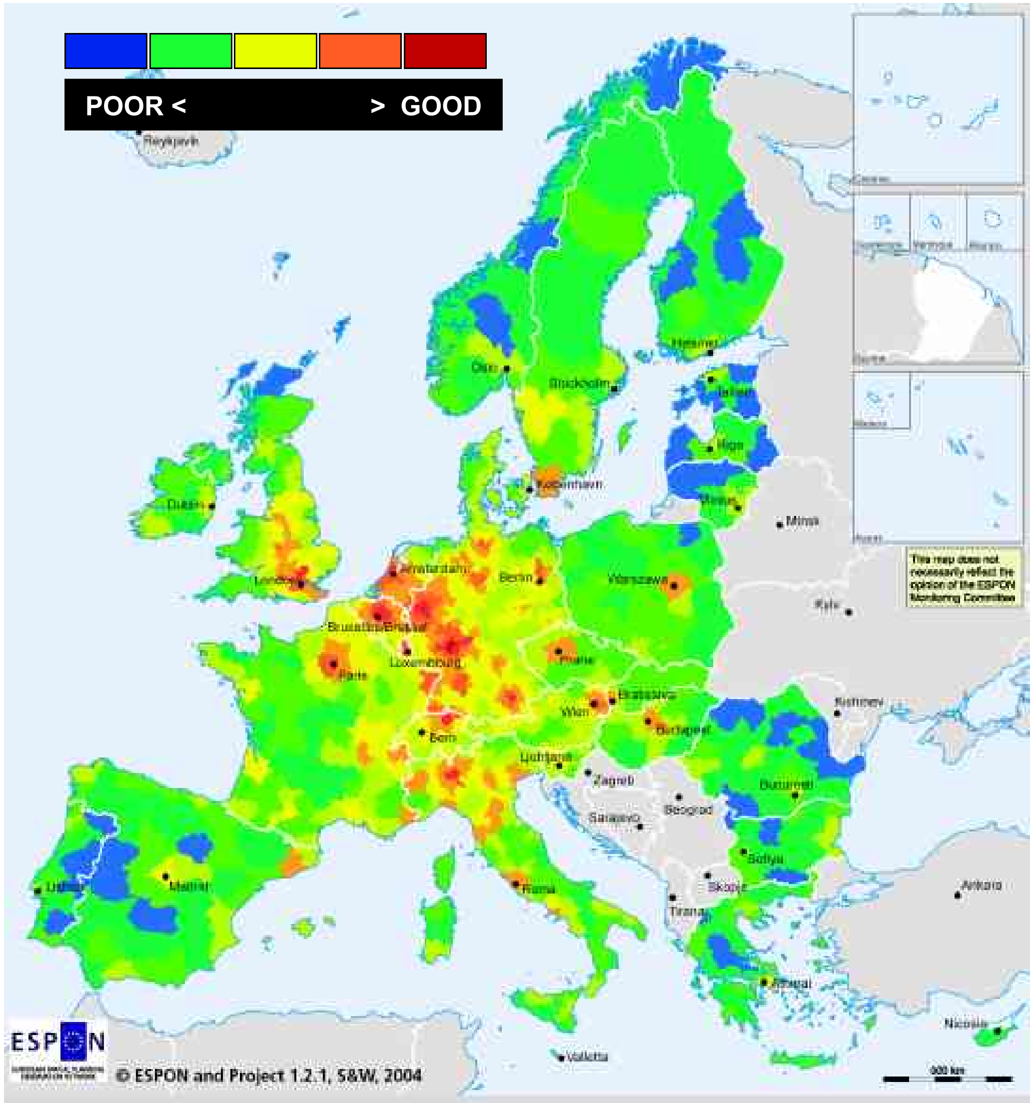


• Air transport (**0,4 trillions pkm***;
share: 8%; dynamics: +49%**)

* EUROSTAT for 2000   ** Period: 1995-2004

Accessibility

- Multimodal potential accessibility measures transport infrastructure quality of modes (car,rail,air)



ESPON 2004

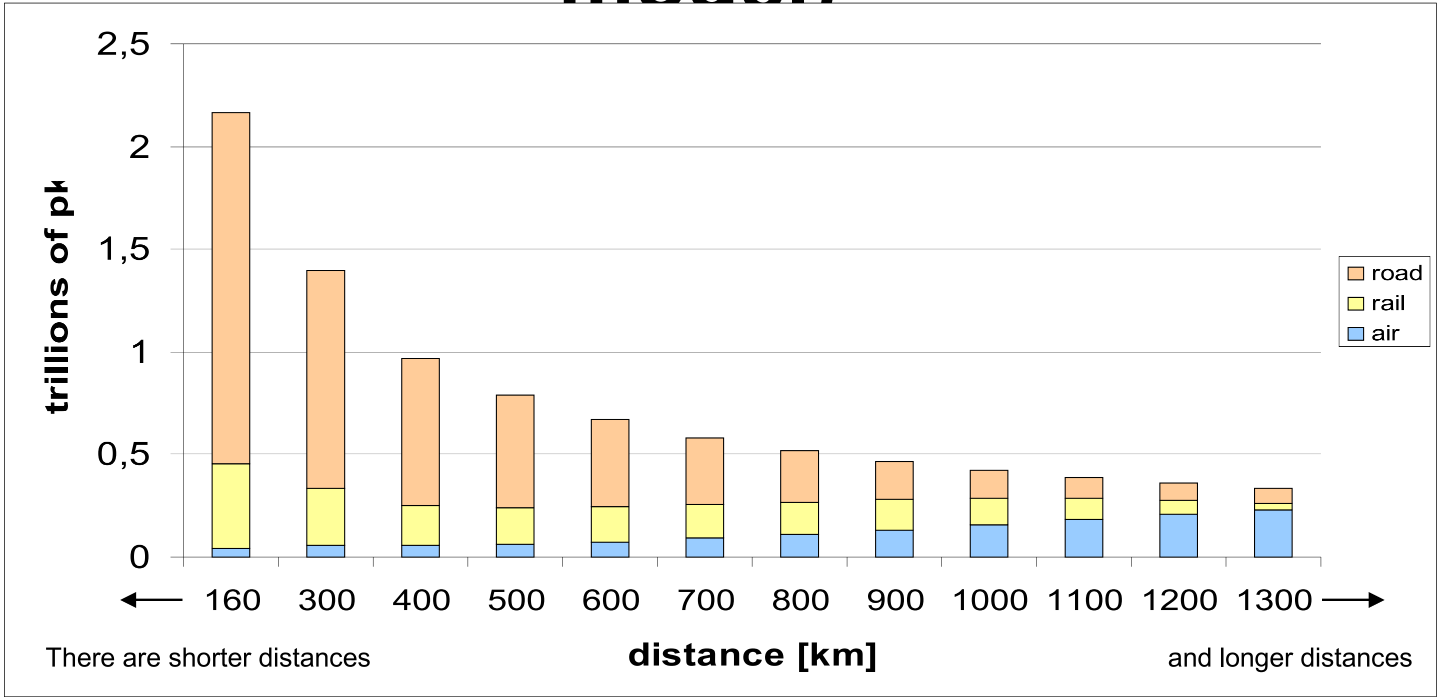
- on interregional national and European destinations
- with underdeveloped transport network,
- where implementation of others modes of fast transport is irrational due to too low flow of passengers

exists a TRANSPORTATION GAP

How to measure the gap?

- Knowing Origin-Destination passenger flows enables calculations. However, it is very difficult or even hardly achievable to gather such empirical data.
- Therefore a model should be built.
- Or - **an existing model outcomes could be adopted**…

Adopting origin-destination passenger flows from ESPON (KTEN model)



(69%) Road pkm: 25 * 10^12 pkm

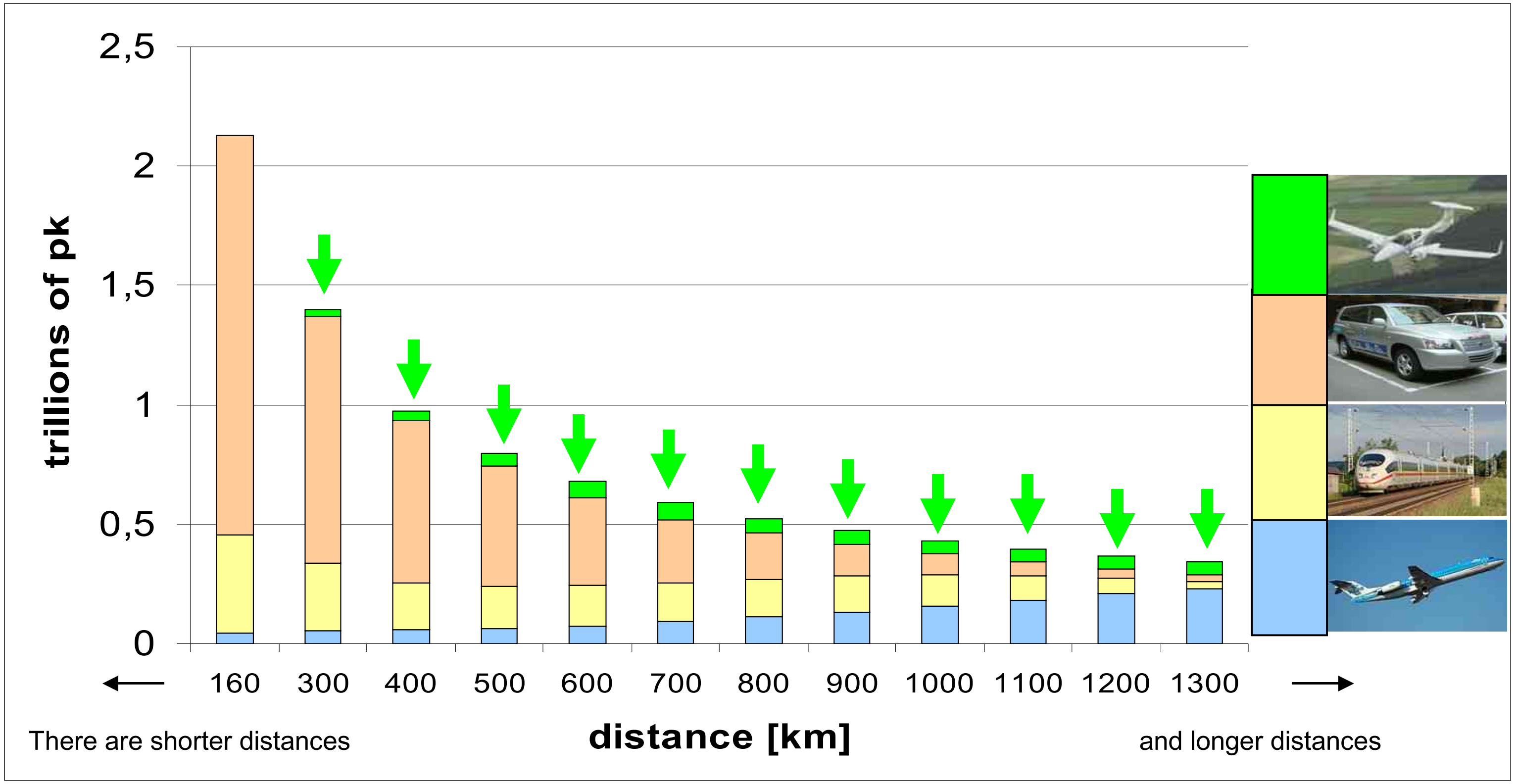
(18%) Rail pkm: 6,7 * 10^12 pkm

(13%) Air pkm: 4,8 * 10^12 pkm

Total pkm: 36 * 10^12 pkm

← *Numbers are ESPON Project 2.1.1 MCRIT's model output*

How wide is the gap?



(69%) Road pkm: 25 * 10^12 pkm

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(13%) Air pkm: 4,8 * 10^12 pkm

Total pkm: 36 * 10^12 pkm

← *Numbers are ESPON Project 2.1.1 MCRIT's model output*

EPATS estimations of the gap :

c.a. 150 * 10^9 pkm

What fits the gap?

European Personal Air Transportation System (EPATS) is a concept of Interactive Transportation System, which adapts aircraft, flight trajectory and transportation services to personalized passenger needs.

- It is to give travelers a free choice of transport mode, according to their need, and limited by their time value

„Improving the energy efficiency of all modes of transport"
according „European Energy Strategy for Transport"

- It enables origin-destination travel between all European regions at speeds considerably higher than car speed, and yet, at equivalent costs

Conclusions

- Europe needs a new, supplementary **mode** of transport

- A mode that is **harmonized** with general trends (door-to-door, multimodality, energy efficiency)

- A mode that will give us a new tool to manage the **challenge of mobility**

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

Make your individual escape from massive car traffic

SOURCES

- http://www.espon.eu – European Spatial Planning and Observatory Network; ESPON Project 3.4.1, *Europe in the World: Territorial evidence and visions*, results by autumn 2007; ESPON Project 2.1.1, *Territorial Impact of EU: Transport and TEN Policies*, 2005
- http://epp.eurostat.ec.eu – EUROSTAT, *Panorama of Transport*, 2007
- http://www.uic.asso.fr - The International Union of Railways (UIC): UIC Project - Lasting Infrastructure Cost Benchmarking (LICB) - LICB Summary_Report UIC C 2006/12/15
- http://www.eurocontrol.int – CFMU Network operation report 2007, March 2008, ver.1
- http://epats.eu – EPATS D2.1 *EPATS Potential transfer of passenger demand to Personal Aviation;* EPATS D1.1 T1.2 *EPATS Airports and facilities database*

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

m3 SYSTEMS

The demand for personal air transport in Europe

ILA Conference

Berlin, 28 May 2008

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

Which potential transfer of traffic from existing transport modes to personal air transport in 2020?

Estimation Method

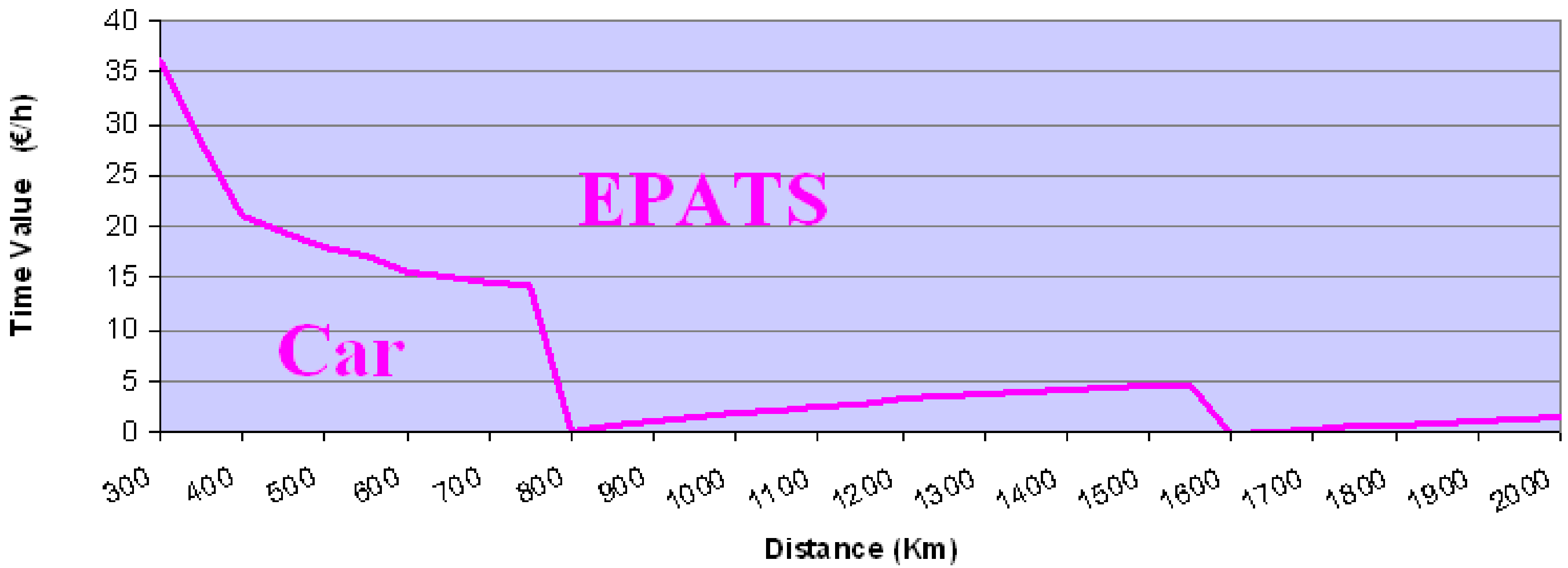
Generalised Cost method including:

- The direct cost borne by the traveller
- The travel time and its associated cost value

⇨ A traveller will choose the transport mode that minimizes his/her generalised cost

Indifference curves

Indifference Curve
between CAR and EPATS
EXAMPLE

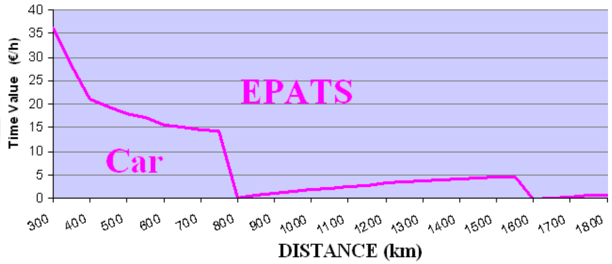


I

Method

Data and Assumptions

Indifference curves between 2 modes
Time value vs. distance



Journeys distribution
vs. distance and value of time

Pkm Distribution		DISTANCE cat.		
		D1	D2	D3
TIME VALUE €/h	TV 1	•••	••	•••
	TV2	•••	•••	•••
	TV3	•••	•••	•••

Modal Split

		DISTANCE cat.		
		D1	D2	D3
TIME VALUE €/h	TV 1	•••	••	•••
	TV2	•••	•••	•••
	TV3	•••	•••	•••

Car
Epats

Results : **Potential Transfer of passenger-km to EPATS**

Potential connections

63 429 total regional connections in Europe

↓

Criteria
Accessibility
Economic attractiveness
Curent traffic
Distance

↓

15223 potential connections for Personal air transport

(=24% of the total connections)

Transport modes

– EPATS generalised cost for traveller compared with the corresponding gesneralised costs of
  - Road transport
  - Traditional air transport
  - High speed rail transport

– High-speed rail not kept since always preferred to EPATS

Data collection

– <u>Sources:</u>

- Various databases from previous EU projects: DATELINE, TREMOVE, ASSESS, etc.
- EUROSTAT
- National statistics organisms
- Etc.

– <u>2020 scenarios:</u>

- ASSESS scenarios (Assessment of the contribution of the TEN and other transport policy measures to the mid-term implementation of the White Paper on the European Transport Policy for 2010)

2020 European Personal Air Traffic

2020 European people:
wealthier
and more mobile

↓

152 billions passengers kilometres

319 millions passengers

↓

100%
Business
traffic

2020 Flights

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

CASE A → 44 Million Flights

CASE B → 43 Million Flights

TOP 10 connections between countries

2. France-Spain
3. Portugal-Spain
4. Italy-France
5. United-Kingdom-Ireland
6. Poland-Germany
7. United-Kingdom-France
8. Italy-Spain
9. Italy-Austria
10. France-Germany
11. Italy-Greece

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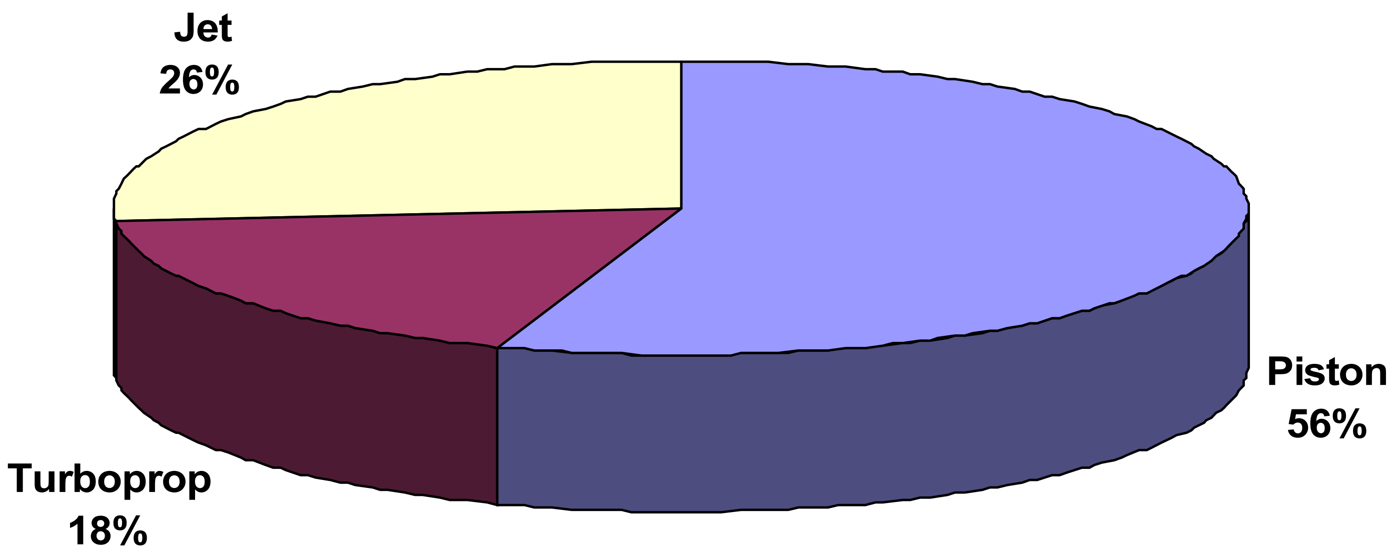
90 000 personal aircraft in Europe



EPATS traffic and fleet in France

- –302 French domestic EPATS connections
- –Estimated Traffic:
  - 15 billion Passenger-Km
  - 36 million passengers
  - 4.7 million flights
- –8400 personal aircraft:
  - 71% piston
  - 23% turboprop
  - 6% jet

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

Poland

EPATS traffic and fleet in Poland

– 70 Polish domestic EPATS connections

– Estimated Traffic:
  - 8 billion Passenger-Km
  - 28 million passengers
  - 4 million flights

– 7000 personal aircraft:
  - 87% piston
  - 13% turboprop
  - 0% jet

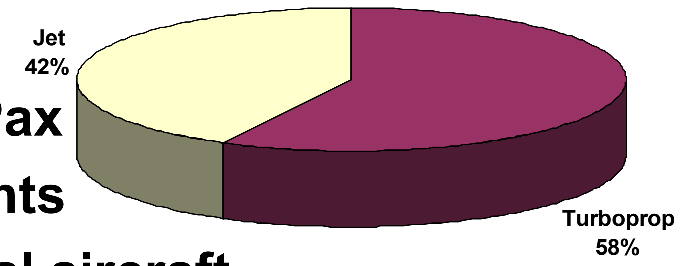
Sensitivity analysis

Operating cost may increase in the future:

- Strong fuel price increase
- New environmental taxes
- New material 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**



Sensitivity analysis

France:

- 44% traffic decrease : **20 million Pax**
- 67% flight decrease: **1.5 million flights**
- 80% fleet decrease: **1 600 personal aircraft**

Poland:

- 90% traffic decrease : **3 million Pax**
- 95% flight decrease: **200 000 flights**
- 72% fleet decrease: **200 personal aircraft**

EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

Conclusion

- ↗ demand in personalized transport services
- ↗ needs in high-speed transport in remote areas

⇩

–Transferred traffic to personal air transport in 2020: 3% of the total European traffic

–90 000 personal aircraft

–25 500 personal aircraft if their operating cost increases by 30% (fuel cost, taxes, SESAR requirements, etc.)

Thank you very much for your attention!

Any questions?

EPATS
ATM General Requirements & relative issues to be solved

ILA Berlin - May 2008
Marc Brochard - EEC

ATM impact assessment
Potential EPATS Traffic

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

These are big figures ….

Can we integrate this new traffic in the ATM in 2020?

ATM impact assessment method

The problematic for assessing EPATS – a new business – on the ATM of the future:

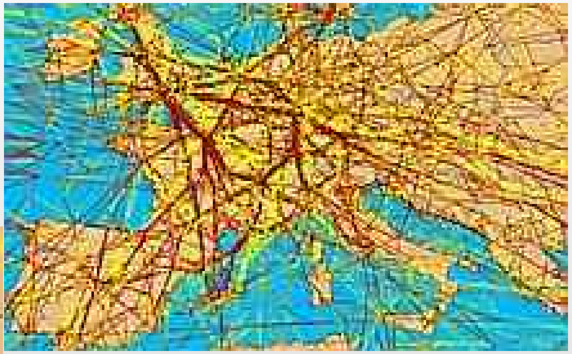
- **No EPATS history** (but do we not already have kind of EPATS in the air?)
- **SESAR concepts** - an evolution of the current ATM system (not a revolution) – providing more capacity, more autonomy, better fitting to airspace users needs (strategic traffic organisation, preferred FL/4D profile– **business trajectory**) – network centric architecture (data and decision sharing – **SWIM**) still human centred …. but <u>still requiring clarifications and validations</u>

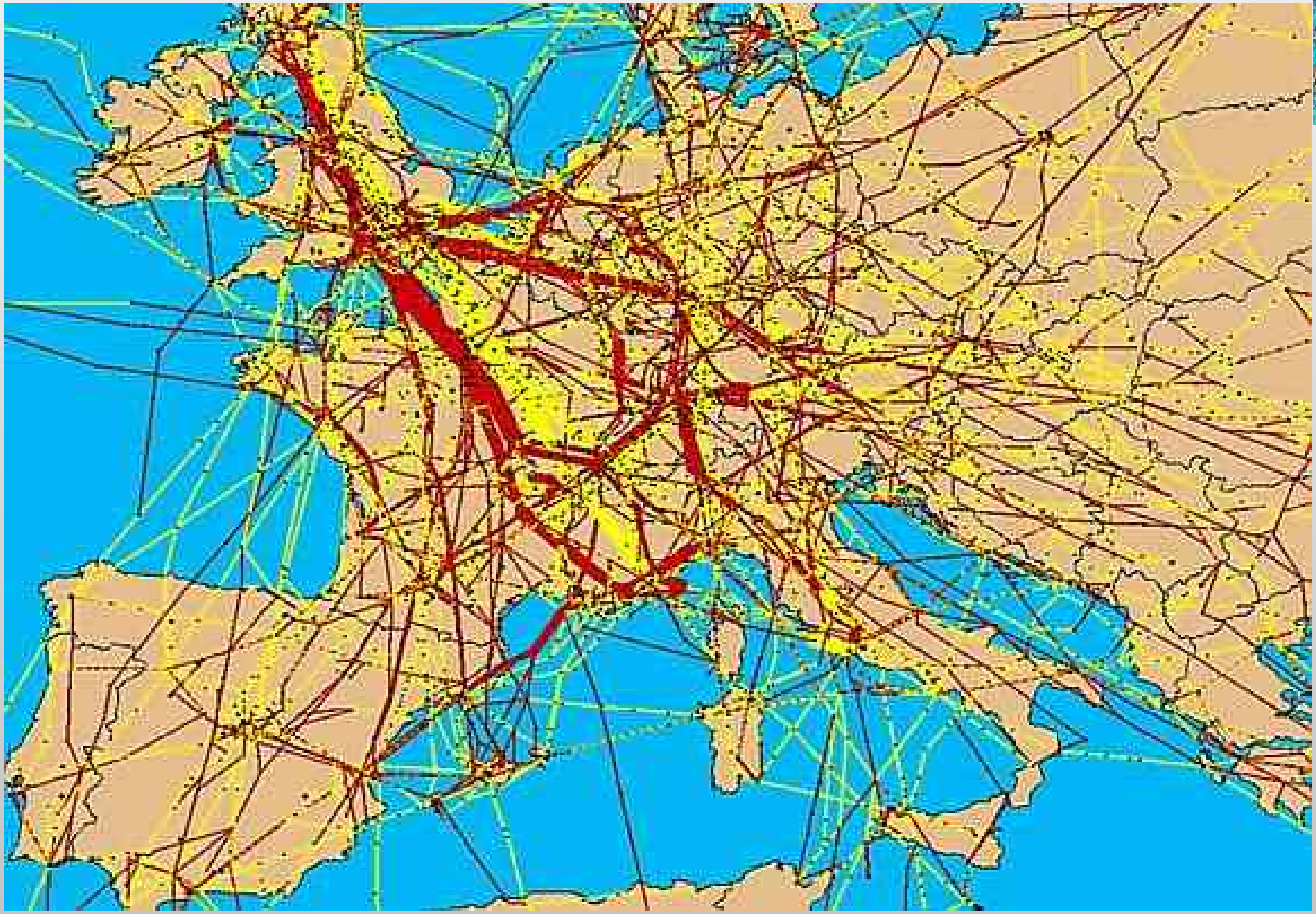
ATM impact assessment
EPATS aircraft

Class of aircraft	ACP-1	ACP-2	ACT-1	ACT-2	ACJ-1	ACJ-2
Crew	1	1	1	1	1	
Pas. Seating (PS)	3	5	9	19	5	
Max Payload [kg]	285	475	855	1805	475	
Useful load [kg]	530	560	1850	2400	1100	
Takeoff weight [kg]	1300	2000	4500	7200	2700	
TO Field length [m]	600	600	1000	1200	800	
Initial gradient [m/m]	0,12	0,18	0,14	0,18	0,18	
Cruise speed [km/h]	320	350	550	550	700	750
Climb speed/Cruise speed CC	0,5	0,5	0,55	0,55	0,6	0,6
Cruise altitude [FL]	100	250	250	250	350	350
Range [km]	1000	1000	1500	1500	2500	2500
ATM Capability: SESAR level	1	1	3	3	3	3
Total fixed operations time (TFOT) [min]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Average Load Factor (LF)*	0,7	0,7	0,7	0,7	0,7	
Hours flown by year*	300	400	500	1400	400	
Life Cycle [years]	20	20	20	20	20	
Average Great Circle Distance (GCD) [km]	400	400	700	700	1100	
Average throughout distance to GCD rate (R)	1	1	1,1	1,1	1,15	
Airport access/egress time [min]	15	15	20	20	20	

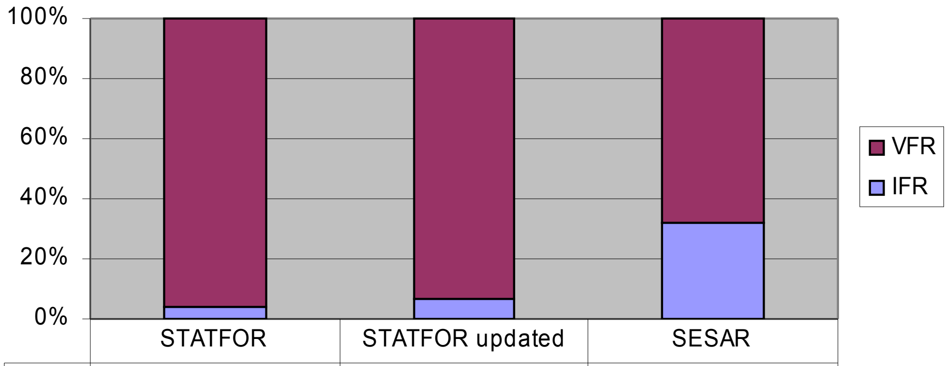
ATM impact assessment
EPATS traffic today

2007, EPATS "kind of"= 839500 flights a year
= 8.1% of total IFR traffic

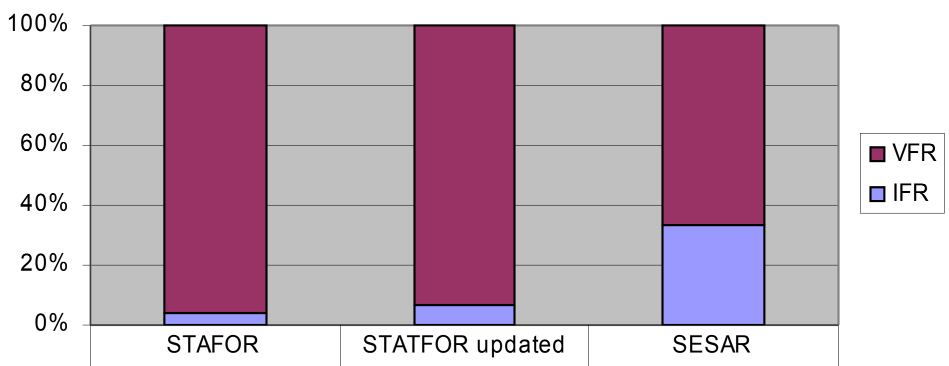




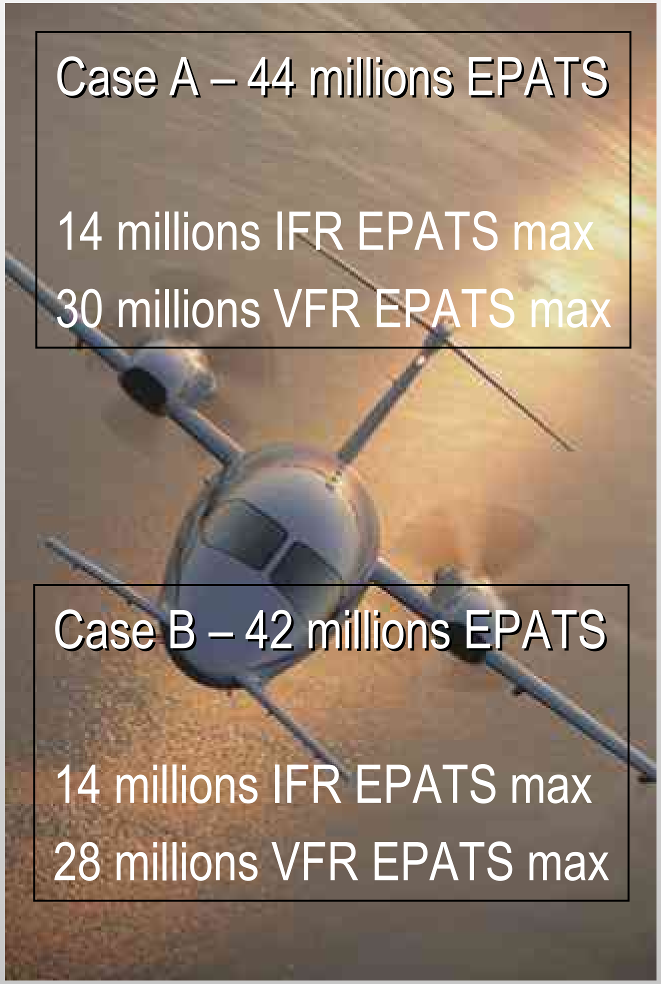
ATM impact assessment
EPATS traffic 2020 vs capacity



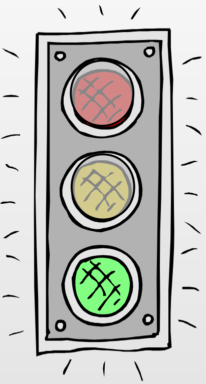
	STATFOR	STATFOR updated	SESAR
VFR	42.397	41.263	29.899
IFR	1.782	2.916	14.28



	STAFOR	STATFOR updated	SESAR
VFR	41.142	40.091	28.644
IFR	1.782	2.833	14.28

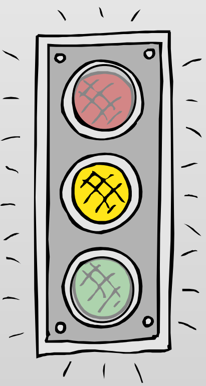


ATM impact assessment
EPATS traffic 2020 vs capacity



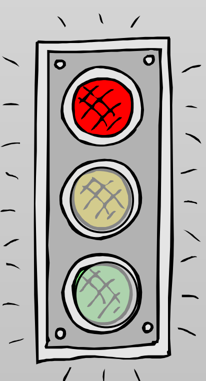
Within STATFOR - up to 2 millions EPATS IFR

Extending STATFOR – up to 3 millions EPATS IFR



Filling SESAR target capacities - up to 14 millions EPATS IFR

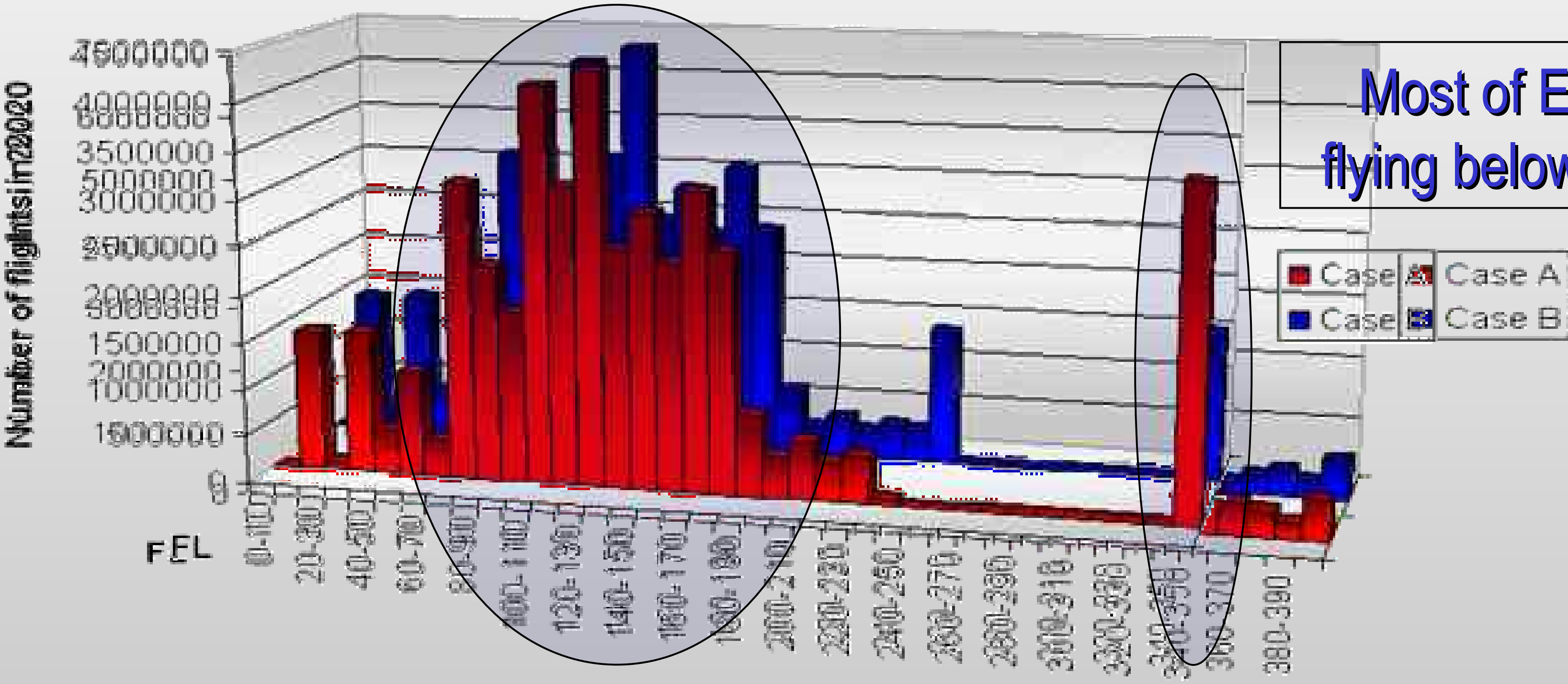
SESAR theoretical target capacity = limitations to be assessed



Beyond 14 millions EPATS IFR – outside the overall 2020 ATM capacities

ATM impact assessment
FL distribution

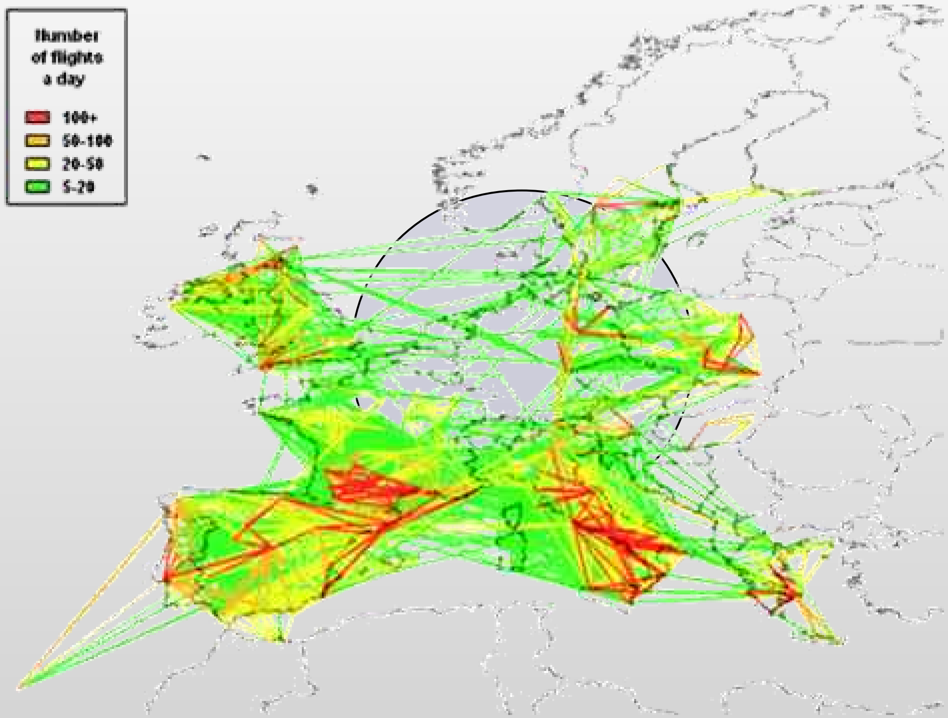
EPATS cruising Flight Level distribution (standard distribution, not integrating ATM constraints)



Most of EPATS flying below FL190

SESAR Airspace design for IFR and VFR vs managed and un-managed airspace (vertical (FL) and geographical design – <u>dynamic and morphing</u>)

ATM impact assessment
Geographic distribution

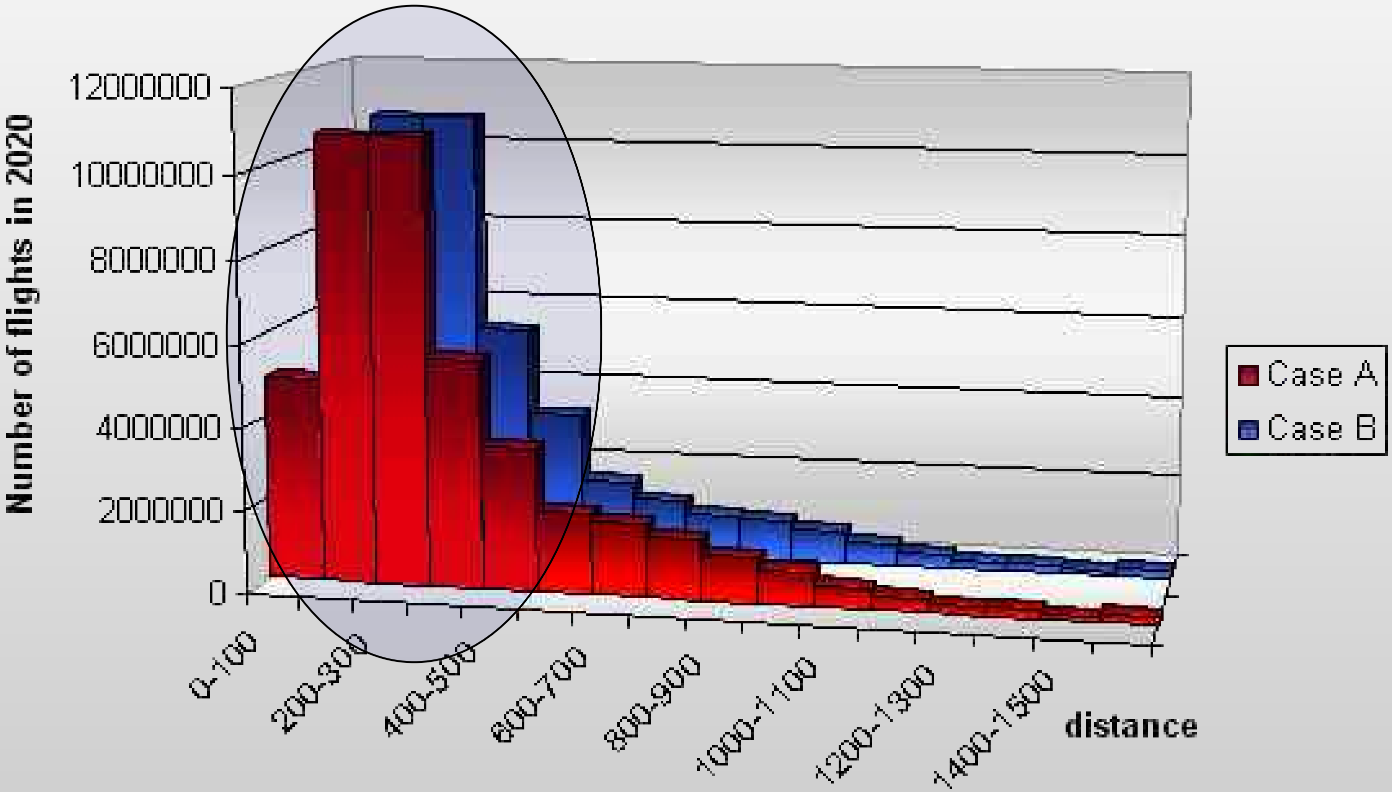


EPATS seems to be avoiding the current ECAC Core Area

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

Mixed traffic (traditional ones + EPATS (IFR & VFR)) with TMA potential impact

ATM impact assessment
Distance distribution



Most of EPATS seems to be flying not longer than 500 Kms

ATM impact assessment
EPATS Daily Traffic

Daily EPATS traffic :

- highly distributed over Europe with potential impact on traffic complexity (mixing IFR & VFR flights)
- avoiding current ECAC Core Area, most congested Airport and Waypoints …. but integrated in TMA
- May be creating new dense/congested area and airports (mainly south of Europe but also England)
- Flying at low level (FL190) and on relative short distances (500Km)

EPATS to fit in the SESAR Business Trajectory process: strategic planning and negotiation

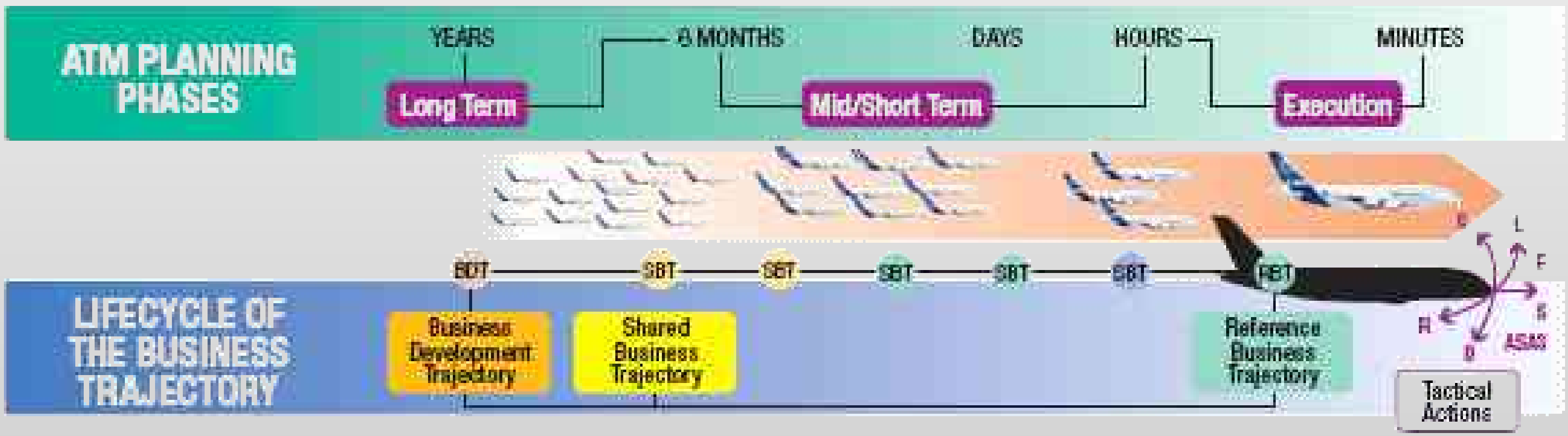


Figure 1: The Business Trajectory lifecycle

What will be the EPATS business model?

Flight on request or scheduled?

ATM impact assessment
Conclusions – ATM Impacts

ATM impact:

- System capacity (<u>**sever challenge for SESAR**</u> to handle 14 Millions EPATS IFR flights with <u>high number of EPATS VFR flights</u>)
- Traffic complexity (high distribution – new dense area leading to design new SESAR managed airspaces)
- Airspace design both for IFR <u>and</u> VFR EPATS flights (might be constrained by the SESAR airspace design as most of EPATS flight will be in un-managed airspace – dynamic and morphing airspace)
- Terminal area Safety (mixing traditional traffic with EPATS traffic with different aircraft performances (speed – wake vortex) – dense area thus SESAR managed airspace – IFR only? VFR?)
- Safety (Self separation management & self conflict avoidance - less skilled EPATS pilots? – on-board equipment mandatory for flying SESAR – **single pilot**)

ATM impact assessment
Conclusions - R&D needs

EPATS R&D needs:

SESAR Airspace design for IFR and VFR vs managed and un-managed airspace (vertical (FL) and geographical design – dynamic and morphing)

SESAR Business Trajectory management for EPATS flight (IFR and VFR?) and EPATS FL allocation (including flight planning and trajectory negotiation and SWIM issues)

SESAR and VFR flights

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 (AMAN, DMAN, SIDs, STARs, CDA concept, Aircraft performances)

En-Route operation mixing EPATS and traditional flights (Aircraft performances, managed airspace, Routing, separation management)

EPATS scenarios for EPATS traffic assessment: Safety, flight efficiency, cost, effective capacity, complexity, delay

AGATE animation - business theme
NASA Langley Research Center 12/1/1998 Image # EL-1999-00066

Thank you …

Contact:
marc.brochard@eurocontrol.int
www.eurocontrol.int

Dedicated to innovation in aerospace

European Air Transportation System

Safety and Environment

Dr. F.J. van Schaik

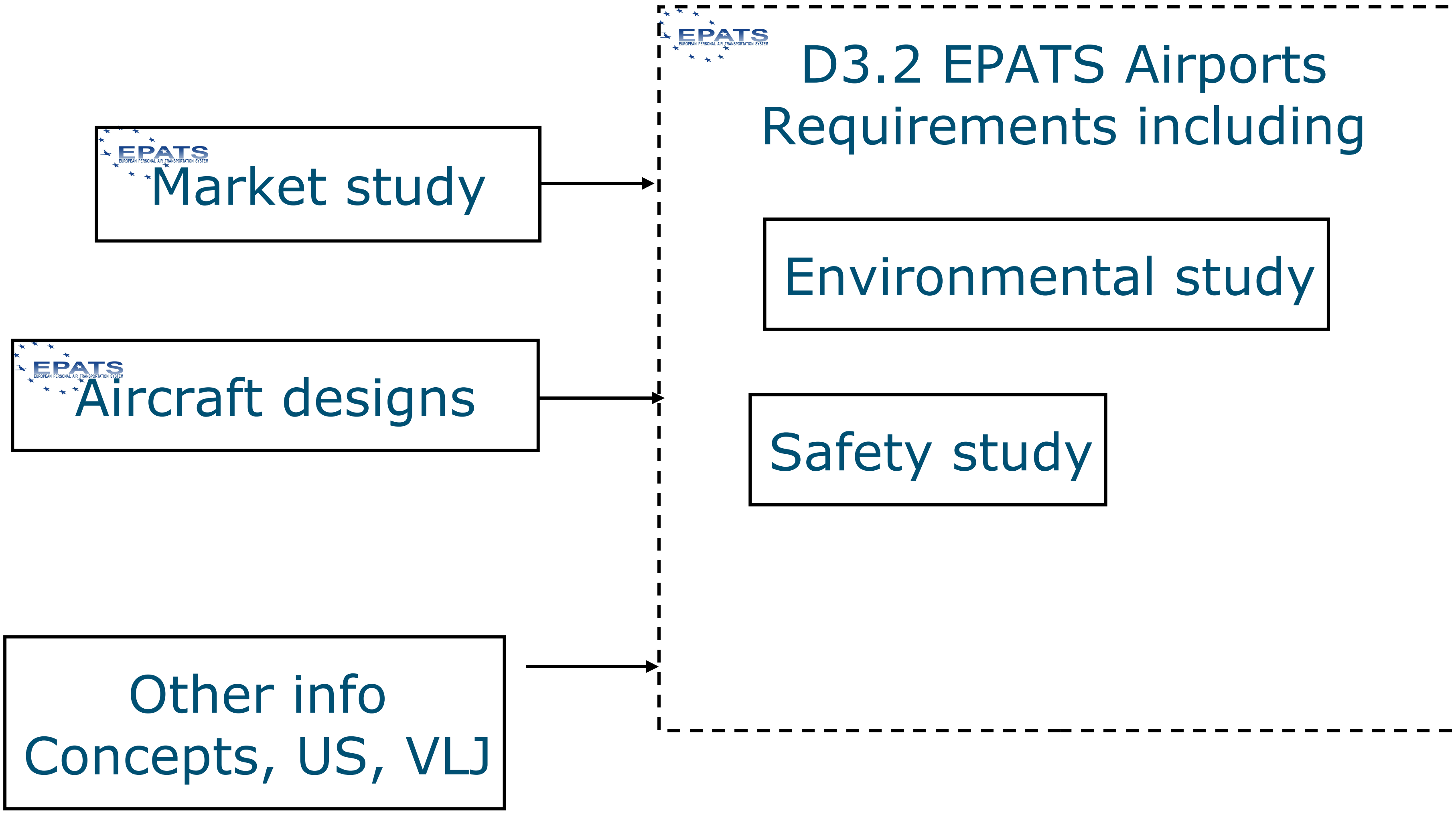
Ir. R. Hogenhuis, Ir. R. Wever

Content

- Approach / EPATS aircraft / EPATS operations

- Environmental issues
- Safety issues
- Recommendations

Approach


Market study
Aircraft designs
Other info
Concepts, US, VLJ
D3.2 EPATS Airports
Requirements including
Environmental study
Safety study

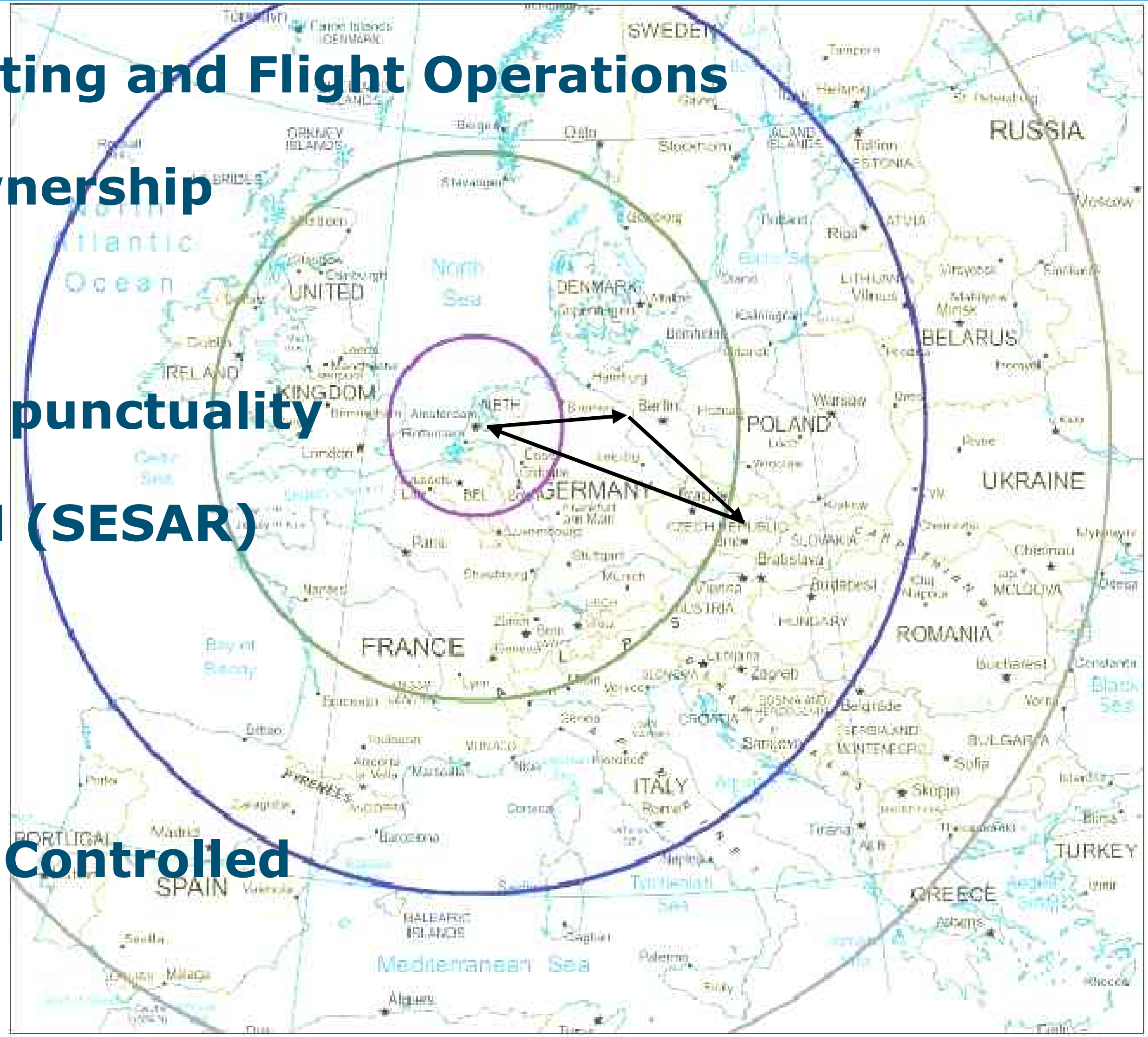
EPATS aircraft

- GNSS / P-RNAV
- ADS-B
- ACAS
- TAWS
- EFB / Moving Map
- Weather
- HUD / SVS / EVS
- FADEC

2020: about 100.000 a/c

EPATS Flight Operations

- **Internet Based Ticketing and Flight Operations**
- **Air Taxi / Shared Ownership**
- **One day return**
- **High reliability, High punctuality**
- **Network Centric ATM (SESAR)**
- **All weather 24 ops**
- **VFR / IFR / SCA**
- **(Un)controlled/ Self Controlled**



Environmental issues

Assumptions:

- **100.000 a/c 2000 airports**
- **365 flights per EPATS a/c per year**

lead to:

- **+24000 movements per year (m/y) per airport**
- **Some airports will get 3x more movements**
- **Other airports can't have more than present day**

Environmental issues / noise

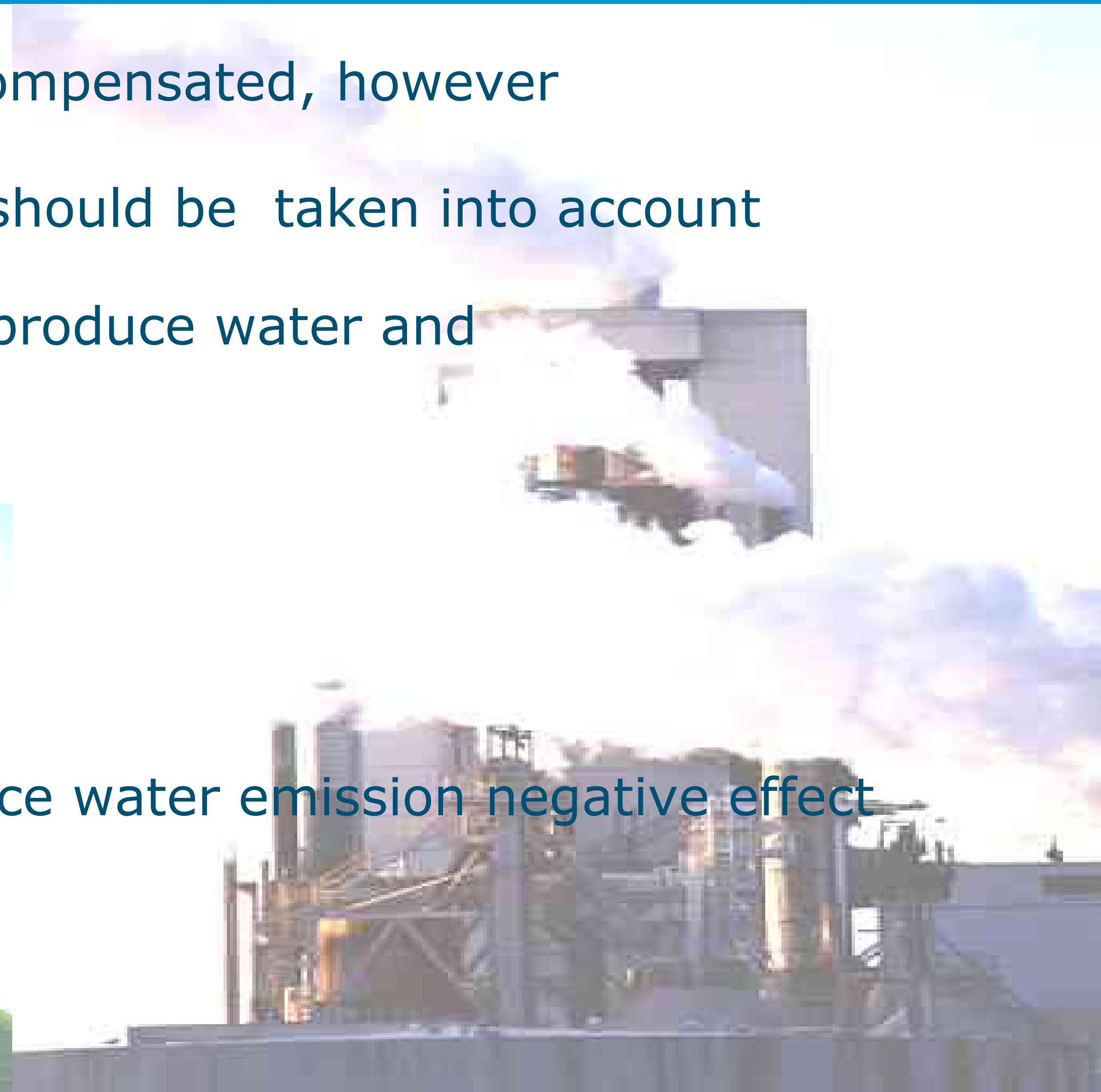
Aircraft + type	year	MTOW	pas	range	LA TO	LA APP	LA TO corr	LA APP corr
Cessna Citation Encore (J)	1998	7634	11	7634	58.3	83.0	54.9	79.6
Mitsubishi MU300 Diamond I (J)	1996	7394	7	2744	71.9	77.2	70.4	75.7
Cessna Citation 525 CJ (J)	1998	4853	5	2408	60.3	81.7	60.3	81.7
Piper PA-42 Cheyenne (TP)	1977	5125	6-9	3015	70.3	77.1	67.7	74.5
Beech Super King Air B200 (TP)	1981	5670	13	3251	68.8	77.8	64.7	73.7
Cessna 421C (P)	1976	3103	8	2756	61.0	74.0	59.0	72.0
Beech Bonanza A36 (P)	1970	1633	3-5	1291	67.8	64.0	67.8	64.0
Eclipse 500 (VLJ)	2007	2719	5	2408	54.9	72.8	54.9	72.8

Noise = f (construction date, weight and number of passengers)

--> Piston/ turbo prop aircraft are preferred for noise

--> New aircraft become more and more silent

Environmental issues / emissions

- If bio-fuel is used, CO_2 is compensated, however
- The total production chain should be taken into account
- If Hydrogen is used, it will produce water and

it is inefficient to make it and

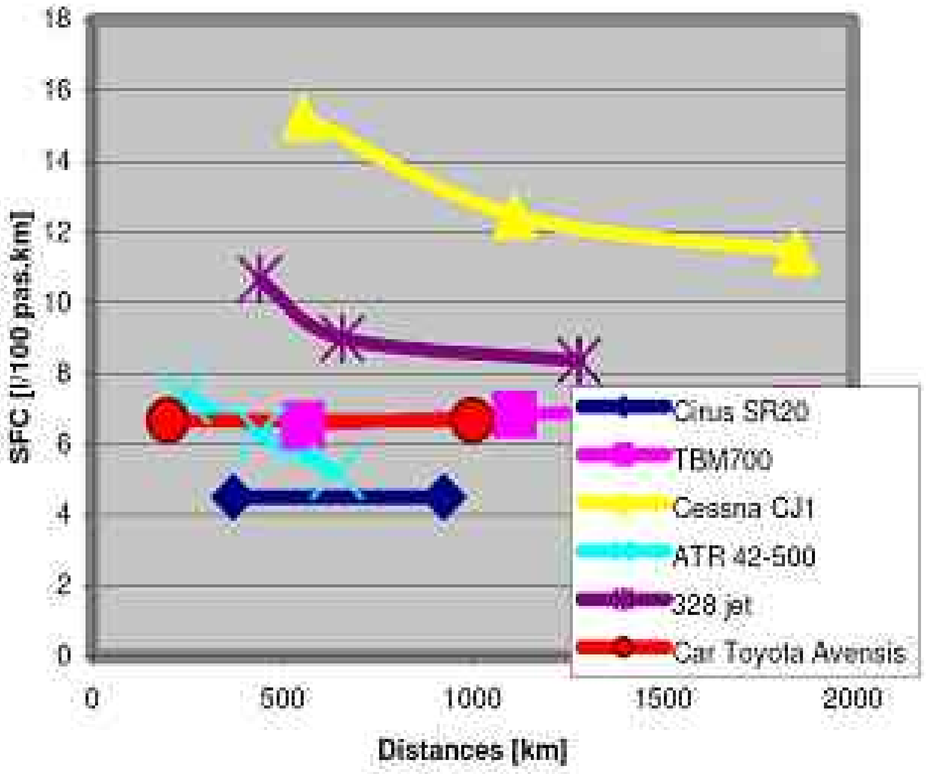
it needs heavy tanks

- Flying below 7 km will reduce water emission negative effect
- Restricted study

Environmental issues / emissions

Comparison of Specific Fuel Consumption:

(kg. fuel per passenger kilometre)



Piston and Turbo

are better

than jets

Car load factor 0.3

A/c load factor 0.6 to 0.9

Safety issues studied

- Aircraft manufacturing and certification
- Flight operations
- Training and qualification
- Airport and Air Traffic Control
- Safety programs and
- Safety oversight

Safety issues

- CS23 is not CS25
- 100.000 new pilots!
- Aspects of pilot training, inexperienced pilots
- Bird and wildlife, de-icing
- New technology, new ATM concepts like Self Controlled Airspace
- (Single) pilot operations / communications
- Controller workload

Safety and Environmental conclusions and recommendations (1) / noise

- Many local airports are noise constraint and the upcoming EPATS might become a problem quickly => Socio - economic impact
- Local economy might forgive more noise
- VLJs replacing regular light jets reduce the noise impact
- Single and twin piston engines and turboprops give better or comparable noise characteristics during approach (comp. to VLJ)
- VLJ produce less noise during the take-off than conventional jets
- Engines should become more silent, higher efficiency, new propulsion techniques

Safety and Environmental conclusions and recommendations (2) / noise and emissions

- Development of noise abatement routes, CDA , avoid the night
- Piston and turboprop engines have lower emissions than VLJs
- Piston and turboprop a/c are cleaner than VLJ up to 600 km but are slower
- Increase the load factor (optimisation)
- Fuel research for low environmental impact

==> It is difficult to predict what is possible

==> Define goals

- (e.g.) Can we bring/keep the airport noise below that of provincial roads?

Safety and Environmental conclusions and recommendations (3) / Safety

- Are current regulations sufficiently safe for EPATS?
- R&D in automation supporting safe single pilot operations, flight envelope protection and further automation of flight
- Single pilot operations and feasibility study of the virtual co-pilot, Single Pilot Resource Management
- Mentor pilot and scenario based training concepts in EPATS
- Safe integration of EPATS aircraft in the air transport system of today has to be studied in more detail (impact on ATC and airport)
- Tailoring and application of commercial aviation safety programs to EPATS operators and outsourcing of safety programs shall be studied

Overall recommendations

- Better EPATS statistics and forecasts needed
- EPATS will come quietly, so prepare!
  - **ATM safety research**
  - **Environmental friendly procedures**
  - **Emissions**
  - **Remote airfields / control / autoland / de-ice**
- Better SESAR for EPATS
- Single pilot Resource Management / Safety

Conclusion

Can you do without your PC? No?

You also can't do without your PA!

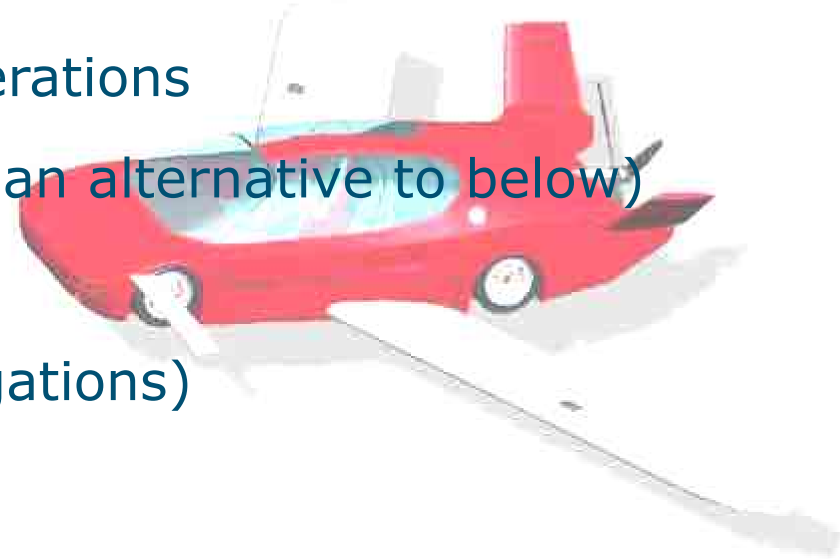
Safety issues in alphabetical order (1)

- Clear air turbulence/jet stream core or boundary encounters
- Convective weather encounters
- FMS programming and autoflight vs. manual flight control
- High-altitude upset
- Inadequate "land and hold short" (LAHSO) preparation
- Inadequate crosswind takeoff/landing preparation
- Inadequate exercise of "command"
- Inadequate knowledge of high-altitude weather
- Inadequate preparation for high-rate/high-speed climbs

Source NBAA

Safety issues in alphabetical order (2)

- Incorrect/less-than-optimum cruise altitude selection
- Jet blast damage behind larger jets during ground operations
- Lack of pilot self-evaluations
- Low-fuel arrivals trying to stretch range
- Microburst/windshear encounters /Mountain wave encounters
- Physiological effect of high-altitude operations
- Recognizing single pilot "red flags" (as an alternative to below)
- Single pilot adherence to checklists
- VLJs misunderstood by ATC (pilot mitigations)
- Wake turbulence encounters
- Winter operations



Source NBAA

EPATS Conference
ILA Berlin, May 28, 2008

Missions Requirement for EPATS Aircraft




Affordable Personal Air Transport

WP4 Leader: **Institute of Aviation / Włodzimierz Gnarowski**

Presentation: Institute of Aviation / Michał Pokorski

REQUIREMENTS STRUCTURE

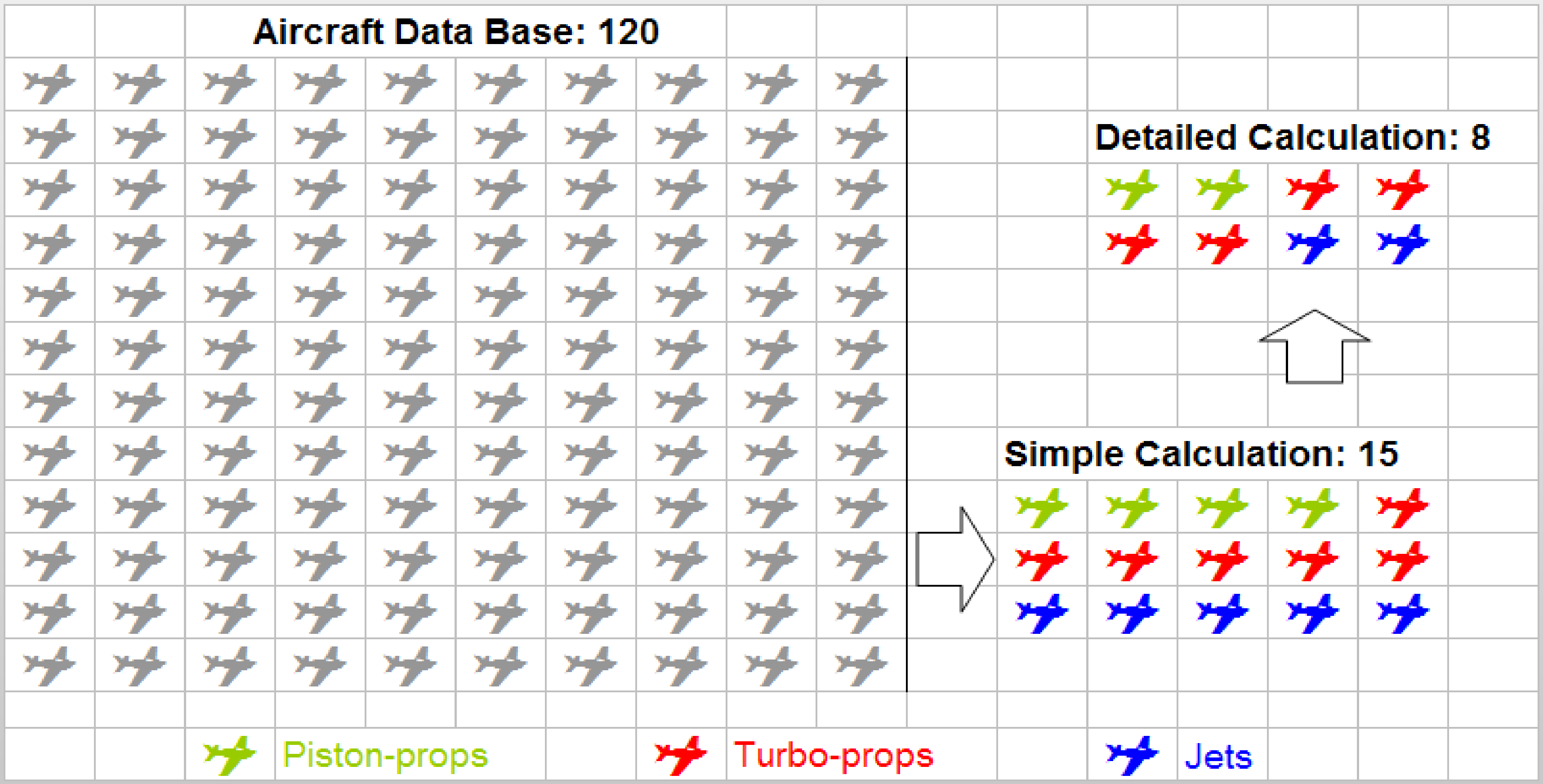
- Airport performances
- Mission requirements
  - Range
  - Flight levels
  - Cruise speed
- Operating
  - Life Time
- Regulations
  - CS-23

Range limits to needs

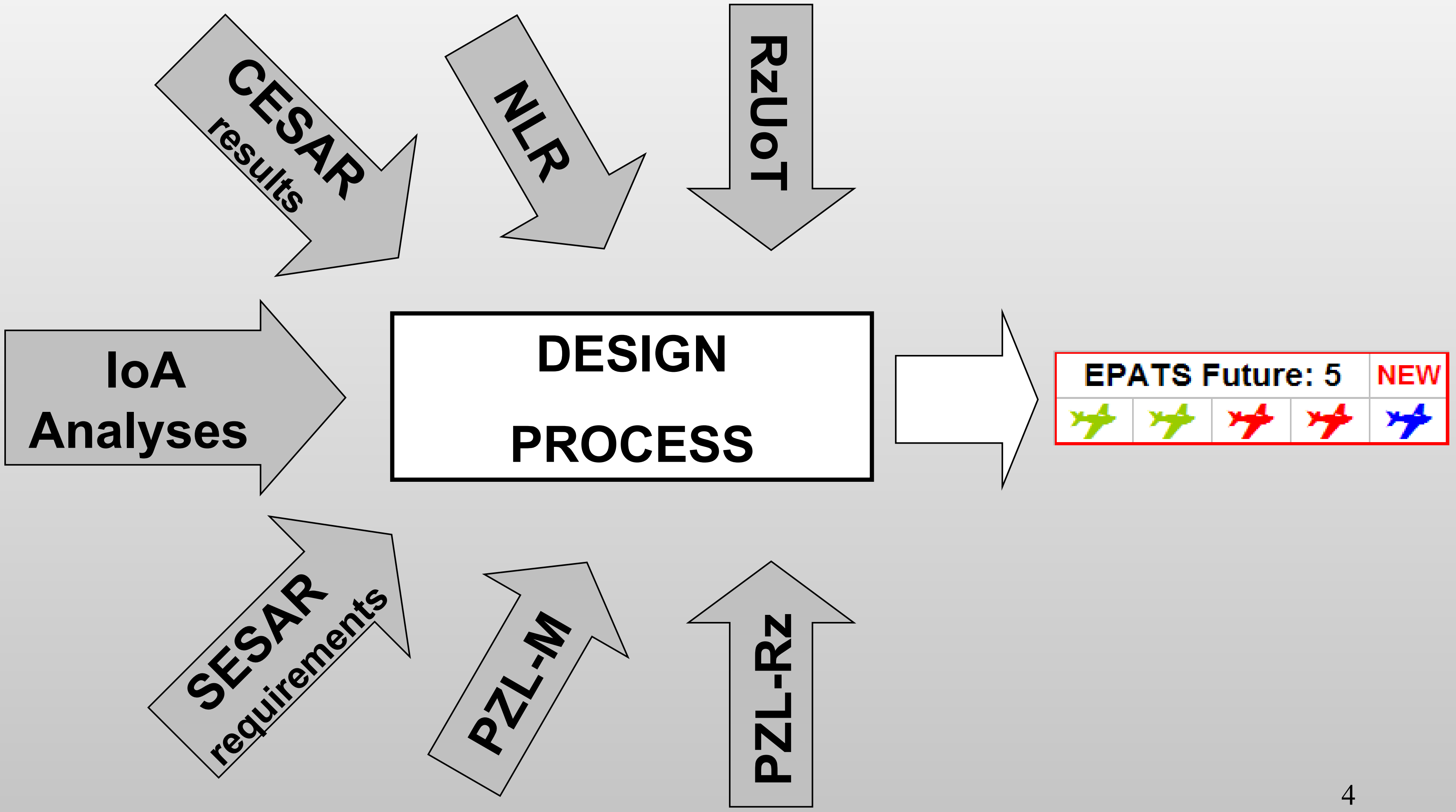
80% runways available

The most favourable flight conditions

REFERENCE AIRCRAFT SELECTION

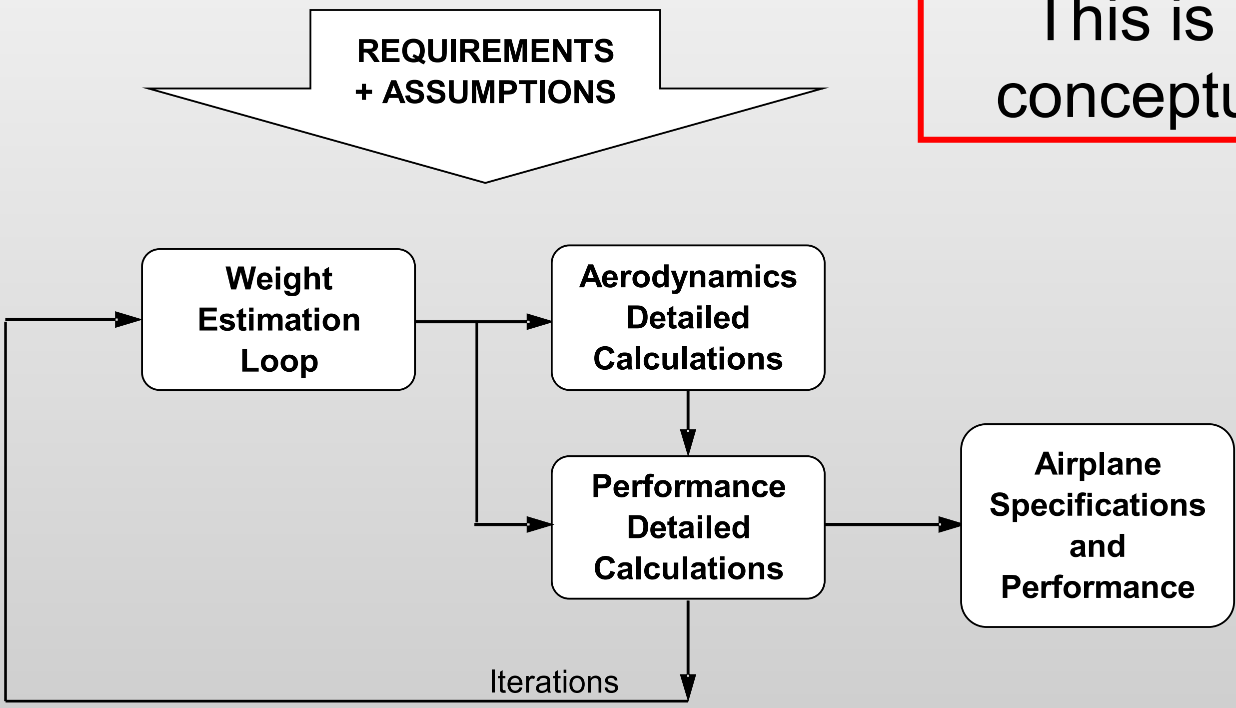


FUTURE AIRCRAFT DESIGN: 2020



AIRCRAFT DESIGN PROCESS

This is not a full conceptual design



AIRCRAFT COMPARISION: Reference vs Future

2020

PISTONS

1eng 4seat

2eng 6seat

TURBO-PROPS

2eng 8pax

2eng 19pax

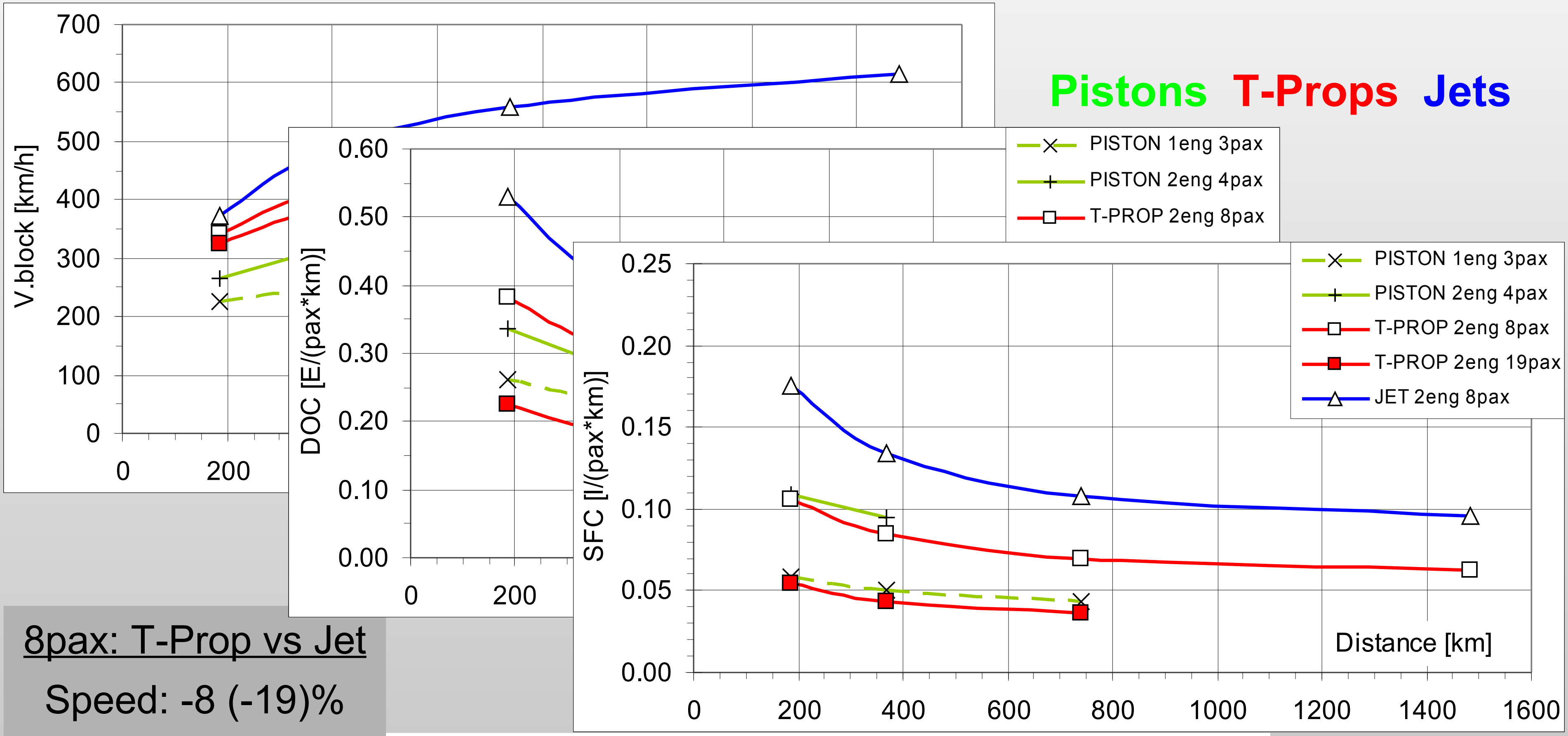
JETS

2eng 8pax

	PISTONS 1eng 4seat	PISTONS 2eng 6seat	TURBO-PROPS 2eng 8pax	TURBO-PROPS 2eng 19pax	JETS 2eng 8pax
Range full seats	1000 km	500 km	2000 km	1000 km	2000 km
Speed (bl.) km/h	Similar	+11(+13)%	-17 (-10)%	+10(+17)%	Similar
DOC €/(pax*km)	-18%	-37%	-23 (-32)%	-12 (-15)%	-24%
SFC l/(pax*km)	-20%	-26%	-11 (-28)%	-16%	-21%

short (long) distance

FUTURE AIRCRAFT PERFORMANCE: 2020



8pax: T-Prop vs Jet

Speed: -8 (-19)%

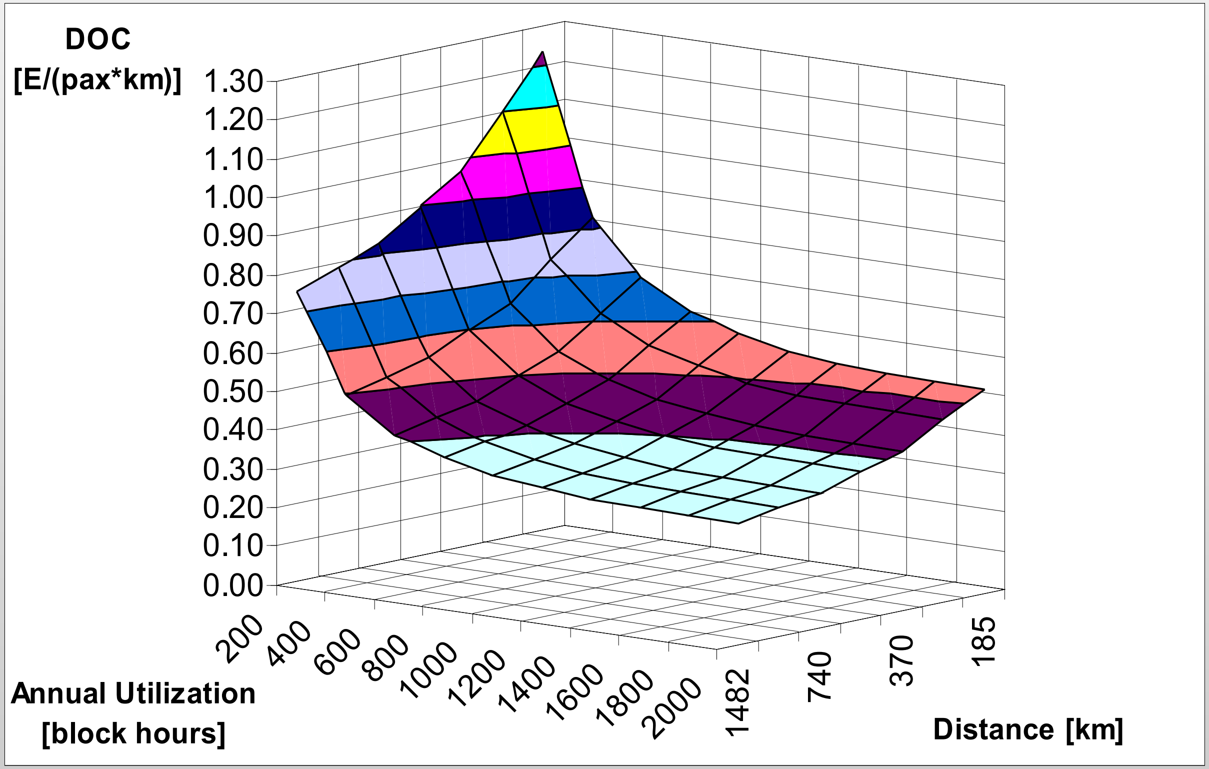
DOC: -28 (-19)%

SFC: -39 (-34)%

Airplanes' features as a functions of distance

REMARKS - OPERATING

DOC Very Sensitive to Utilization Intensity



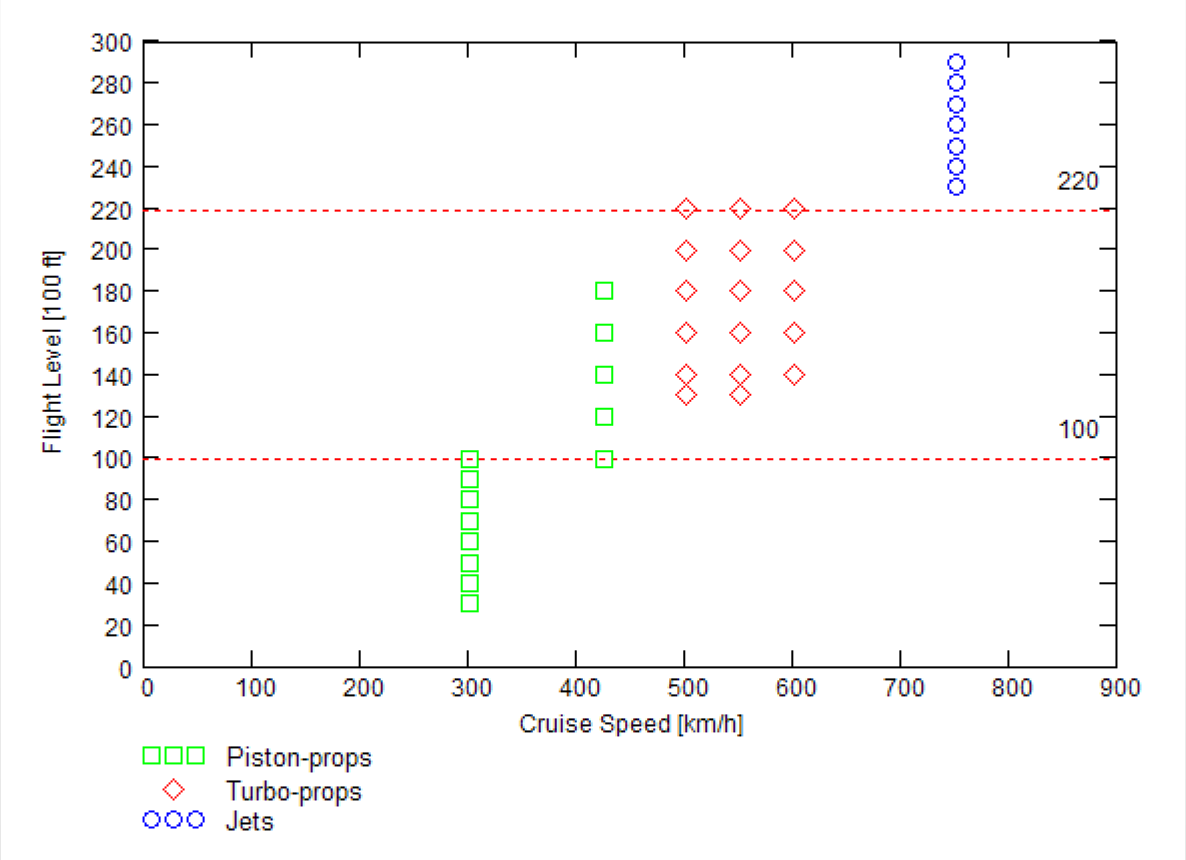
Distance Impact

Today Indirect Cost level: 100 % DOC

Future goal: 50 % DOC

REMARKS – AIRSPACE STRUCTURE PROPOSAL

Current Airspace Load



Economic Parameters

Fuel Consumption

Different airplanes – different performances – different favourable flight conditions

CONCLUSIONS

1. Affordable personal air transport is REAL.

- Aircraft fitted to needs:
  - Range, speed, size, etc.

- Operating optimization:
  - High utilization intensity,
  - Low indirect cost.

4. Pistons and turbo-props the most suitable.

Thank you for your attention

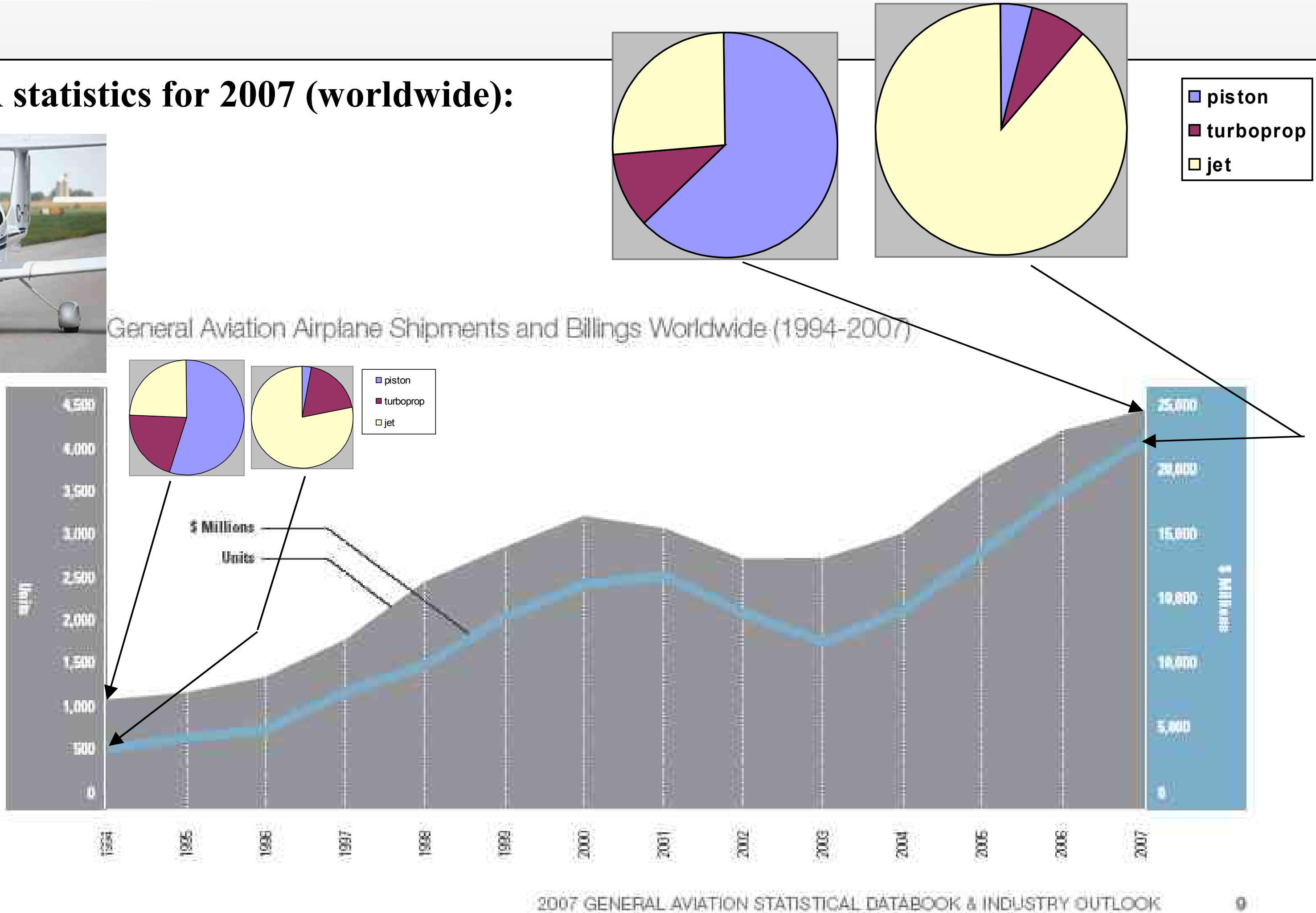
EUROPEAN GA MANUFACTURERS CAPABILITIES

Presented by Janusz Pietruszka
Polskie Zaklady Lotnicze Sp. z o.o in Mielec, Poland

EPATS Conference
ILA Berlin, May 28th, 2008

European GA manufacturers capability

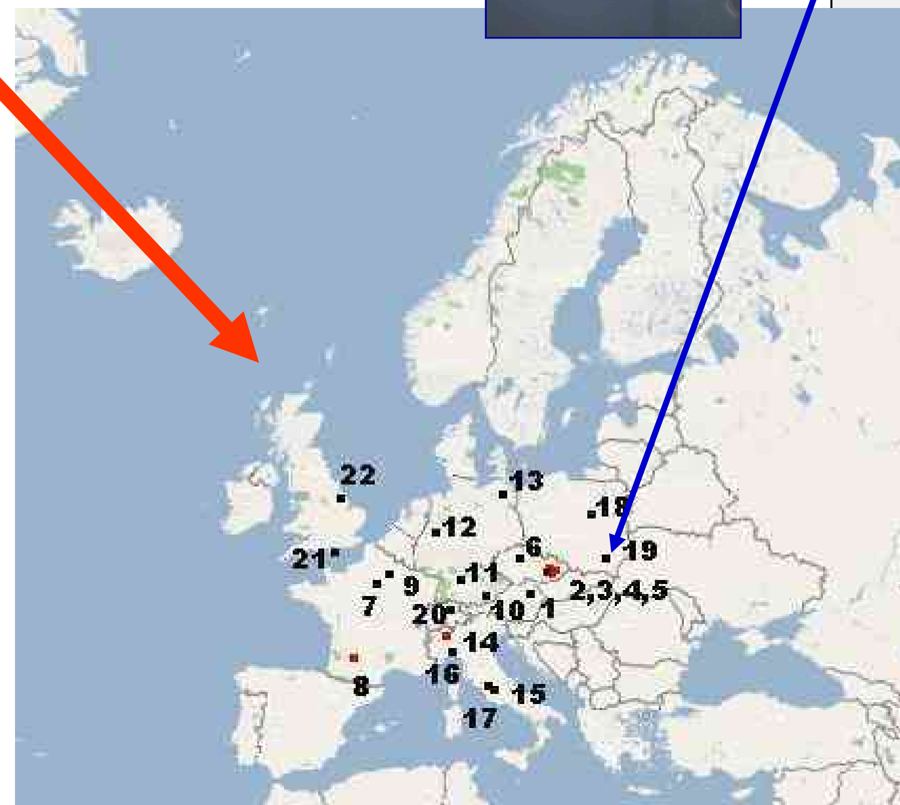
GAMA statistics for 2007 (worldwide):



European GA manufacturers capability

Number of GA manufacturers in Europe on EASA website

Country	No. of DOA (small aeropl.)	No. of POA A2 – small aeropl.
Czech Republic	**5**	**5**
Italy	**4**	**4**
Germany	**3**	**3**
France	**2**	**3**
United Kingdom	**3**	~~2~~ **1**
Poland	**2**	~~2~~ **1**
Austria	**1**	**1**
Switzerland	**1**	**1**
Spain	**1**	**1**
Sweden	**1**	**0**
Total	**23**	~~22~~ **20**



European GA manufacturers capability

Number of European aviation firms with POA on EASA website

Country	No. of POA
United Kingdom	**184**
France	**181**
Germany	**157**
Czech Republic	**42**
Italy	**37**
Poland	**29 (8 in Mielec county)**
Switzerland	**12**
Netherlands	**12**
Sweden	**11**
Spain	**10**
Austria	**9**
Belgium	**6**
Romania	**4**
Slovakia+Finland+Norway+Portugal+Lithuania+Luxemburg	**9**
Total in Europe	**703**

European GA manufacturers capability

Estimation of EPATS Airplanes manufacturing potential capability of GA manufacturers in Europe – data source:

- ***EASA web-site survey,***
- ***Jane's All of the World Aircraft,***
- ***Questionnaire sent to 24 European firms with POA A2 (small airplanes),***
- ***GAMA statistics for 2007.***

Results of the survey:

European GA manufacturers capability (annual output) is limited by finalists with EASA POA (A2).

Results of the questionnaire - a*nswer from 5 firms (3 Czech, 1 Italian, and 1 French):*

Preference in metallic airframe, lower threshold of interest even below 100 a/c per year, upper threshold of interest about 1000 a/c per year.

Notes about GAMA:

GAMA conducts good statistics.

Some European GA manufacturers are GAMA members.

Estimation of EPATS Airplanes manufacturing potential capability of GA manufacturers in Europe – assumptions:

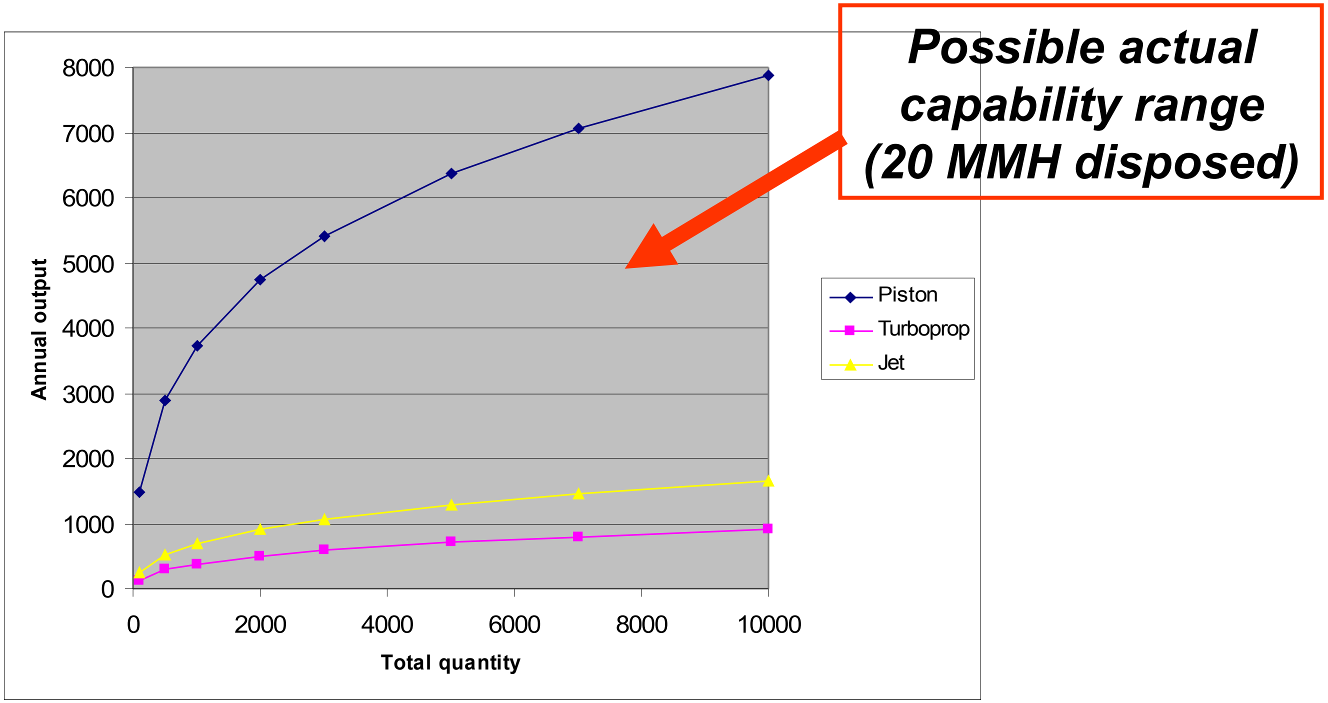
- **In short-coming years total level of employees will be stable (about 11 500 employees),**
- **In short-coming years there will be no big technology improvements,**
- **Some GA manufacturers are underloaded by their own products, and some are fully loaded.**

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.**

Estimation of EPATS Airplanes manufacturing potential capability of GA manufacturers in Europe – comment about total quantity of airplanes:

According to learning curve, potential capability depends on total quantity of airplanes



European GA manufacturers capability

Estimation of EPATS Airplanes manufacturing potential capability of GA manufacturers in Europe – other comments:

- On GA market it is strong competition between US and European manufacturers (note: European products are sold also in the USA),
- Changes observed in EC policy acording to GA may influence growth of European GA manufacturers capabilities (EC memorandum January 11th, 2008, FP6 projects EPATS, CESAR).

Thank you for your attention

Our goal to develop the European Personalized Air Transportation System using new enabling technologies

Personal Air Transport in Europe and Opportunities for a Revival of the Small Aircraft Manufacturers

ILA, BERLIN, May 28, 2007,

Vision of EPATS business strategy

Prof. – Dr. Alfred BARON

Institute of Aviation (Poland)

Prof . - Dr. Jozsef ROHACS

Department of Aircraft and Ships, Budapest University of technology and Economics (Hungary)

Introduction

- EPATS - SATS
- System development
- Possible future - benefits
- Business strategy

Conclusions

Introduction
EPATS main goals

- To provide access to a high-speed mode of transport to regions depending on road mobility due to low passenger volumes for inter-city connections
- To reduce door-to-door travel time and increase daily radius of action

while securing:
- Safety comparable with airlines
- Cost of trip comparable with car
- Operational reliability similar to car
- Comfort of travel comparable to car and airline
- Environmental pollution reduction compared to road transport

1. EPATS – SATS

1.1. US activities

US – our colleagues in new business: PATS

- AGATE – Advance General Aviation Transport Experiments
  - revitalizing general aviation

- SATS – Small Aircraft Transportation System
- operation at airports without tower and radar
- operation in all weather conditions
- integration into general ATM
- improved single-pilot ability

1. EPATS - SATS

1.2. European activities

- Several European activities
  - Growth in European light aircraft production
    - about 20 % per year for the last 5 years
  - European project proposals (aircraft development, automation, cockpit instru-mentation, safety, etc.)
- EPATS – European Personal Air Transportation
- Objectives: development of interregional air transport where
  - other transportation modes are not faster,
  - or have disadvantages for individual, social, ecological aspects and / or
  - transportation infrastructure is underdeveloped.
- EUROPE does not want to loose a new market.

1. EPATS - SATS

1.3. Concept difference

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

- 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

1. EPATS - SATS

1.4. EPATS key elements

Aircraft fleet

- Technically Advanced Aircraft (TAA) 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

ATM system

- Integrated in SESAR, according to SESAR capability level

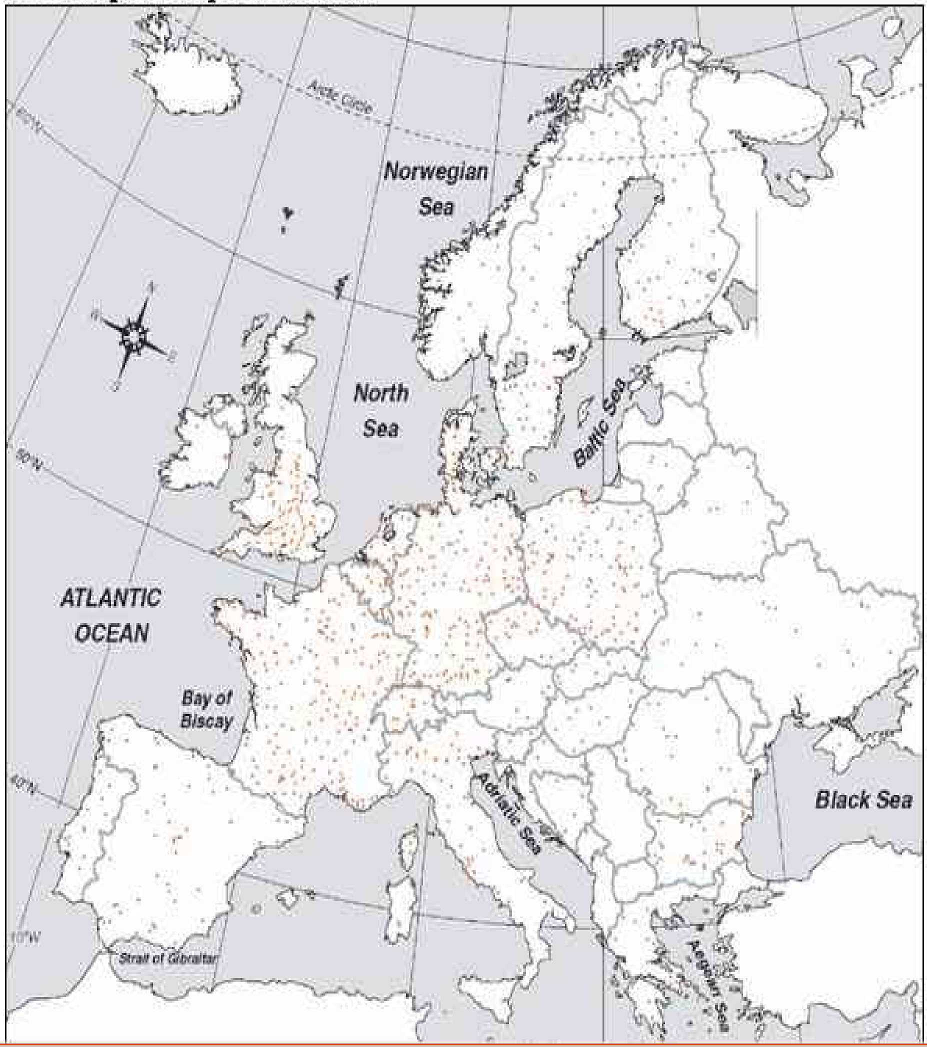
1. EPATS - SATS

1.4. EPATS key elements – cont'd

Airport network

Europe's Airports	Number of Airports
Total landing facilities	2126
Primary airports	450
Main Pas. Airports (HUB)	43
Paved	1336
IFR	737

All European airports location



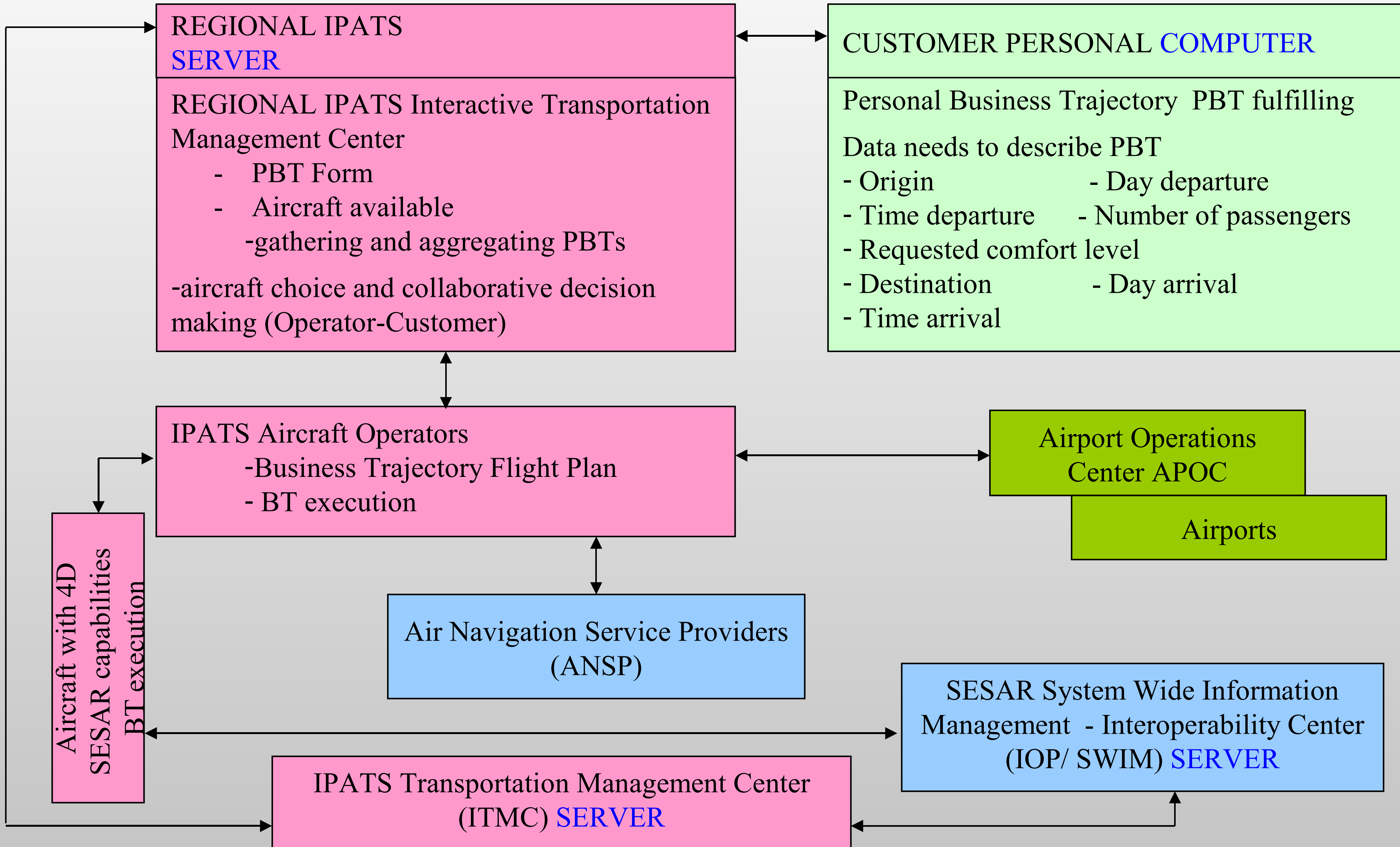
2 System developments

2.1. Aircraft and operations

- EPATS aircraft technology is available for developing the safe, economic and environmental friendly small aircraft
- aircraft ownerships - private, fractional, public, cooperate.
- operators – private, non-commercial and commercial
- Pilots – License adequately: PPL, CPL, ATPL

2. System developments

2.3. Interactive transportation



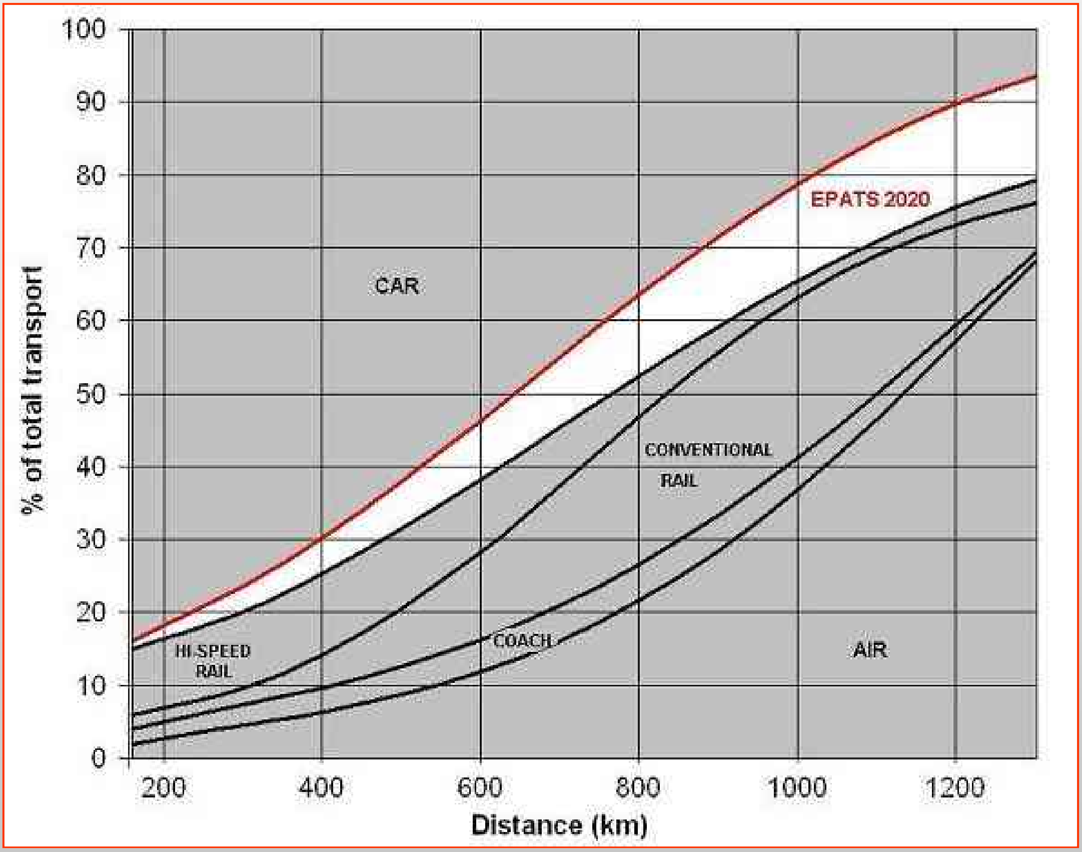
3. Possible future - benefits

3.1. Demand 2020

319 million passengers
152 billion passenger kilometers

90.000 aircraft in which:
- 50 000 pistons
- 16 000 turboprops
- 24 000 jets

Forecasted modal split



3. Possible future - benefits

3.2. Benefits

EPATS develops benefits for all the stakeholders:

Passengers - quicker, cheaper on demand flights

Pilots – safe flying even in case of limited experience

Producers - 10 000 new aircraft per year

Operators - new business, low cost operation

Service providers - new business (rent a plane, air taxi, maintenance, interactive transport management etc.)

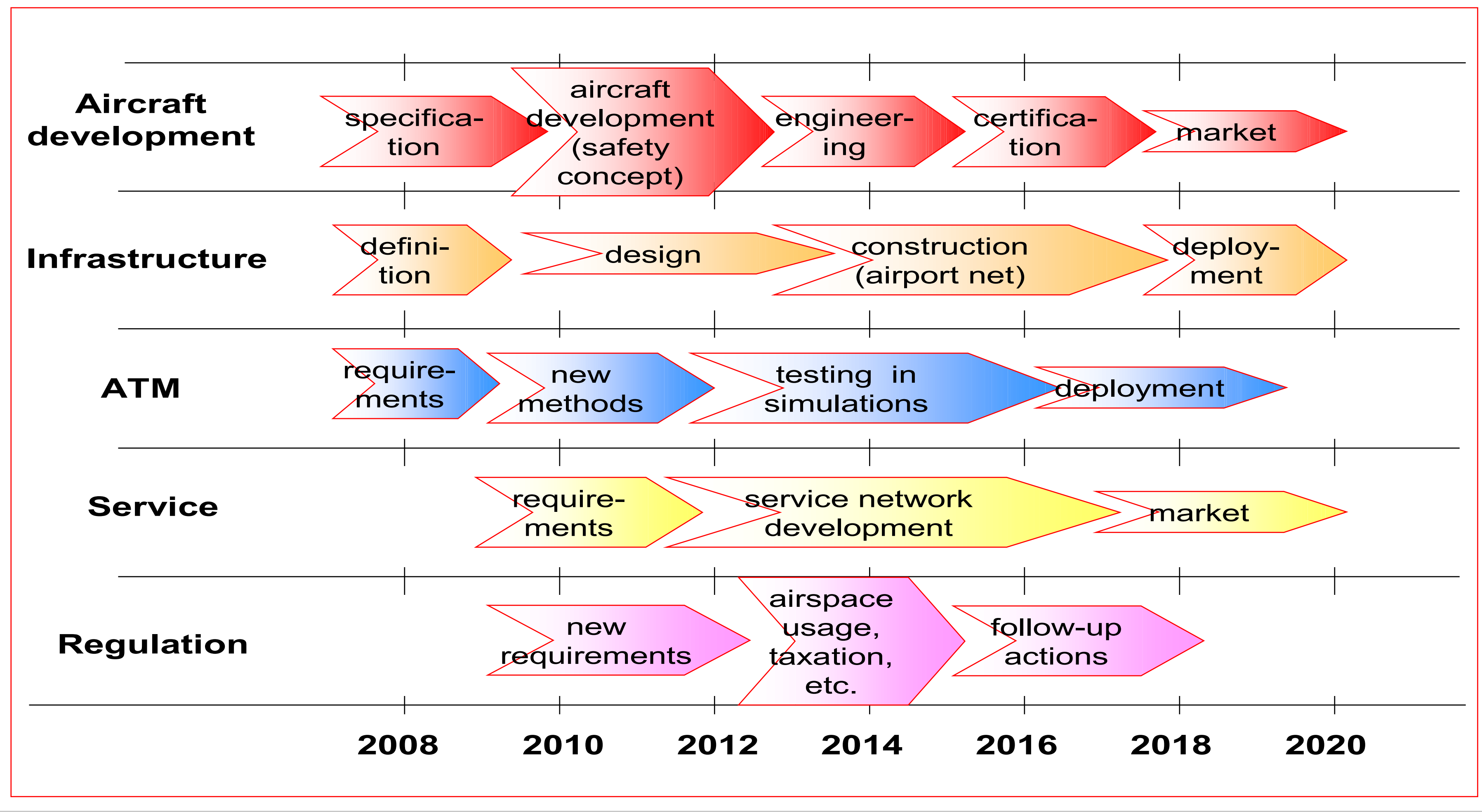
Society - new business:

- greener sustainable transport
- partial solution for traffic jam
- about 0,5 millions new jobs in EUROPE

EC level - securing the European position in competition with US

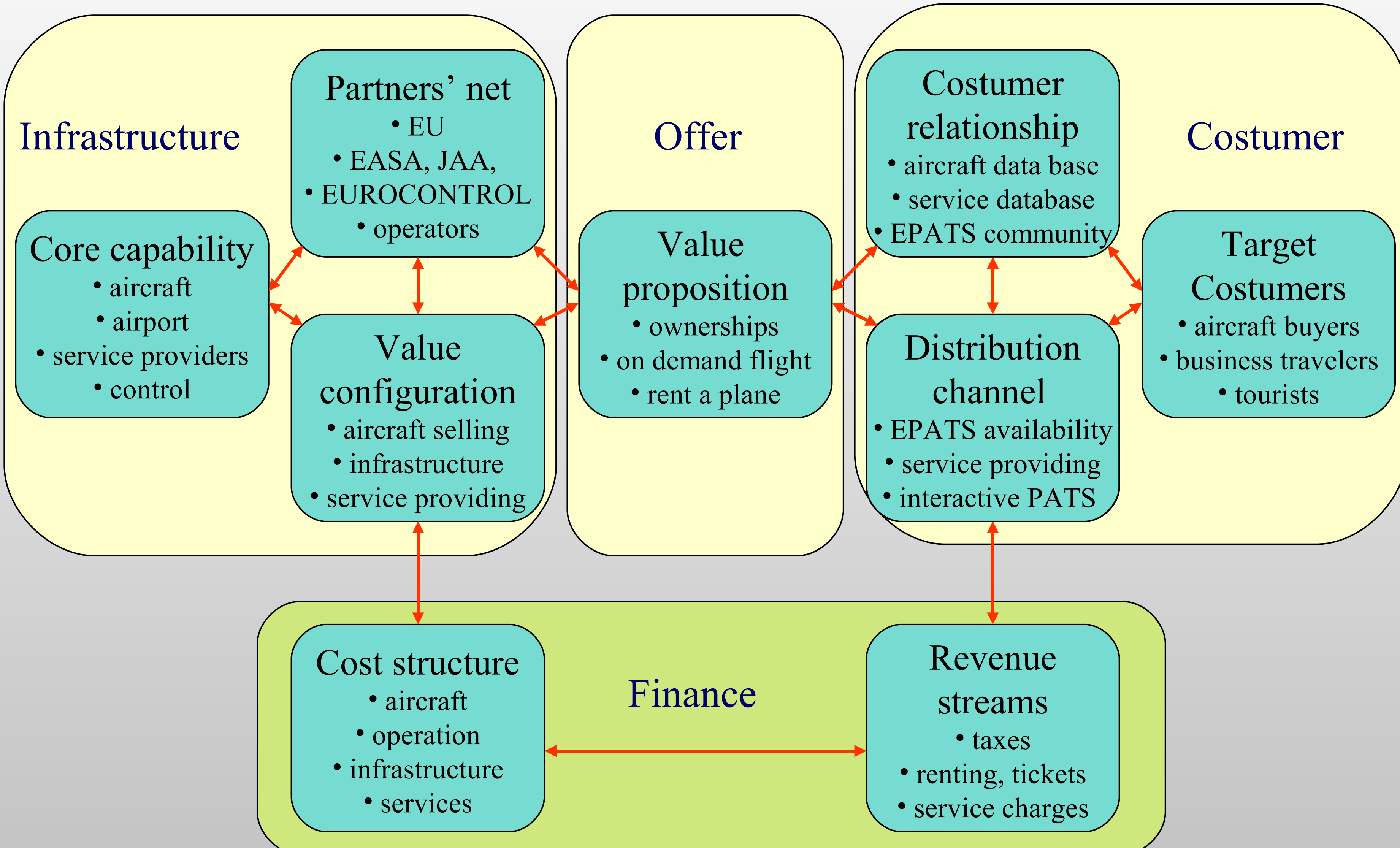
3. Possible future - benefits

3.3. Roadmap



4. Business strategy

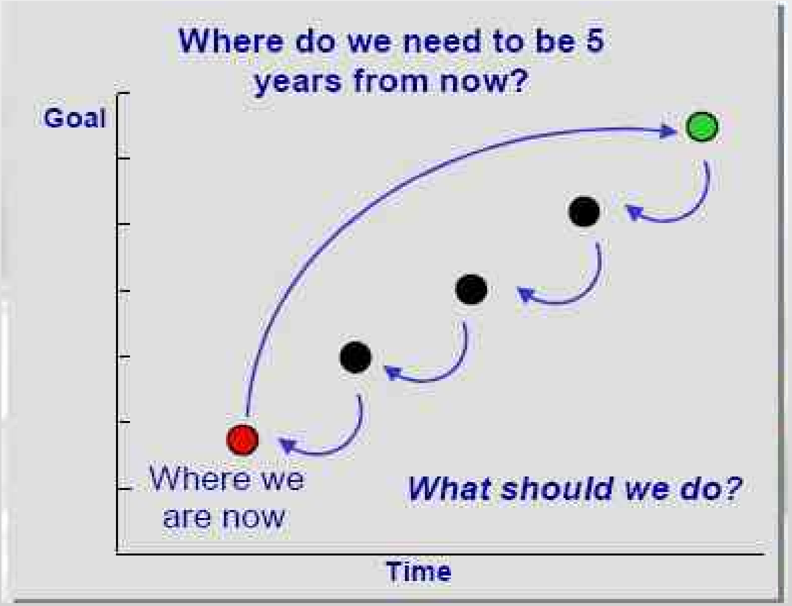
4.1. Business models



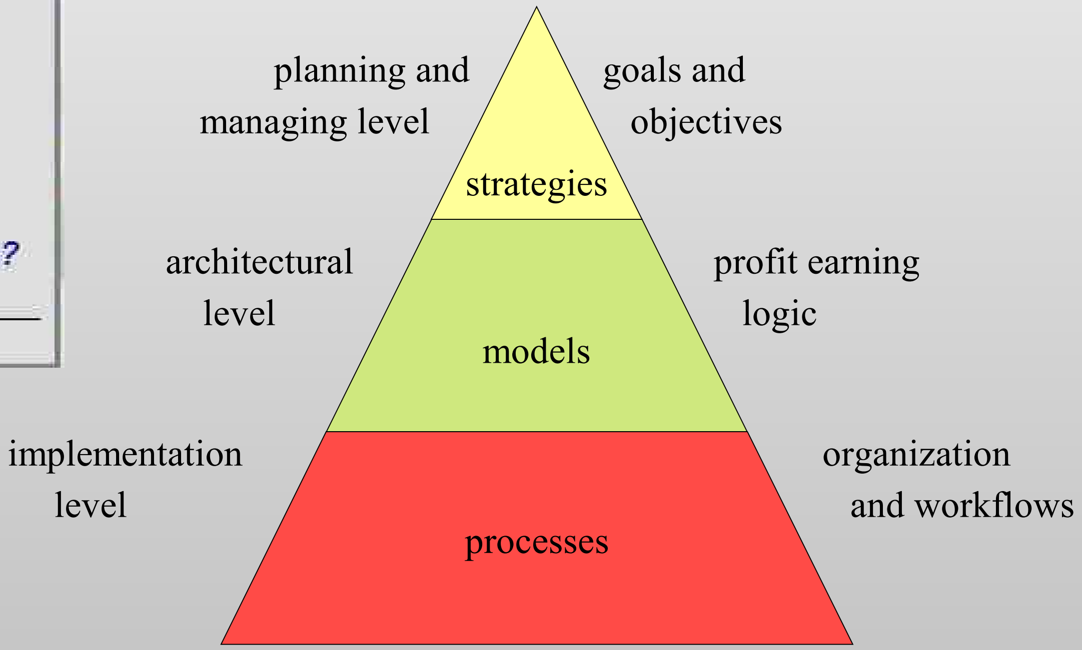
4. Business strategy

4.2. Strategic thinking

Context-derived strategic thinking



Business „pyramid”



4. Business strategy

4.3. Strategic management

Business strategic management –

- direction and scope of an organization or system in the long-term to achieve advantages and fulfill stakeholders' expectations
- changes in internal and external conditions for reaching the goals.

EPATS required

- EU support for the system (infrastructure and aircraft) development,
- Development of new aircraft technologies
- new legacy and integration of EPATS into the existing systems (certification, ATM, etc.)
- Catalyzing the system development (taxation system)

Conclusions
EPATS system development

EPATS implementation needs investigations and investments in :

- Modernization of local and regional airport.
- Development of ATM-ATC System
- Development of Interactive Transport Service Network
- Organization of regional EPATS Carriers
- Development of EPATS aircraft technologies and production
- Development of Pilot Training Base
- Unification and adaptation of legal issues and the certification according to the new requirements of EPATS

Conclusions

Expected results

Studies results clearly show , that

comparing the social benefits resulting from EPATS implementation and the cost involved for its realization, the benefits outbalance the required contribution.

COMMENTS

TITLE:

COMMENTS TO SESAR DEFINITION PHASE (DELIVERABLES D1, D2, D3) FROM EPATS PROJECT PERSPECTIVE

Content:

Prepared by

EPATS Consortium

Warsaw, May 2008

COMMENTS TO SESAR DEFINITION PHASE (DELIVERABLES D1, D2, D3) FROM EPATS PROJECT PERSPECTIVE

INTRODUCTION

"Business as usual is not an option for the ATM of the future" is one of the major statements from SESAR definition phase. Therefore, the SESAR performance target has been developed in order to better understand the trends for the future Air Transport demand and potential market for designing the Air Traffic Management (ATM) system for 2020.

Understanding the trends for the future Air Transport requires a thorough knowledge on current and predicted aircraft traffic at all European airports and in total European airspace. In the SESAR Definition Phase Deliverables, while forecasting air traffic, main attention was paid to the development of commercial airlines (be it major or regional carriers, low-cost or charter) The trend of personal aircraft was totally ignored in the SESAR visions.

One of the main factors influencing ATM system design is the number of flights operated according to the IFR rules. Specific ATM regulations are defined for allowing aircraft flying VFR but the number of VFR flights is not considered to be a sizing factor for ATM. It is, therefore, important to consider the passenger air transport forecasting as well as General Aviation, especially including personal aviation (EPATS) operating under the same IFR and VFR rules. Thus, it is even more important, because the number of controlled personal aircraft operations will potentially be growing quicker than its equivalent in commercial traffic and soon will dominate. Nowadays, in the United States, the number of personal aircraft operations exceeds the number of commercial aircraft.

Also, from the ATM point of view, aircraft size is not as significant as their flying parameters such as speed, flight level, take-off and landing characteristics and on-board CNS equipment. Today's aircraft, whether it is a commercial or business aircraft, differ, mainly in terms of size and dimensions, when their flying parameters impacting ATM-ATC procedures could be similar or the same. With the development of personal aircraft, traffic may become a mix of aircraft with different flying characteristics operated in the same airspace.

CURRENT AND FORECASTED STATE OF CIVIL AVIATION ACCORDING SESAR

Present the main statements and figures of current and forecasted state of civil aviation according to SESAR D1, D2 and D3 deliverables as the following:

European Aviation Operations *(D1 page 8)*

- *Traffic in 2005 : 9.2 Millions*
- *On a peak day ATM controls ~30,000 Commercial flights operated by ~5,000 aircraft.*
- *Services are also provided to ~200,000 General Aviation (GA) flights operated by ~50,000 aircraft,*
- *By 2025, demand is expected to be 2.4 times higher than today,*

Air traffic management *(D1 page 9)*

- *Some 100 main European airport "nodes" which are linked together by ~600 airspace sector nodes operated by more than 36 ANSPs.*
- *Capacity: In 2005 average delay per flight: 1.9 minutes (50% en-route, 50% airports).*
- *Costs: average rate of 0.76 € /km (en-route phase) Equivalent cost around twice as much as that in the United States (US).*

***Airspace Users** (D1 page 18)*

Commercial Airlines.

- *Number in Europe: ~100*
- *Number of aircraft: 8683*
- *Production metric: 650 mln pax*

General Aviation

- *GA includes all aircraft except those of airlines, business aviation and state-owned aircraft*
- *Number of aircraft: 52000*

Business Aviation

- *In 2005 6.9% of all instrument flight rules (IFR) flights in Europe were made by business aviation.*
- *Since 2001, this segment has grown twice as fast as the rest of the traffic, with business jet flights growing particularly strongly in 2005 by 8.9%.*
- *The forecast level of growth in European business aircraft over the next 10 years is, on average, expected to be about 4% growth per year.*
- *Business aircraft are certified in accordance with the same regulations as airliners and operate to the same rules. Business Jets can operate at high altitude (above 41000ft.) and from both large and small airports (using runways from 4000ft).*

From D2 page 19:

- *Business aviation is forecast to grow substantially, with its fleet expected to increase by 1000 aircraft in Europe within the next 15 years. EBAA reported a steady growth at around 5%/year.*
- *According to IAOPA, GA (mostly VFR) traffic is expected to grow steadily at an average of 2%/year up to 2020.*

Trends in Europe

- *Share of passenger air traffic expected to increase from 8% in 2000 to 11% in 2020*
- *Revenue Passenger Kilometers (RPK) expected to increase by ~4.4% per annum*
- *Overall demand for flight movements - expected to increase by ~4.2% per annum*
- *Market segmentation &Fleet Development - more very small jets &more very large aircraft*
- *Network adjustment due to constraints - lack of infrastructure at airports may constrain growth to ~3.4%per annum*

New types of demand may emerge, such as:

- *Air taxis providing more personalized types of air transport service using very light jets (VLJs).*
- *Unmanned aerial vehicles (UAVs) being used, for example, more extensively by the military, police, and for the carriage of freight.*

Vision of Air Transport in 2020

The effect of the lack of airports' infrastructure in constraining the demand is that the growth in air traffic will be constrained to be about 1.7 times higher than in 2005, resulting in the ability to accommodate only about 16 Mn flights.

As 70% of the 50 largest European airports have reached their saturation points today, a clear vision is needed of how to both create more capacity
The obvious solution would be to simply build more runways and this must certainly be strongly progressed. However ecological and land management considerations within Europe prevent new runway capacity to be added easily. Therefore complementary measures must also be taken to mitigate against the potential impact of a lack of airport capacity. These measures should include:

- *Developing new technologies and procedures that can optimize the use of the available airport capacity*
- *Improve the coordination during the tactical flight planning process of the departure and arrival times*
- *The airspace users' decision to change their business model*
- *Enhancing the All Weather capability of the system to maintain the capacity of airports under all conditions.*
- *Other possibilities to provide and/or secure additional airport capacity should include measures such as engagement with local communities,*
- *Establishing an inter-modal transport structure within which air transport and railway industries can compete on an equally competitive basis,*

Airborne Costs
• For scheduled airlines and business aviation it has been assumed that aircraft will be equipped in order to comply with the ATM capability level-3 by 2020;
• For General Aviation it has been assumed that GA aircraft will be equipped with only ATM capability level-1 by 2020.

*For Scheduled Airlines and Business Aviation, it is assumed that it will be required to fully equip 100% (ATM capability level-3) of aircraft by 2020 either through retrofit or forward fit (i.e. about 12,500 aircraft in 2020). General Aviation also assumes a 100% participation by 2020 either through retrofit or new aircraft purchase (i.e. about **132,000** powered aircraft and aerial vehicles in 2020).(Page 72)*

Basic Unit cost per aircraft:
Forward Fit costs – Structural and Incidental

Airspace User Type	Scheduled airlines	Business Aviation	GA IFR*	GA VFR*
Unit cost [Euros]	1 200 000	1 100 000	29 000	6 000

* Retrofit

COMMENTS FROM EPATS PROJECT PERSPECTIVE

Some of the above mentioned points and figures raise controversies Especially:

1. The given General Aviation definition corresponds to the aircraft, but not to the particular aviation system, which is the correct meaning of General Aviation. An exclusion of Business Aviation from GA would require a precise definition of this term. According to EUROCONTROL: business aviation is defined via a list of aircraft types. They include jet-, turboprop- and piston-engine aircraft covered seating from 4 to 19 (max seats: 19-jet, 9- piston, 15- turboprop).

In the light of FAA definition „General Aviation is defined as all aviation other than commercial and military aviation" or „General Aviation refers to all flights other than military and scheduled airline, both private and commercial. GA flights range from gliders and powered parachutes to large, non-scheduled cargo jet flights. General aviation covers a huge range of activities, both commercial and non-commercial, including private flight, air charter, air-taxi, business and corporate aircraft, training flight, air ambulance, gliding and many others".
Accepting an American definition, generally accepted globally, we had assumed that EPATS belongs to GA, and the word "personalized" means, that the system is dedicated to personal transport and adjusted to individual needs of population and, also, it fulfills the operation requirements according to the adequate regulations (FAR 135). EPATS gathers private aircraft, as well as Business, corporate, state, air-taxi and commuter aircraft.
Accepting a common GA definition and its subsystems, including EPATS, is compulsory for statistic research and creating common European civil aviation data base, including General Aviation. It concerns aircraft as well as all airports and landing facilities or air traffic control and management facilities.

2. The different figures concerning the number of Aircraft (50 000, 52 000 and 132000) of GA and the number of serviced flights (200 000) are raising lot of concerns for the EPATS group. What figure is true and what aircraft where included in these figures? Are they registered? Operational? What is the scope of flight service? Different sources provide different numbers paying no attention to what kind of aircraft is counted. The GA Statistical Data Book, GAMA gives the following numbers for Europe: 36 100 aircraft and 6 000 000 flight hours yearly. It does not seem to be consistent with the figures mentioned in SESAR Deliverables.

3. Saying that „*Business aircraft are certified in accordance with the same regulations as airliners and operate to the same rules"* is questionable In the light of the American definition, as well as the EUROCONTROL's one (the list of aircraft considered as business aircraft contains aircraft certified under FAR 23/ JAR 23 rules and operating under FAR 135). This statement is true in terms of some large business aircraft e.g. Falcon. The aircraft belonging to GA category may be certified and operated under different rules. It concerns business aircraft also. It is assumed, that EPATS aircraft will be certified under CS 23 tightened by some requirements of CS 25 regulations.

4. The forecasted business aircraft growth in 2020, given as 1000 aircraft is based on market analysis and concerns small jets only. The forecast did not include new transportation conceptions. It does not take into account the newly arising personal transport elaborated in EPATS and especially the possibility of transferring a fair share of European interregional car traffic on small aircraft, operating in an interactive system. Also, saying that „*GA (mostly VFR) traffic is expected to grow steadily at an average of 2%/year up to 2020."* is the effect of last years trend arbitrary extrapolation, and not an outcome of deepened study and real potential of this sector of Aviation development, which realizes in the US more flights than the passenger aviation. 2/3 of these are Itinerant flights and 30% of them are IFR flights.

5. "*New types of demand may emerge, such as: Air taxis providing more personalized types of air transport service using very light jets (VLJs)."* It is beyond any doubts that, a demand for new air transport services, similar to road taxi services is appearing. It is caused by the following reasons:
   - Population of the European Union Member States are getting wealthier and more mobile

- Growing demand for business people daily accessibility extension and increase of affordability to high speed transport of remote from main communication channels, EU regions
- The existing nowadays technological possibilities enabling small aircraft production and operation at the costs similar to personal cars and better in terms of safety and environmental protection
- The potential synergy created by the European Union and created transport development mechanisms, including research programmes with SESAR and EPATS among them.

Nevertheless, demand for new kind of service arises not only as a demand for very light jets, which, because of the high costs could be used by very sparse and rich people (less than 0,1 % of population), but also a demand for small modern propeller aircraft, which costs are comparable to personal cars and which could be used by those who drive long interregional trips (a substantial part of population).

6. The presented material shows the operation structure increase until 2025, finally assumed growth (2,4 times higher or 1,7 times higher) and way to realize it. The air transport vision description in 2020 and air companies forecasts, including the one of Airbus or EUROCONTROL show that air operations growth will be caused, mainly, by demand on air transport and increase in large aircraft fleet, where this growth is (or will be directed) to main communication ways and nodes of Europe. It is why doubling the traffic on these connections constitutes a great challenge for ATM. It is also an important logistic and ecological problem for today overburdened airports.

7. The presented forecasted costs of on-board equipment securing the adequate ATM level for business aircraft (1 100 000 Euro) are similar to the prices of nowadays offered very light jets equipped with up-to-date CNS systems (Eclipse). The difference in costs between business and GA aircraft operating under IFR is questionable (1 100 000 and 29 000 Euro). There do not seem to be any reasons for such a huge gap. As for the table 15 (in D3), general costs of R&D reaching only 3,6 Million Euro is far below reasonable amount. The listed, predicted by SESAR costs of new ATM systems implementation raise concerns.

EPATS CONCEPTION AND ITS CONCLUSIONS ON AIR TRAFFIC FORECASTS

EPATS conception lead to decrease the intensity at main communication channels and nodes in Europe by using all existing airports and flying Origin-Destination routes using aircraft adequate to “Business Trajectory” and volume of passenger flow. Simultaneously, the conception focuses on balanced European space management and sustainable development through making high speed, safe and ecologically friendlier modes available to remote EU regions, which are far from main communication ways and have low accessibility indicators.

The essential air transport In EPATS system will be done outside main airways, in the airspace and at the airports, so far, not used. Most of the flights will be done between airports of NUTS2 (280) and NUTS3(1180) regions, that do not have direct scheduled air connections, nor hi-speed train. Pistons, constituting most of the fleet, will fly in the airspace below 6 000 m, turboprops at 6 to 8 thousand and only very light jets will operate at levels typical for large passenger aircraft, i.e. above 9 000 m. The basic problem of ATM-ATC is securing possibilities to start and land in all weather conditions at poorly equipped airports and safe execution of flights in uncontrolled space.

The preliminary EPATS study on potential demand 2020 in Europe shows the need for:

Airplanes (4-19 pax)	Fleet	Flights per year
Piston's	49 000	23 000 000
Turboprop	16 000	16 000 000
Jets	24 000	4 000 000
Together	**89 000**	**43 000 000**

While estimating of the potential demand for EPATS aircraft, the basic assumption was that travelers planning their trip choose this mode, which is the most affordable and optimally fulfills their needs, "more for less", i.e., which minimizes their generalized costs of travel (A certain, monetary value is assigned to all factors like time, comfort, security, etc., influencing the mode choice, which is included in the generalized costs calculations – in the preliminary studies, the most important factor was considered only – the value of time in travel).

The above outcomes were obtained basing on a model, which calculates the potentially transferred to EPATS share of different purpose travels in EU done by car or air on connections between NUTS2 regions, by travelers of different value of time (income levels). The choice criteria were minimization of generalized costs. The costs of transport of particular types of vehicles were computed according to the generally accepted methods, the income distributions were taken form data extended by Pareto law of high income and the passenger flows were provided by the outcomes of one of ESPON projects (MCRIT's pax. flows). The detailed description of chosen method was given in the document entitled: "European Personal Air Transportation System – An Interactive Transportation Network" elaborated by Institute of Aviation.

The outcomes depend on many factors, but mainly on accuracy of mode operating cost calculation and assumed values for cost components, including e.g. navigation and airport fees or costs of equipping aircraft with CNS systems. Taking under consideration uncertainty of source data, the outcomes presented above may deviate from reality, both, in plus as well as in minus. Outcomes of other forecasts concerning small aircraft development and basing on potential analysis and social benefit indicate possibility of similar or greater amounts of demand, e.g. Non-Linear Prediction Model for the European Small Aircraft Accessibility for 2020 by Daniel Rohacs. Also SESAR D3 part 4, page 71, when talking about equipping aircraft with new on-board ATM systems it is said: : "General Aviation also assumes a 100% participation by 2020 either through retrofit or new aircraft purchase (i.e. about **132,000 powered aircraft** and aerial vehicles in 2020)."

Slight increase in GA traffic, forecasted, as above in D1 SESAR at the level of 2% is derived from arbitral evaluations and scenario assumption, which determines this Aviation sector by market forces only. It may not be completely true, because this sector has been for many years in recession and cannot gain the momentum only by itself. According to SESAR scenario, large aircraft will secure the blooming of air transport and large hubs and, therefore, its development should be widely supported by state and Union authorities.

EPATS studies, and especially mobility and accessibility of European regions outcomes analysis (done especially in the framework of ESPON Projects) lets us to conclude, that both sectors, in terms of their importance for sustainable growth of the Union should be treated similarly.
Apart from the need to continue further, deeper forecasting EPATS analysis, basing on wide knowledge on European mobility and real state of the General Aviation (aircraft, airport, ATM) by

using more accurate models of interregional passenger mobility, it can be said even today, that as the cars dominated surface traffic, the small aircraft will dominate air traffic.

The EPATS study outcomes clearly show that small piston's aircraft will dominate in the perspective of 10-20 years. On one hand it will be so because these are the least costs aircraft, when securing level of safety and comfort as for the large aircraft and much more secure than car, on the other because of the wealth and income distribution increase. The distribution shows that traveling by very light jets will be affordable for the richest, less than 0,1% share of the Union population only.

The table below shows modal split minimizing travel costs according to distance and time value of travelers. As it is visible, small propellers dominate in intervals from 300 – 900 km:

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

It is important to note, that the largest amount of research work to be done in terms of new technologies will be exactly in the area of small pistons, mainly because the need of to modernize propulsion and to improve mediocre ride quality caused, above all, by the need to use lower flight levels, where the turbulence is more painstaking. Apart from further safety improvement, a struggle for small aircraft comfort should be the first topic for research.

EPATS - AN INTERACTIVE SYSTEM

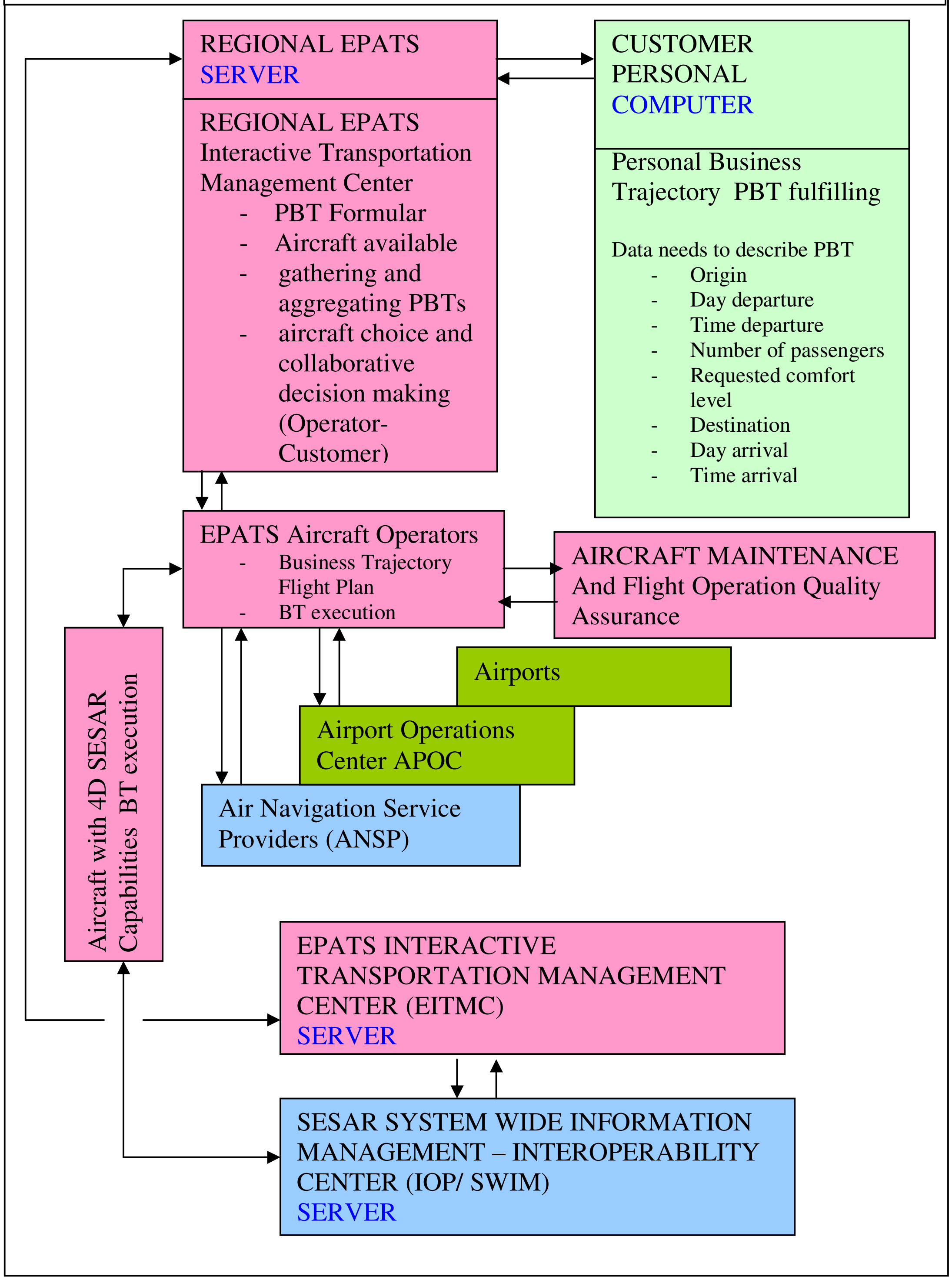
One of the main features of EPATS system conception is taking advantage of the internet network and introducing interactive air transport service ordering and tailoring it to planning and execution of business trajectory network described in D3 SESAR Chapter 2 The ATM Target Concept.
The EPATS Interactive Transportation System will employ a Net-Centric method i.e. *Participating as a part of a continuously-evolving, complex community of people, devices, information and services interconnected by a communication network to achieve optimal benefit of resources and better synchronization of events and their consequences.*

System functioning was described in the document called „European Personal Air Transportation System – An Interactive Transportation Network" and is shown on a chart below.

Implementation of interactive internet network will bring several significant advantages:

- Knowledge diffusion concerning small aircraft transport possibilities
- Increases of share of people participating in air transport
- Cheaper flights: fly one-way, pay for one-way only, similar to urban taxi cubs
- Increases of EPATS energy and economy efficiency through better fleet allocation with multiplied annual volume and load factors closer to 100%.
- Better use of airspace
- Facilitates air traffic management and its monitoring
- Increases regional accessibility levels and their more balanced development

EPATS INTERACTIVE TRANSPORTATION SCHEME



CONCLUSIONS

- ➔ The 2020 forecast is based on large aircraft inter-hub transport predictions, omitting, in its essence, traffic generated by GA aircraft and EU regions with no high speed modes of transport.
- ➔ The forecasted by SESAR aircraft traffic in the European Airspace requires verification. The forecast should be based on EU population mobility and surveyed and analyzed data coming from the present state of General Aviation (according to the generally accepted definition of FAA).
- ➔ The forecast should take under consideration the Regional Sustainable Development Strategy of the European Commission, but also transportation sustainable development, staying aware of the ecology and energy limits.
- ➔ The predicted costs of new on-board CNS systems require further, authoritative analysis. The differences between European and American costs of forward fit and retrofit require deeper studies and particular conclusions and strategic proposals.
- ➔ The presented SESAR conception lacks clear relation between the volume and structure of forecasted air traffic and structure and characteristics of future ATM. There were 740 airports listed, that will be serviced by the ATM. Future of the rest, 1500 of airports and landing facilities, was left behind the veil of silence.

PROPOSALS TO BE CONSIDERED

The following list should be included to SESAR-connected studies:

1. Accessibility level analysis of the European regions and mobility of their population. Joining studies planned in ESPON European Program for 2013. Initiating technical meeting between SESAR, ESPON and EPATS.
2. Initiating activities leading to the development of a European database for Civil Aviation Statistical Analysis. The database would be gathering data concerning state and activities and, also, forecasting studies of the mentioned transport sector (aircraft, airports, ATM infrastructure, air traffic and its structure). This database and associated services could be supported by EASA or EUROCONTROL.
3. Initiating stocktaking of all airport and landing facilities in the EU Member States and Strategic Plan of European Airport Modernization including, equally, all the existing, as well as the appearing airports and airfields. The program should be implemented by different entities, consulted with the adequate institutions and coordinated by EC DG Energy and Transport.
4. Initiating research programme leading to creation of tools for analysis and air transport cost calculation for different types of aircraft and different Business Trajectories (standard methods, programmes, data bases, best practices on labor and capital costs calculations, etc.). Data bases should include average prices of propulsion units and on-board equipment modules and should be periodically updated. The use of these tools should allow for comparisons at the stage of planning and taking rational strategic decisions.
5. Designing Interactive EPATS network in connection with IOP/SWIM systems.
6. Assessing the impact of EPATS in SESAR and developing within the SESAR WP, research activities for smooth integration of EPATS in the SESAR system.

EPATS

European Personal Air Transport System

Background

The EPATS (European Personal Air Transportation System) focuses on the future Highly Customer Oriented and Time, and Cost Efficient Air Transport System. It fills a niche between Surface and Scheduled Air Transport. Future mobility cannot be satisfied only through investments in hub and spoke, or rail - and highway systems.

This future EPATS system will provide a **wider use of small aircraft, served by small airports, to create access to more communities in less time.**
The goal of the EPATS proposal is to demonstrate the needs and potential of small aircraft business development and to propose recommendations for the introduction of this new European Air Transportation System in the context of the European Research Areas.

The EPATS study will address the following issues:

- The potential new markets for personal aviation up to 2020.
- The potential impact of this new way of transport on the European ATM, and airport infrastructures, as well as the environmental, safety and security issues involved.
- The EPATS general specification and R&D Roadmap

The studies will be carried out by a Consortium supported by representative experts of the EPATS stakeholder community.

The deliverables of these studies will be reports containing a joint vision on the personal air transportation system in Europe of 2020 and proposals for developing this new small aircraft business at a European level.

Objectives

1. **To identify the new market for personal aviation in Europe as the result of technology development and society needs**. Characteristics of this travel mode will be **reduced door-to-door travel time** by using small airports and small aircraft at low cost, operating in all weather conditions, serving also the suburban, rural and remote locations, and particularly the population that do not have access to high speed transportation networks.

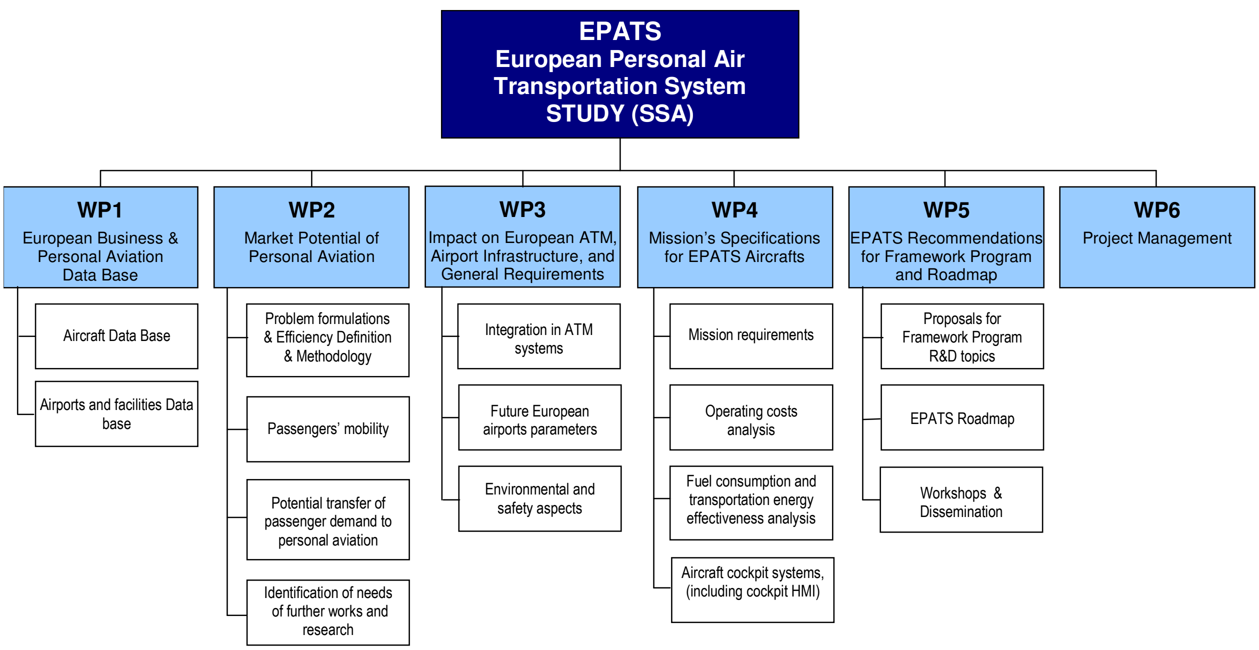
   This market study will **demonstrate if such a market is likely to develop** and **quantify this new market**. An estimate will be provided on the types and number of aeroplanes that would be needed to serve such a market. The study will identify the number of aeroplanes needed to replace existing aeroplanes, and needed to satisfy the potential new demand.

2. **To understand the impact of this potential market on the European ATM and airport infrastructures and to specify issues to be solved.** The study will address the need for special ATM system developments linked to the potential market demand in the context of the Single European Sky initiative. This work will be fed into the SESAR (Single European Sky ATM Research) project.

3. **To quantify the economic impact** of implementing a new European personal air transport system in terms of transportation effectiveness and job creation.

4. **To identify and assess mission's requirements for possible new classes of aeroplanes** based on advanced technologies, which will satisfy the society needs for flexible, fast, easy to use, efficient, low cost, near all weather, safe and environmentally friendly air travel.
5. **To identify the step changes in European industry development of engines and avionics** for small aircraft, and in technologies that need to be researched urgently in order to ensure a competitive position of the European aircraft industry, which is composed of many small and medium sized companies in this market segment.
6. To propose recommendations (in terms of the **EPATS research and development roadmap**) for the introduction of this new European Air Transportation System in the context of the European Research Areas and European partnership.
7. To disseminate the conclusions of the study amongst the European stakeholders, to increase interest in the potential new market, and to promote the revitalisation of the European General Aviation industry .

Description of work



EPATS

European Personal Air Transport System

Results

Del. No.	Deliverable name	WP No.	Lead participant
D1.1	Report on European Business & Personal Aviation Data Base and findings.	WP1	IoA
D2.1	Potential transfer of passenger demand to personal aviation by 2020 and needs of further R&D works.	WP2	M3S
D2.2	Experts seminar	WP2	IoA
D3.1	EPATS ATM General requirements & related issues to be solved.	WP3	EEC
D3.2	EPATS Airports General requirements, safety and environmental aspects & related issues to be solved.	WP3	NLR
D4.1	EPATS aircraft missions specification	WP4	IoA
D4.2	Operating Costs Analysis Report	WP4	IoA
D4.3	Fuel consumption and transportation energy effectiveness Analysis Report	WP4	RzUoT
D5.1	EPATS Research and Development Program	WP5	IoA
D5.2	EPATS Roadmap	WP5	IoA
D5.3	Meeting with SESAR	WP5	EEC
D5.4	Meeting with CESAR	WP5	IoA
D5.5	Workshop	WP5	IoA
D5.6	Berlin Airshow Conference	WP5	AD Cuenta
D5.7	EPATS presentation CD Rom	WP5	IoA
D6.1	Management reports of kick-off, mid-term progress, and final	WP6	IoA
D6.2	Project Management Plan	WP6	IoA
D6.3	EPATS website, and flimsy	WP5	IoA
D6.4	Financial statements (end year, final)	WP6	IoA

EPATS

European Personal Air Transport System

More Information

Acronym: EPATS
Name of proposal: European Personal Air Transportation System STUDY
Contract number: ASA6-CT-2006-044549
Instrument: Specific Support Action
Total cost: 279 950 EUR
EU contribution: 279 950 EUR
Call: FP6-2002-Aero-2
Starting date: 1 January 2007
Ending date: 30 June 2008
Duration: 18 month
Objective: Developing an EU research strategy in the sector
Research domain: T hematic call in the area of Aeronautics Specific Support Actions
Website : Under preparation
Coordinator: Krzysztof PIWEK, Institute of Aviation
E-mail: khp@ilot.edu.pl
Tel: (+48) 0 22 868 56 81
Fax: (+48) 0 22 846 44 32

Partners

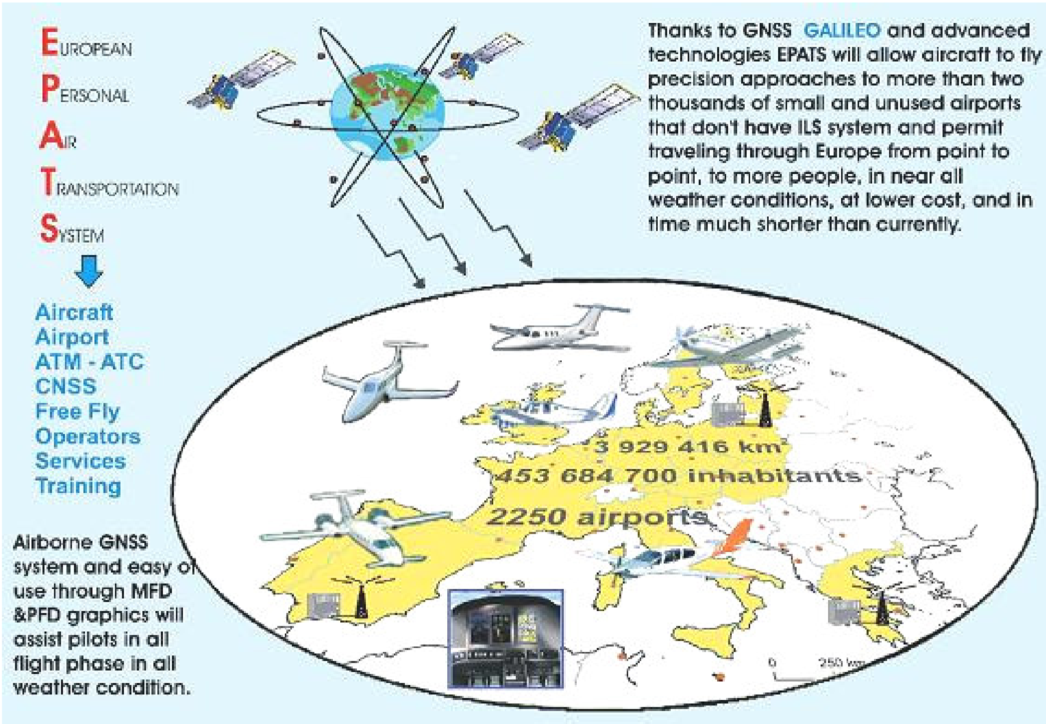
Participant no.	Organisation name	Organisation short name	Country
1 (coordinator)	Institute of Aviation	**IoA**	**Poland**
2	Eurocontrol Experimental Center	**EEC**	**Europe**
3	M3systems	**M3S**	**France**
4	National Aerospace Laboratory	**NLR**	**Netherlands**
5	Polskie Zakłady Lotnicze sp. z o.o. w Mielcu	**PZL M**	**Poland**
6	Rzeszow University of Technology	**RzUoT**	**Poland**
7	WSK PZL Rzeszów S.A.	**PZL Rz**	**Poland**
8	Budapest University of Technology & Economics	**BUTE**	**Hungary**
9	Windrose Air Jet Charter GmbH	**Windrose**	**Germany**
10	AD Cuenta	**AD Cuenta**	**Netherlands**

Lead Organisation	**Site**
Institute of Aviation	Al. Krakowska 110/114, 02-256 Warszawa, Poland

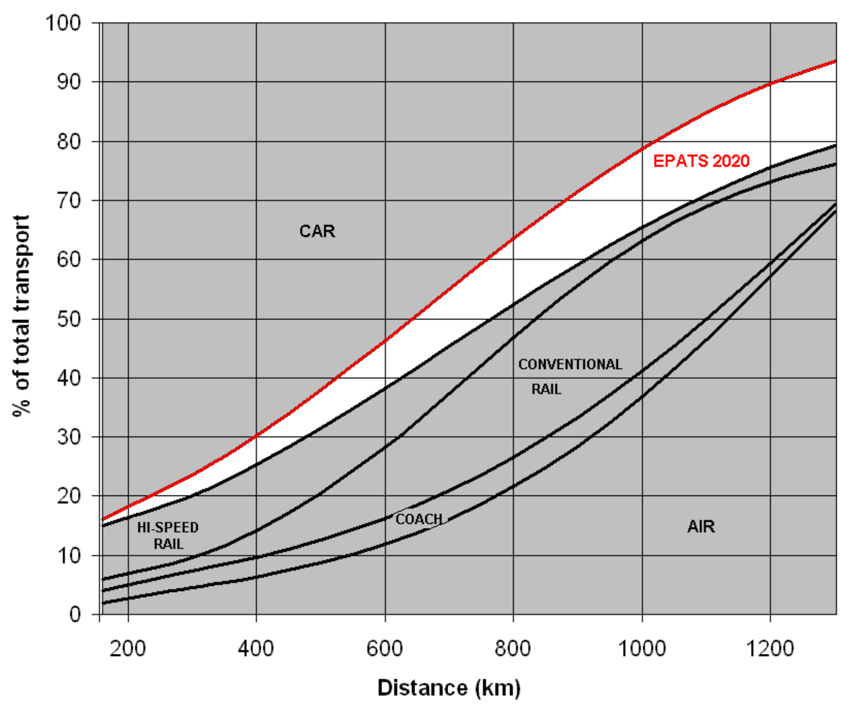
EPATS

European Personal Air Transport System

Two representative pictures or graphics



European Interregional Modal Split and EPATS Share Prognosis 2020



EPATS
EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

Document number: EPATS Vision 2020-V3

EPATS VISION 2020
AND
AIRCRAFT MISSIONS REQUIREMENTS

Prepared for:
EPATS Consortium

Prepared by:
INSTITUTE OF AVIATION
al. Krakowska 110/114, 02-256 Warsaw, Poland

May 2008

Contents:

WHAT IS EPATS ?	
EUROPEAN	Born and operate in Europe
INTERREGIONAL	Links all European Regions (NUTS 2, NUTS 3)
INTERACTIVE	Links all actors (Customers – Providers) in real time by network
DAILY-ROUND-TRIP	High-speed and point-to-point connection lead to high daily radius of action
AFFORDABLE	Accessibility to small airports and low generalized cost trip make the system affordable
SAFE	News aircraft, operational and air traffic management technologies makes the system safe.
PERSONALIZED	Adjust aircraft fleet and operations to passengers flow and population personal needs
AIR – FREE-FLIGHT	Automated Air Traffic Management in Single European Sky ATM environment (SESAR project)
TRANSPORTATION SYSTEM	

1. INTRODUCTION

Similarly as in current road transport, where coaches are operated according to scheduled routes and timetables while dominating personal cars are operated in a non scheduled manner, in future air transport along with air lines flying scheduled routes and timetables there will be personal aircraft operated without any schedule gradually taking dominating position.

European **P**ersonal **A**ir **T**ransportation **S**ystem – **EPATS** is designed mainly to provide service for population of regions far from main communication routes and devoid of high-speed mode of transport and for people, who highly value time, efficiency and comfort of travel. It is to be used on travels between regions, cities on distances between 250 and 2000 km, on routes with relatively low passenger flow, without convenient connections, operated so far using mainly personal cars. EPATS fills niche between Surface and Scheduled Air Transport.

At the most global level, the objective of the EPATS is to reduce economic disparities substantially that exists locally, regionally and nationally in Europe. Such economic disparities result from the inequitable distribution of accessibility in constrained nodal and network based infrastructure. The European highway and hub & spoke are clear examples of such constrained infrastructures. The on-demand, point-to-point access capabilities of EPATS reduce these constraints.

EPATS system includes numerous different subsystem elements, which are working in close cooperation and each of them opens a new market and a new business. These are: airports network, ATM-ATC System, EPATS air carriers, Customers – Providers Services network, Aircraft Service & Maintenance, GA Manufacturers. EPATS represents various aspects of business, including its purpose, services, strategies, infrastructure, organizational structures, trading practices and operational processes and policies. It contains different components like value proposition, value network, revenues generation, etc. It deals with innovative products which diffuse into the society and economy. The business model is based on the developed business and marketing strategies, utilization of the values chain of activities and on the innovation diffusion process.
EPATS is a very complex and large system depending on the development of technologies, economy, synergy and other transportation system. The development of a full business model of EPATS is not feasible in the framework of this study. Therefore we will present a framework of business description only.

2. EPATS STRATEGIES

It is anticipated, that in every region with airfield and proper conditions there will be activities taken to create a local small aircraft transport system. Such activities should be initiated by local authorities, economical organizations, owners and administration of airports, small carriers, aviation organizations, etc. Creating technical and economical foundations – business plans, investment plans, legal basis analyses etc. – will be performed by proper institutions, Area Planning Offices and Research Centers.

Process of creating regional small aircraft transport system is a long-term, innovative, diffusion process. It will be generated under favorable conditions, if local community is aware of its real capabilities, wherever opinion that flying small aircraft is expensive and reserved for VIPs and very wealthy people. Still too many people associates aviation with something not common and not very safe. Very few are aware tough, that modern aircraft could consume less fuel per passenger kilometer, provide less expensive travel and better safety than cars. That is why it is very important to widely disseminate knowledge of modern small aircraft's real capabilities and possibilities of their development.

Most favorable conditions for small aircraft transport system development are present in regions without fast communication connections, with airfields and functioning General Aviation at the same time, where aviation communities are strong. Such regions are common in every EU member state. In Poland such regions are, ie. regions of Rzeszów, Mielec, Bielsko, Opole, Lublin, Koszalin, Mazury and so on. In these regions there are reasons to start Small Aircraft Transport.

It is anticipated that carrier organizations and EPATS aircraft fleet home-bases providing transport services for people will be set up in every region. Such base would consist of various types of aircraft adapted to population's income and needs: piston, turboprop and jets, 4 to 19 seaters. Initially modern aircraft, available currently on the market will be used, and as system develops, according to anticipated plans, these

airplanes will be replaced with new types, designed with 21st century capabilities and needs in mind. It is predicted that such gradual replacement of aircraft fleet might start in the twenties. At that time small aircraft transport will be available for medium class population.

A new organizational model of regional small aircraft transport system and alliance structure is needed. It should consist of semiautonomous business units that are responsible for their own profitability. Such company must balance the autonomy of the business units with the need to coordinate some of their activities. Companies enter alliances to effectively meet the needs of cooperation and personal transportation coordination. Such alliance is also needed to assure aircraft maintenance and Flight Operation Quality Assurance (FOQA)

Establishing regional small aircraft transport system will require gradual modernization of small airfields. Equipment will have to be adapted to modern CNS systems, take off and landings in bad weather. Parking space and aircraft servicing must be provided. Appropriate personnel work and proper passenger service conditions have to be created. Modernization of small airfields must be carried out based on Joint European Union Requirements and Small Airfields Development Plan with financial support from European Commission and interested Country and Regions. It is estimated that funds for one small airfield modernization should value between over ten and several tens of millions of Euro.

We envision public financing support of small carriers operations in the framework of PSO rules (Public Service Obligatory) established by EU Regulations 2408/92.

3. SERVICES AND TARGET CUSTOMERS

Aircraft fleet structure, airport network in which they operate and reservation system is intended to provide access to EPATS transport system services to people now traveling to remote locations in home country or Europe by car or scheduled airlines not providing convenient connections. System users would be both hi-income peoples , already taking advantage of expensive services of Charter Companies and Aero-Taxi, as well as medium class population, who need to see real advantages in travelling small airplanes.

Lately Introduced in air transport, relatively cheap 5-7 seater VLJ's widens demand for their service. It will remain, however an expansive mode of transport available to small fraction of population – 0,1 % (VIP's, high-income population exceeding 70 Euro per hour). Introducing into system, along with VLJ's, cheap and advanced 4-6 seater pistons and 10-19 commuter turboprops while employing interactive distribution network of transport services, providing effective use of aircraft, will enable decreasing travel costs to level below that of car travel. With short distance to airport it enables access to system services and creates conditions for partial replacement of car by an airplane.

Main EPATS clients will the people taking short business trips to different domestic and intra-european regions, who are various organizations, companies, authorities or institutions employees, businessmen, managers, VIPs etc. These trips account for 20% of all remote trips (above 200 km) and are most often taken by small groups of 2-5 people who travel distances 200 to 1200 km. For these clients **4-5 seater pistons** are suited – for lower income people, and jets – for higher income people.

Main **10-19 seater commuter turboprop** users will be inhabitants of remote regions, lacking high-speed travel connections taking trips to various regions for various reasons: family, professional, training, dealing with something, recreational etc. These trips are both one or several day trips. Until now inhabitants have been taking them by cars. Thanks to introducing interactive seat reservation system and "aircraft pooling" system it is possible to match destinations with time of every client travel and to plan trips in larger groups. It allows to book larger and less expensive aircraft. On connections with more stable passenger flow, it is reasonable to implement scheduled air connection using aircraft matched to volume of the flow.

EPATS system is anticipated to include operational and technical service of private and corporate aircraft. So clientele will include small aircraft owners, both natural and legal persons. As various forms of fractional buying and flying airplanes is getting more popular various legal issues arise, which calls for solutions by Aviation Authorities.
Operating interactive transport service allows to optimize trajectory of flight between any airports.

4. EPATS VISION

EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM – EPATS VISION 2020				
EPATS Components		Current state (2008)*	Preparatory, Research &Development Phase (2020)	Implementation Phase (2030)
AIRCRAFT	Airworthiness Standards	FAR-23 (JAR-23) Normal and Commuter category	Enhanced CS 23 Standards	Personal Aircraft Airworthiness Standards
	Aircraft Types	Single and multi-engine pistons, turboprop and jet aircraft	4 to 19 seatings, single and multi-engine pistons, turboprop and jet aircraft	New Technically Advanced Small Aircraft (TASA)
	Sructure	Mainly metallic structure with thousandth parts. Design concept from 1960th Related structure weigh: 100 – 150 kg per seat Related structure cost: ~250 Euro per kg	Integral components – lower number of parts, mainly composite, automatically formed and/or monolithic part produced from a single metallic block mechanically or chemically Module structure and versality Crashworthiness features requirements Optimized relationship between size, weight, fuel capacity, engine thrust and EPATS missions requirements. Reduction of weight: 20 % Reduction of manufacturing cost: 30%	New Technically Advanced Small Aircraft (TASA)

	Aerodynamics	Aerodynamics concept from 1960th Poor ride quality (Levels of vertical and lateral accelerations as a airplane response to atmospheric turbulence) Lift-drag ratio at cruising speed: 7- 12 Max lift coefficient: 1,8 – 2,2	High / low speed capability via the variable geometry airfoil (in the form of high lift design on leading and trailing edge). High low speed performance and high effectiveness at cruising speed Improved response to atmosphere turbulence (better ride quality) Lift-drag ratio at cruising speed: 10- 15 Max lift coefficient: 2,5 – 3	New Technically Advanced Small Aircraft (TASA)
	Flight Control	Mechanical or hydro - mechanical	Fly-by wire control systems (to be certified to DO-178 B adopted by FAA) (with hydraulic or electric actuator) and Full Authority Digital Engine Control (FADEC) Pilot fly-via-computer	New Technically Advanced Small Aircraft (TASA) with fly-by wire flight control system. New concept of flight control surfaces to make control difficulty level comparable to driving a car.
	Propulsion[1]	Gasoline Piston engines, SFC: ~0,2 l/KM h Related weight: 0,8 kg / KM Price: 65k. $ for 200 KM Propeller: Effectiveness: 0,70-0,80 Turbine engines (800k $ for 1000 daN of thrust)	Compact diesel piston engines running on jet fuel (Jet-A) and bio-fuel, having low fuel consumption (<0,2 l/KM.h) and low mass to power ratio (< 0,8 kg/KM), low vibration and noise levels, meeting ecological requirements. Propeller: Effectiveness: 0,80-0,90 FADEC Small turbofan jet engines with thrust 250 – 800 daN, mass to thrust ratio about 0,12 kg/daN and specific fuel consumption below 0,5 kg/daN.h meeting noise and emissions requirements. FADEC	Piston engine price comparable to car engine price. Jet engine price reduced by an order of magnitude. Introducing hybrid propulsion system - of ECATS (Environmentally Compatible Air Transportation System) project.

	Avionics[2]	In older aircraft dozens of instruments, gauges and swiches to monitor Communication, navigation and flight control based mainly on radio and radar In the last year new avionics systems was introduced. See: avionics reference list [2]	Communication, navigation and flight control based mainly on satellite systems (Galileo); Multi function autopilot (performing flight management and instructor role) linked with fly-by-wire system Intuitive flight desk design. Easy to operate color flight parameters and multifunction displays (monitors) and Head Up Display allowing color visualization Voice threat warning systems (prohibitive proximity to other aircraft or ground objects, deviating from planned flight path) See table 1 EPATS avionics equipment list	New avionics to ensure compliance with SESAR project and: - missions capabilities, - autoland system
	Systems Ice protection systems Lavatory system Emergency systems On-Board Diagnostics System	 Equipped Not equipped Not equipped Not equipped	 More effective ice protection system Equipped for aircraft with more than 6 seatings Automatic emergency flight Back system[3] On-Board Diagnostic System linked with Flight Operation Quality Assurance Center (FOQA) [4]	New Technically Advanced Small Aircraft (TASA)
	Performances Requirements See EPATS Aircraft Missions and Requirements	See Table 2 Reference aircraft	See: Scheme 1 EPATS aircraft categories, operations and missions Table 1 EPATS aircraft missions requirements Fig. 1 EPATS Pyload-Range Capacity	New Technically Advanced Small Aircraft (TASA) fulfilling missions requirements

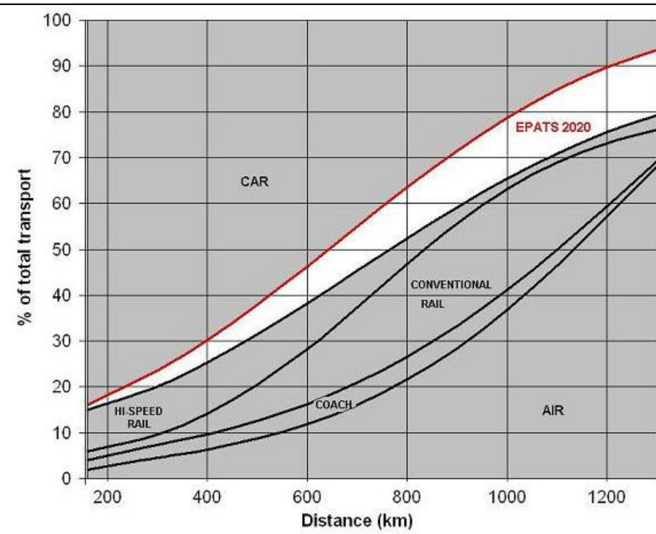
	Comfort	Unsatisfied level of cabin interior noise and vibration, restricted cabin size and poor ride comfort particularly for pistons. Levels of vertical and lateral accelerations as a airplane response to atmospheric turbulence is considered as severe for pistons, moderate for turboprop and slight for jet.	Cabin size and furnishings in new technically advanced 4-6 seating aircraft similar to car. Interior noise and vibration reduced to appropriate level (say 75 dB). Implementation of Anti Noise Control (reduction). Improved Ride Control Index and implementation of ride-control system (coupled with fly-by-wire control)	New Technically Advanced Small Aircraft (TASA)
	Security and Safety	The corporate jet accident rate of 0.08 accidents per 100,000 departures compares favourably with the scheduled airline rate of 0.112 for hull loss and/or fatal accidents per 100,000 departures of jet aircraft over 60,000 lbs and 0.241 for non-scheduled and all other operations of jet aircraft over 60,000 lbs	Accident rate of EPATS aircraft comparable with scheduled aircraft. due to: - fully automated control system (Digital Fly-by-wire, FADEC, autopilot) - Automatic emergency flight Back system - On-Board Diagnostic System and FOQA - Crashworthiness features - Automated ATM and digital CNS - More effective ice protection system - More restrictive CS 23	
	Maintenance To maintain and improve airworthiness	Maintenance man-hours required per flight hour: 0,5 – 2 TBO: 2000 - 3000	Performance of overhaul, repair, inspection, replacement, modification as well as Flight Operation Quality Assurance (FOQA) and Maintenance Resource Management (MRM) are standardized and centralized	Maintenance man-hours required per flight hour: 0,25 – 1 TBO:> 5000

AIRPORTS		There is about 2200 landing facilities from which only 43 main airports handle 85% of the European air traffic. The remaining , in which 1336 paved and 737 IFR, are weakly utilized.	The increase of airports number is not envisaged. Only successive modernization is assumed. For EPATS operation 3 groups of landing facilities are predicted: • Typical controlled regional airport in every NUTS 2 region with aircraft fleet suitable to regional passenger traffic and with technical and operational maintenance service • SATS airport with low passenger flow, no carrier base, 1 airstrip with artificial surface at least 1000 m long, no lights, no control tower, providing minimum service. • Airfield for emergency landing, meeting specific requirements Most of abovementioned airports will emerge from aero club and others airfields as a results of regional community and authorities initiative.	Successive adaptation to EPATS requirements in each NUTS 3 region are planned

ATM	ATM – ATC	Radio-electronic equipment (radio communication, radar approach systems and ILS), lights on airstrips and taxi ways, VOR/DME stations ATM-ATC manages 9 mln flights a year	New Air Traffic Control system designed for SATS, which will operate below air space operated by air lines (below 7000 m) and separated from airliner traffic. Main features of new ATC system for SATS are: • Air traffic control enroute and in airports' MTA are separated • Aircraft position In flight is determined by satellite system and information on air traffic is delivered to pilot through system of transponders and pilot is warned if approaching 15 km radius visually on monitor and acoustically. • In the area of large airport control and management of air traffic is transferred to airport control according to specific procedures. In SATS airport area pilots control flight path according to specifically elaborated procedures adapted to newly implemented communication, navigation and air traffic control technologies. Full information on traffic situation in air and on the ground will be displayed on monitor.	Fully operational European air traffic management and control system SATS, based on "Open Sky" and „Free Flight" rules. Ability to land on airfields with no lights, control tower in nearly all weather conditions. SESAR project implemented. ATM-ATC manages 52 mln flights a year

OPERATIONAL SYSTEM	Operators and Customers – Providers Interactive Booking System	About 2500 aircraft , from which 1190 are commercial aircraft (mainly turbine) operated by 866 air-taxi companies employing 25 980 peoples, The remaining are Corporate and Owner operated. The customers of air-taxi are major corporation and larger business (60%), Governments (20%) and others wealthiest clients . Air-taxi companies offer on demand flight from point to point and operate from about 200 airports. The relationship Customers-providers goes through Brokers by phone and internet With the appearance of VLJ's a new type of Next Generation Air-Taxi Company is born (see Air-Taxi Association ATXA, www.atxa.com) and a new neutral booking engine on Connect IT Technology are being created. New using VLJ's Air-Taxi Company are coming on market.	In the first phase of development EPATS will be based on existing advanced airplanes. The fleet structure will be adapted to the passengers flow and their value of time – from cheaper piston to expensive jet. In every NUTS 2 (267) region bases of EPATS commercial Operators offering transport service suitable to needs and wealth structures of population will arise. They will operate in the framework of Public Interactive Transportation System supported by local community and authorities. The EPATS commercial operations (which meet FAR 135 standards) provide services: On demand and air-taxi services by aircraft and by seat, subscription flights and scheduled flight on connection with low (below 30 passengers by day) but periodically stable passenger flow. The system will operate from and to all European airports that meet a set of standards defined by EPATS Association – expected to be 1100 at the end of first phase The number of personal aircraft operating in the European small aircraft transportation system is expected to reach 3 200 units and the number of flights 2, 4 mln Community economic development alliances, which include the airport authority, municipalities, chambers of commerce, and others organizations as well as air-taxi company and small aircraft Carriers in the implementation of EPATS magnet program will lead, step by step, to Regional EPATS Association emerging and finally to EPATS Association, which will collect Operators and Contributors and manage Interactive Transportation System Network	New technically advanced aircraft will emerge and create new business advantages. As a results of systematic and exhaustive interregional mobility surveys, data about passengers flow will be more trustworthy and structure fleet planning more reliable. This permits to invest more in the aircraft fleet deployment. Demand prognosis shows the potential of market for 90 000 EPATS aircraft, from which 55% piston's, 20% turboprop and 25% jet These aircraft will operate from airport of each NUTS 3 (1150) sub region and link them with each others The EPATS Interactive Transportation Network will be linked with SESAR System Wide Information Management (SWIM)

PILOT TRAINING		Few pilot schools owning flight simulators and several tens of centers authorized to give flight training. Traditional training methods. Low level of computers usage. Acquiring pilot license cost is thousandth Euros and with IFR authorization cost is many times higher.	Adapting training programs to new piloting and navigation technologies and new Air Traffic Management and Control procedures. Lowering pilot training costs by wide usage of simulators, personal computers and internet. Implementing wide aviation education of the society.	Complete change of training methods. After acquiring the license, instructor is replaced with autopilot, which signals all mistakes and corrects pilot's actions. Training is available to wide range of population and acquiring pilot license becomes similar to getting a driving license. Population with pilot license is many times bigger

MARKET	EPATS transportation demand [5] EPATS Fleet [5] EPATS aircraft production in EU	2,5 mln passengers 2 mld passenger.kilometers 2150 aircraft in which: 1100 pistons 300 turboprops 750 jets 660 aircraft in which: 438** pistons 151 turboprops 71***jets	4 mln passengers 3 mld passengers kilometers 3200 aircraft in which: 1600 pistons 450 turboprops 1300 jets	43 million flights per year Demand prognosis shows the potential of market for: 90 000 EPATS aircraft, 50 000 pistons 16 000 turboprops 24 000 jets
	MODAL SPLIT FOR INTERREGIONAL TRIPS I EU * It concerns only GA used for transportation purpose: aero-taxi,, personal, business and corporate aircraft, commuter with seatings less 19. ** Mainly Diamond aircraft *** Dassault Falcon aircraft			

5. EPATS AIRCRAFT MISSIONS AND REQUIREMENTS

The EPATS aircraft performances vision 2020 is based on analysis of forecasted market needs, evaluation of existing aircraft, trends in technology development, and on the existing knowledge and long experience in aircraft design. Trade off studies and costs analysis was made to verify it. [5] [6]

EPATS aircraft categories and their main missions

Piston aircraft

It will comply CS-23 requirements for normal and commuter category with news amendments concerning reinforced safety and environment

The dominant position of piston aircraft (70% of all, nowadays) will gradually decline together with population income increase in favor of jets.

The cheapest, available in price of high class personal car, one engine aircraft will partially replace car in travels on distances 300-500 km as a private aircraft. These aircraft will be piloted by user bearing a VFR, private pilot license the most often, although they will comply EPATS requirements and have IFR capacity for commercial operation.

Two-engine aircraft will operate as an air-taxi with costs comparable to a ground taxi. These will be used for one day business trips on routes connecting remote, peripheral regions on distances 300-700 km. The aircraft will be piloted by VFR/IFR commercial pilots. Their customers will be mainly small enterprise managers

Turboprop aircraft

It will comply CS-23 requirements for normal and commuter category with news amendments concerning reinforced safety and environment

9 – 19-seaters, operated by small carrier companies will serve direct, regular air connections, characterized by low intensity of traffic (5000 – 10 000 passengers yearly), between peripheral regions on distances 300-1500km, to Hubs. These aircraft will also provide charter service on routes with low, irregular flow of passengers (tourism, seasonal travel to work abroad, sport, cultural events, etc.). Costs of travel using these aircraft should be comparable with costs of traveling by low-cost carriers and should be available to most of the citizens.

Jet aircraft

It will comply CS-23 requirements for normal category with news amendments concerning reinforced safety and environment and jet propultion.

Two main categories for utilization is planned:

Small 3 – 5-seaters, Very Light Jets with maximum take-off weight below 5000 kg will be used as air-taxi providing transport from any to any region in country or the EU and as executive (the aircraft should be viewed as a productive machine). Cost efficiency could be reached by high value managers and 7-9 -seaters will operate in the area of whole Europe as a corporate and business airline charter - regularly scheduled flights between city pairs deemed profitable.

EPATS aircraft and reference aircraft comparison

Comparing to the reference list aircraft the EPATS 2020 aircraft characteristics will differ as follow:

- Increased comfort: lower noise and vibrations, smoother flight (improved ride quality due to active control), larger and more ergonomic cockpit (especially in single engine aircraft).
- More intuitive and easier to fly
- Single control station – one pilot flight crewmember (possible thanks fully Automated flight control and air traffic management system)
- All Electric Aircraft configuration
- Implementation of lighter and smaller, highly reliable propulsion systems requiring less maintenance and manufactured at significantly lower production costs.

Implementation of piston engines fueled by bio-fuels.
Increased propellers efficiency (more than 0,85) .

- Using new technologies and materials in airframe to decrease weight and manufacture costs.
- Using module components increasing possibility of equipment retrofit and aircraft type adaptation to meet market demand. The baseline aircraft should give possibility to produce derivative versions (for example: different fuselage length will have common wing, empennage, cockpit, engine,…)
- Introducing higher level of equipment and structure elements unification and standardization.
- Decrease of minimum speeds (through new aerodynamic solutions)
- Reducing the chance of “pilot error” and if an accident occurs, more crashworty.
- Increasing flight safety through introduction of more rigorous requirements of JAR-23 for EPATS aircraft (including some JAR-25 regulations)
- Automated flight control and air traffic management system (allowing one pilot crew).
- Integrated flight management system (flight planning, alerts on restricted air space, air traffic control frequencies and terrain variations, report fuel capacity and weight allowance, inform about weather,…). Easy access to flight information and situation by PFD (Primary Flight Display) and MFD (Multi Function Display) use.
- Reducing fuel consumption through more efficient power systems, lower airframe weight and new aerodynamic solutions
- Lower purchase price – reached thanks to new technological solutions applied in respective stages of full life cycle, increased production scale and appearing cooperation possibilities in the EU
- Lower operating costs – through lower fuel consumption, costs of purchase and maintenance

EPATS AIRCRAFT CATEGORIES, OPERATIONS AND MISSIONS

Aircraft

GENERAL AVIATION AIRCRAFT CS-23

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

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

All others GA Aircraft
CS-23 all categories

Ownership

- Private
- Fractional
- Corporate
- Public

Operations

Non Commercial transport
Part 91

- Individuals or corporate operations

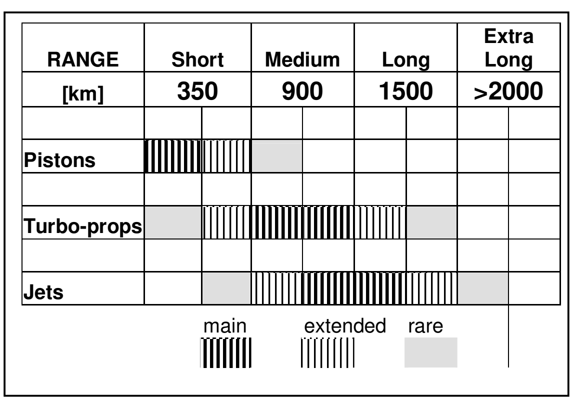
Commercial Transport
Part 135

- 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 daily 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,

Scheme 1

EPATS BASELINE AIRCRAFT PERFORMANCE (VISION 2020) Table 1

Aircraft Class	Single Engine *	Twin Engine Piston	Twin Engine Turboprop		Twin Jet	
Class number	**1**	**2**	**3**	**4**	**5**	**6**
Primary Missions	Private and Business trips and Air-Taxi - on demand passenger services for mid class (short range)	Air-Taxi - on demand passenger services for mid class (short range)	Commuter- on demand and scheduled passenger services on low density passenger flow, affordable for population majority	Commuter – on demand and scheduled passenger services on low density passenger flow affordable for population majority	Private and Business trips and Air-Taxi - on demand passenger services for high value managers	Commuter on demand transportation and Private, Business trips and Air-Taxi - on demand passenger services for high value managers
Seating **	1+3	1+5	1+9	1+19	1+5	1+9
Cabin With [m] **High [m]**	>1,30 >1,30	>1,30 >1,30	>1,80 >1,70	>1,85 >1,75	>1,50 >1,50	>1,60 >1,60
Lavatory	No	No	Yes	Yes	Yes	Yes
Pressurized		No	Yes	Yes	Yes	Yes
All weather perform	Yes	Yes	Yes	Yes	Yes	Yes
TO Weight [kg]	<1300	<2000	<5000	<7200	<2700	<6000
Cruising speed [km/h]	350	>350	>550	>550	>750	>750
Cruise altitude [FL]		80-200	150-250	150-250	250-300	250-300
BFL [m]	<600	<600	<1000	<1000	<1000	<1000
Range Full Payload **[km]**	>1000	>1000	>1500	>1500	>2500	>2500
SFC at Vcr [l/seat.km]	<0,035	<0,035	<0,04	<0,03	<0,08	<0,07
DOC [Euro/seat.km]	<0,15	<0,12	<0,20	<0,15	<0,35	<0,30
Price [1000 Euro}	<200	<400	<1700	<4200	<1000	<3000
Specification***	CS-23 A	CS-23 A	CS-23 A	CS-23 A	CS-23 A	CS-23 A

FIXED OPERATION TIME									
1	Fixed flight Operation Time	Pre-flight Check-list Engine start warmup,		5	8	8	12	12	12
2		Embarquement		1	2	1	4	1	3
3		Climb to cruise level (CT)		10	20	20	20	20	20
4		Eng.Shutdown,parking		1	2	1	2	2	2
5		Debarquement		1	2	1	4	1	3

* Concerns both piston and turbo engines [1)]

** The first figure means air-crew number as well as command station, the second the certificated number of passenger seating

*** A - means with news amendments concerning reinforced safety and environment for travel aircraft

1)A single engine aircraft is assumed to be at the same safety level as multi engine airplanes and be approved for commercial transport of people (air-taxi). In order to do it, such an aircraft in case of engine failure has to catch up on the limited propulsion redundancy by other means of safety. Apart from enforcing propulsion reliability, emergency-landing possibilities should be extended, both, in classical as well as unconventional meaning (e.g. using a parachute emergency system). Preparing for such a possibility requires lower aircraft weight and speed in comparison to a multiengine aircraft. Such aircraft is estimated to have less than 1500 kg, cruising speed lower of 350 km/h and with the stalling speed of no more 100 km/h enabling safe emergency landing. In practice, this condition may be rationally fulfilled by the light, propeller driven aircraft.

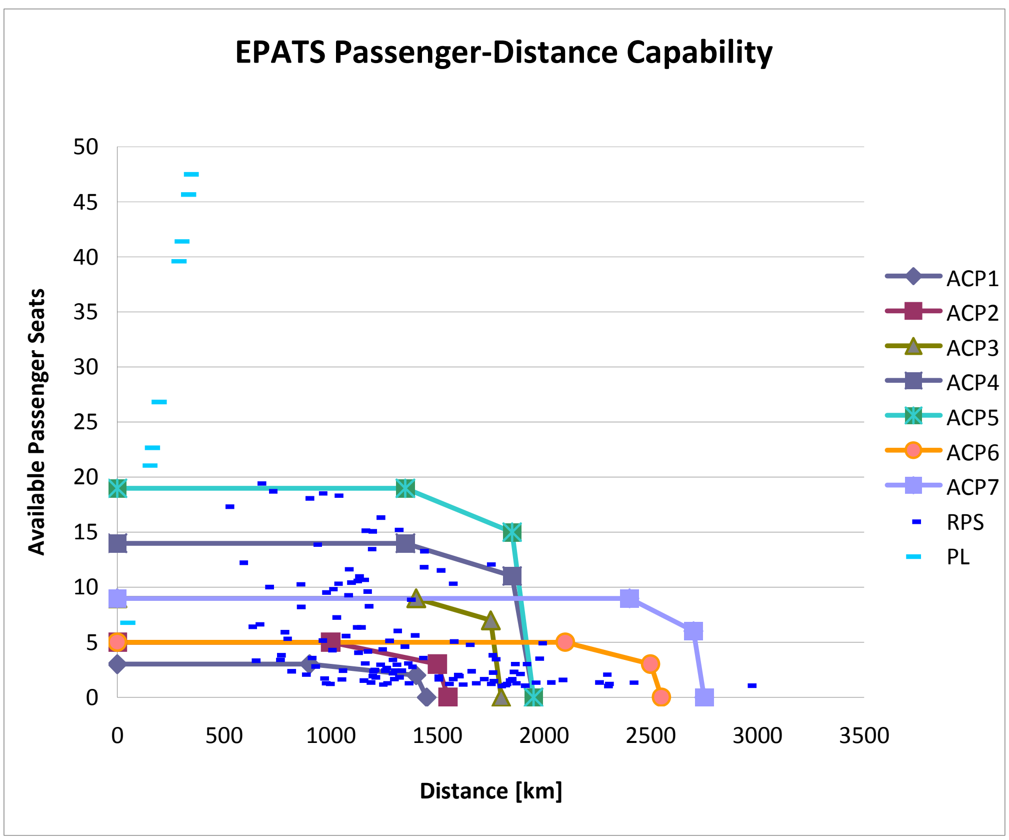
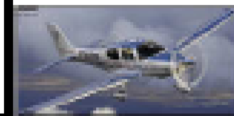
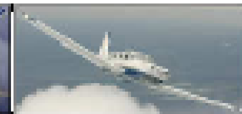
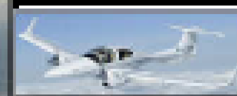
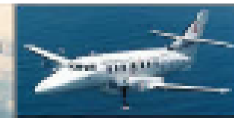


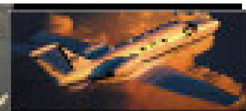
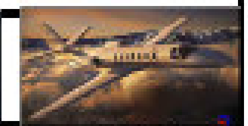
Fig 1 EPATS Payload-Range Capacity against a background of passengers-ranges shifted from passenger car daily traffic from Polish Region NUTS2 PL0B (Pomorskie) to all others European Regions (source ESPON)

EPATS aircraft avionics equipment list

	Engine	Engine Piston	Engine Turboprop		Engine Jet	
Class number	**1**	**2**	**3**	**4**	**5**	**6**
Communications						
dual 8.33 kHz VHF radio	√	√	√	√	√	√
SWIM dual data link	√	√	√	√	√	√
WiMax			√	√	√	√
broadband services					O	O
Navigation						
dual GNSS /w SBAS	√	√	√	√	√	√
dual DME	√	√	√	√	√	√
RVSM					√	√
P-RNAV FMS	√	√				
4D RNAV FMS			√	√	√	√
ILS receiver(s)	√	√	√	√	√	√
Surveillance						
ADS-B In/Out 1090ES	√	√				
enhanced ADS-B			√	√	√	√
TAS	√	√	√		√	
TCAS II				√		√
ELT 406 MHz	√	√	√	√	√	√
FDR & CVR				√		√
TAWS-B	√	√	√		√	
TAWS-A				√		√
lightning detection (sferics)	√	√				
weather radar			√	√	√	√
Human machine interface						
IFD (PFD/MFD/audio/AP)	√	√	√	√	√	√
HUD / SVS / EVS					O	O
EFB	√	√	√	√	√	√

	EPATS AIRCRAFT REFERENCE LIST PART 1	SINGLE-ENGINE PISTONS		MULTI-ENGINE PISTONS	
					
Manufacturer Model		Cirrus SR-22	Piper Saratoga II TC	Diamond DA-42 Twin Star	Piper Seneca V
Price [1000 €]		274	425	395	567
Certification Year		2000	1997	2004	1996
Characteristic					
	Seating	1 + 3	1 + 5	1 + 3	1 + 5
Dimensions Internal [m]					
	Lenght	3.3	3.16	3.40	3.15
	Width	1.24	1.24	1.10	1.24
	Hight	1.27	1.07	1.00	1.07
Est.	Cabin Volume [m^3]	*5.197*	*4.193*	*3.740*	*4.179*
Power					
	Engine	Teledyne Continental IO-550-N	Textron Lycoming TIO-540-AH1A	Thielert Centurion v. 2.0	Teledyne Continental TSIO-360-RB
	Price [1000 €]			30	
	Output [kW]	231	224	99	164
	Weight	187	245.8	149.8	149
	SFC			0.22	
	TBO [h]	2000			1800
Weights [kg]					
	Max. TO	1542	1633	1786	2154
	Max. Payload				428
	Useful Load	531	516	532	562
	Max. Fuel	301 (251 usable)	301 usable	265 l (Jet-A)	332
Performance					
	Max. Cruise Speed [km/h]	343	343	335	300
	Service Ceiling [FL]	175	200	180	150
	Rate of Climb [m/min]	426		390 (1702 kg)	446
	TO Distance to 15 m [m]	486	552	527 (1702 kg)	671
Est.	DOC/(pax*km)	*0.105*	*0.082*	*0.177*	*0.146*
Est.	SFC - Block [litre/(pax*km)]	*0.044*	*0.040*	*0.050*	*0.059*
Range					
	Range (max. payload) [km]	1502	1563	1698	1533

EPATS AIRCRAFT REFERENCE LIST PART 2		SINGLE-ENGINE TURBOPROPS		MULTI-ENGINE TURBOPROPS		
						
Manufacturer Model		Epic Dynasty	Pilatus PC-12	Piaggio Avanti II	Beechcraft King Air 350	BAE Jetstream 32EP
Price [1000 €]		1 444	2.24	5.85	4 422	
Certification Year		2008	1994	2006	1990	1997
Characteristic						
	Seating	1 + 5	1 + 9	1 + 9	2 + 15	2 + 19
Dimensions internal [m]						
	Lenght	4.57	5.16	4.55	5.94	7.39
	Width	1.40	1.53	1.85	1.37	1.85
	Hight	1.49	1.47	1.75	1.45	1.8
Est.	Cabin Volume [m^3]	*9.533*	*11.605*	*14.731*	*11.800*	*24.609*
Power						
	Engine	P&WC PT6-67A	P&WC PT6A-67B	P&WC PT6A-66B	P&WC PT6A-60A	Garett TPE331-12
	Price [1000 €]					
	Output [kW]	895	895	2 x 634	2 x 783	2 x 761
	Weight [kg]	230	234	213	216	182
	SFC [kg/(kW*h)]	0.333	0.332	0.377	0.333	0.333
	TBO [h]	3000	3500	3000	3600	5000
Weights [kg]						
	Max.Ramp/TO [kg]	3314	4740	5466	6804	7360
	Max. Payload [kg]	613	1123	907		2042
	Useful Load [kg]		1873	1950	2531	2400
	Max. (Usable) Fuel [kg]	856-1070	(1227)		1639	1489
Performance						
	Max. Cruise Speed [km/h]	630	500	737	578	491
	Service Ceiling [FL]	310	300	410	350	250
	Rate of Climb [m/min]		480	899	832	
	TO Distance 15 m (BFL) [m]	488	(917)	(1295)	(1006)	1432
Est.	DOC/(pax*km)	*0.259*	*0.186*	*0.250 /*	*0.109*	*0.119*
Est.	SFC - Block [litre/(pax*km)]	*0.076*	*0.082*	*0.069 /*	*0.063*	*0.043*
Range						
	Range (max. payload) [km]	2870	2583	2453	1737	915

EPATS AIRCRAFT REFERENCE LIST PART 3	SINGLE-ENGINE JETS	MULTI-ENGINE JETS				
						
Manufacturer Model	Diamond D-Jet	Eclipse 500	Cessna Citation Mustang	Evation EV20 Vantage	Grob SPn	Cessna Citation Encore +
Price [1000 €]	1 080	1 126	1.881	2.407	5 800	6 290
Certification Year	2007	2007			2008	
Characteristic						
Seating	2 + 3	1+ 4 / 5	2 + 4	2 + 8	1(2) + 8	2 + 9 / 11
Dimensions Internal [m]						
Lenght	3.53	3.76	2.97	5.26	5.10	5.28
Width	1.42	1.42	1.42	1.65	1.52	1.47
Hight	1.44	1.27	1.37	1.57	1.64	1.45
Est. Cabin Volume [m^3]	*7.218*	*6.781*	*5.778*	*13.626*	*12.713*	*11.254*
Power						
Engine	Williams FJ33-4A	P&WC PW610F	P&WC PW615F	Williams FJ44-1AP	Williams FJ44-3A	P&WC PW535B
Price [1000 €]						
Output [kN]	6.99	2 x 4.0	2 x 6.5	2 x 8.77	2 x 12.5	2 x 15.12
Weight [kg]	136.2			208.8		
SFC [kg/(kW*h)]				0.475	0.456	
TBO [h]		3500	3500	3500	4000	5000
Weights [kg]						
Max.Ramp/TO [kg]	2300	2719	3925	4200	6300	7634
Max. Payload [kg]				908		
Useful Load [kg]	1018	1089	1444	1907	2205	2917
Max. (Usable) Fuel [kg]		765	(1171.3)	1249		2449
Performance						
Max. Cruise Speed[km/h]	583	685	630	790	754	793
Service Ceiling [FL]	250	410	410	410	410	450
Rate of Climb [m/min]		1044	917.4	914.4	1320	
TO Distance to 15 m (BFL) [m]	620	714	(947.9)	762	(914)	(1073)
Est. DOC/(pax*km)	*0.208*	*0.282 /*	*0.365*	*0.200*	*0.282*	*0.253 /*
Est. SFC - Block [litre/(pax*km)]	*0.094*	*0.1041 /*	*0.147*	*0.069*	*0.103*	*0.1122 /*
Range						
Range (max. payload) [km]	1426	1426 / 1019	1865	2228	3093	21[illegible]39

References

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2 European Personal Air Transportation System (EPATS) study. Cockpit avionics & human machine interface requirements. NLR-Memorandum ASAS-2007-066
3 SOFIA – Safe Automatic Flight Back (Flight return function to emergency landing field)
1. ONBASS – OnBoard Active Safety System For Generale Aviation – A system able to predict and prevent accidents in GA.
4 D1.1 European Business & Personal Aviation Database and Findings
5 D2.1 Market potential of personal aviation
6 D1.1 Chapter 4 Accidents rate in general aviation

The demand for personal air transport in Europe

By Isabelle Laplace

m3 SYSTEMS

Abstract

By proposing an alternative the traditional transport modes (car, traditional airlines, train), personal aviation would aim at capturing a share of their traffic. An essential question then arises: what could be the potential transfer of traffic from the existing transport mode to personal aviation? This article provides answers to this question, by developing an estimation method based on the minimization of the generalised cost of transport.

The main result is the strong expected development of personal aviation in the future. In 2020, the potential transfer of traffic to personal aviation would represent 3% of the total European traffic and would be performed by 90 000 personal aircraft. This fleet size would then decrease to 25 500 if the operational cost of personal aircraft would increase by 30%.

This article hence not only shows the existing potential of market of personal aviation, but also highlights the essential role in the future air transport market that such a new transport mode may play in 2020.

Key words

Personal air transport, traffic distribution, generalized cost

1. Introduction

In modern society, the need to travel within Europe is more and more important, and is expected to increase. The extension of the European Union to 27 members amplifies this phenomenon. However, current transport modes have limitations and suffer already from congestion in some places: most large airports are congested or could quickly reach their maximal capacity. Conversely, other areas, especially in Eastern Europe, are hardly accessible.

Moreover, society is evolving : passengers are becoming more exigent in terms of time and cost, but their behaviour is also changing : a phenomenon of individualisation is taking place little by little, meaning that people want to have a choice . Future mobility therefore cannot be entirely satisfied by current transport systems, such as hubs, railways or highways.

A new transport mode is thus needed, and from this perspective, a new concept, the Personal Aviation, has been proposed. It would consist in realizing long-distance trips in a short time at an acceptable cost, thanks to the use of small aircraft (jet, turboprop, pistons) departing from small airports. These aircraft, operating in all weather conditions, could deserve any kind of

location, but their interest would be overall to serve inaccessible areas. The concept of personal aviation implies the development of a system. This system is called "EPATS": European Personal Air Transportation System which is a complex collection of systems, procedures, facilities, aircraft and people, working together. EPATS would be developed especially in regions where the airlines are extremely little present and where high-speed trains do not work, owing to the low flow of passengers.

By proposing an alternative the traditional transport modes (car, traditional airlines, train), this new transport mode would then aim at capturing a share of their traffic. An essential question then arises: what could be the potential transfer of traffic from the existing transport mode to personal aviation?

This article provides answers to this question for year 2020, by developing an estimation method based on the minimization of the generalised cost of transport. Moreover, aware of the potential future increase in the cost of personal aviation (due for instance to new materials in aircraft so as to be compliant with SESAR requirements or new environmental taxes, etc.) we also evaluate the impact of such increases in the cost of personal aviation on the estimated transferred traffic.

2. Developed method

a. Generalized cost

The goal is to calculate the potential number of passenger-km that could be transferred from current transport modes to EPATS by 2020. These estimations will give a global indication of the future EPATS market. It must be pointed out that "inferred traffic" is not taken into account in this study.
For these estimations, we assumed have to make the assumption that a traveller chooses a transport mode by comparing the modes in terms of money and time. We are not able to take comfort, security or punctuality into account comfort, security or punctuality in our calculations due to the lack of data available on these aspects and the consequent difficulty to in integrating integrate such qualitative variables.

The method used is the generalized costs minimization method, meaning that we compare the generalized cost for each mode of transport. This generalized cost, depending on the travelled distance and the value of time, is the sum of travel cost and time cost. Then, after calculating generalized costs, we select the mode of transport having the smallest lowest travel/time cost aggregate.

Thereby, we define the concept of generalized cost which assigns a monetary value for all these parameters, given the kind of passenger:

$$\boxed{C_g = C_{travel} + \sum C_i} \qquad \text{(in €)}$$

With C_g = Generalized Cost

C_{Travel} = Travel Cost = monetary cost = Direct cost borne by the traveller

C_i = Non-monetary Cost

The only non-monetary cost we use is the "time cost", which depends on the time spent in travelling and on the value of time, i.e. the value that a passenger attributes to his time. More explanations are given in **Błąd! Nie można odnaleźć źródła odwołania.**. Because of the difficulty in evaluating aspects such as comfort, frequency, etc, we did not factor them into our analysis.

The following formula is used to calculate generalized cost:

$$C_g = C_{travel}(d) + \underbrace{V_t \times T_{travel}(d)}_{\text{Time Cost}}$$

With: C_g = Generalized Cost

C_{Travel} = Travel Cost = Out-of-pocket Cost

d = Travelled Distance

V_t = Value of time

T_{travel} = Travel time = time spent in travelling or waiting

Each generalized cost is specific to the considered transport mode. Besides, it depends on the distance, and also on the value of time, therefore on traveller's features. Indeed, the value of time depends on both the person's income and the reason for travelling (a business man will value an hour wasted in transport more highly than a leisure traveller).

That is why we can affirm that:

Generalized Cost (for transport mode i) **=** f° **(distance, value of time)**
With **Value of Time =** f° **(income, trip reason)**

➢ 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.

The function is therefore:

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

With: d = travelled distance
Vm = Average speed

➢ 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.

Note: It is assumed that the passenger goes from the transport mode to his destination point by car.

⇨ 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.

Note: When unit cost is expressed in vehicle-km, we have to divide this cost by the average number of passengers in the vehicle (obtained using the load factor) in order to obtain the operational cost in passenger-km.

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

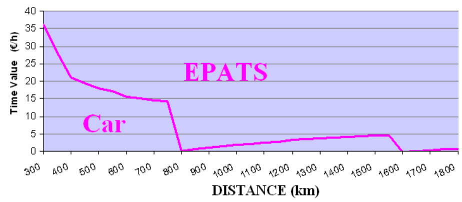
$$C_{Travel} = C_{Access} + \underbrace{Distance \times C_{Unit}}_{C_{Transport}} + C_{Egress} + C_{Additional}$$

b. Estimation method

The main steps of the developed methodology are summarised in Figure 2-1.

Data and Assumptions

Indifference curves between 2 modes
value of time vs. distance



Passenger-km distribution
vs. distance and value of time

Pkm Distribution		**DISTANCE cat.**		
TIME VALUE €/h		D1	D2	D3
	TV 1	...	..	...
	TV2	...	...	...
	TV3	...	...	...

Modal Split

		DISTANCE cat.		
VALUE OF TIME €/h		D1	D2	D3
	TV 1	...	..	...
	TV2	...	...	...
	TV3	...	...	...

Results: **Potential Transfer of passenger-km to EPATS**
= Sum of the Pkm in the blue cases (in the example

Figure 2-1 : Developed methodology

The developed methodology associates information on the comparison of each of the various transport modes with the personal aviation mode and the distribution of traffic of travellers according to their value of time and the travelled distance. This association help to estimate the modal split between the two considered transport modes and as a consequence the level of traffic potentially transferred to the personal aviation mode.

c. Scenarios

By 2020 some parameters of the model will have changed, while others will remain identical. Thus, we need to assess how concerned parameters could evolve over time.
The most difficult and complex element to evaluate is the traffic in terms of passenger-km or of trips. We therefore need to focus on studies providing forecasts for different kinds of traffic (long distance, personal / professional trips, by car / air ...). Even though there are not many studies on this matter for the EU25, we did manage to locate a study that more or less meets our demand: the ASSESS study. Directed by the European Commission in 2005, this study deals with the “Assessment of the contribution of the TEN and other transport policy

measures to the mid-term implementation of the White Paper on the European Transport Policy for 2010". The White Paper of 2001 advocated policy measures in order to achieve a sustainable transport system. These measures are gathered in four objectives: shifting the balance between modes of transport, eliminating bottlenecks, placing users at the heart of transport policy and managing the effect of globalization.
The goal of Assess is then to have an overview of the measures implemented between 2001 and 2005, i.e. to see whether the objectives have been reached or need some adjustments. It also aims at foreseeing the consequences of the implemented measures on traffic and on a certain number of variables such as travel cost or travel time for each mode. Four scenarios have been developed in order to evaluate the effects of the measures. The particularity of this study is that the **scenarios share common assumptions concerning the macroeconomics trends** (Population, GDP, Fuel price, etc). Actually, the scenarios differ in term of degree of implementation of the policy measures: there are the Null, the Partial, the Full and the Extended scenarios.

- The Null scenario (N-scenario) assumes that none measure of the White Paper has been implemented, neither at the European level nor in the Member States. In the absence of the White Paper policy measures, the transport situation is assumed to follow the recently observed trend since the late 1990s.
- Partial implementation scenario (P-scenario) includes measures already implemented and the ones likely to be implemented before 2010. This scenario probably represents the most likely outcome of the implementation of the main White Paper measures, given the progress so far.
- Full implementation scenario (F-scenario) includes all 78 measures introduced in the White Paper and in the White Paper action program.
- Extended scenario (E-scenario) is a kind of mix between the partial and the full implementation scenario: for most measures the extended scenario follows the full scenario while for some measures the partial scenario is followed because there is no indication that the full implementation is feasible.

In the rest of the paper we will present estimations obtained for the **partial implementation scenario** that is considered in the ASSESS project to be the most likely scenario.

3. Personal air traffic in 2020

The potential transfer of passenger demand to EPATS is then estimated by applying the methodology presented in section 2. Estimations obtained at European level, are given in terms of traffic that would be transferred to EPATS and in terms of number of EPATS aircraft that would be necessary to operate to satisfy this demand.

Estimations of the number of flights as well as estimations of the EPATS fleet have been derived from the estimated number of transferred passengers to EPATS and from the category of EPATS aircraft that is considered on each connection. Table 3-1 presents the different allocation rules that we consider.

Aircraft types	Allocation rule
Piston aircraft	200km-250km
Turboprop aircraft	200km-1000km
Jet aircraft	1000km-2500km

Table 3-1 : Rules of allocation of aircraft type according to the connection distance

Estimation of the potential transfer of traffic in 2020 to personal air transport have initially been estimated from three modes of transport (road transport, traditional air transport and rail transport) but estimations showed that travelling with personal aircraft would never be preferred to travelling by train. Hence the potential transfer of traffic would only come from road and traditional air transport modes.

a. Estimated traffic

One of the most important results of the estimations at a European level is the absence of transferred traffic to EPATS (both from road and from air transport mode) for leisure travellers, whatever the considered scenario. Thus, the **transfer of traffic** to EPATS in 2020 would **only concern business passengers.**

This transfer of traffic would represent 152 billions passengers kilometres or 319 millions passengers where 99% of this traffic would come from road transport.

Figure 3-1 presents the estimated EPATS traffic to and from European countries, transferred from air and road transport modes in 2020. Three countries would have the highest level of traffic transferred to personal aviation: Spain, Italy and France. The potential number of passenger kilometres transferred to EPATS to and from each of these three countries would be 4 to 5 times the average level of traffic on the 21 considered European countries. The predominance of Italy and Spain can be mainly explained by the high level of domestic EPATS traffic in these countries that would represent more than 50% of the total traffic to and from these countries. However, the high traffic level to and from France would not only be related to the 32% of domestic traffic but also to the high traffic level with Spain, Italy and United-Kingdom (that would represent 27% of the total EPATS traffic to and from France).

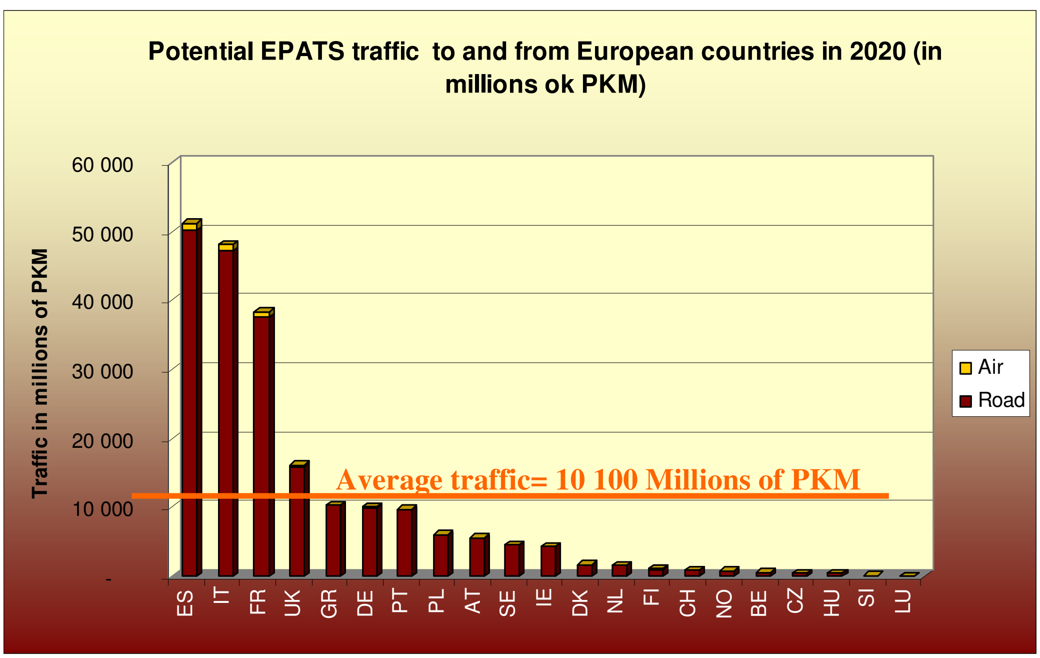


Figure 3-1: Potential EPATS traffic to and from European countries in 2020 (in millions of PKM) (Data sources for estimations: ESPON, ASSESS)

This transferred traffic would also represent 43 millions flights in Europe, where Italy, Spain and France would be the European countries with the highest level of EPATS flights.

However, it is important to note that while Spain would be the European country with the highest level of PKM traffic, Italy would be the country with the highest number of EPATS flights. The reason of the predominance of Italy in terms of number of EPATS flights is the high level of traffic to and from Italy on connections with distances between 200 and 250 Km. This traffic demand would be satisfied by using Piston aircraft that have a small number of passengers (in maximum 5 passengers), leading to numerous flights.

b. Estimated fleet

In total we estimate that **around 90 000 EPATS aircraft** would be operated in 2020 where:

- 56% of these aircraft would be piston aircraft
- 18% of these aircraft would be turboprop aircraft
- 26% of these aircraft would be jet aircraft

In total, we estimate that around:

- 23 million flights will be performed with Piston aircraft at Flight level 250
- 16 million flights will be performed with Turboprop aircraft at Flight level 250
- 3.7 million flights will be performed with Jet aircraft at Flight level 350

c. Sensitivity analysis

Operating costs for EPATS aircraft used in the estimations could increase when for instance adding new materials in aircraft so as to be compliant with SESAR requirements or when adding new environmental taxes, etc. It is therefore particularly interesting to test the sensitivity of the estimated potential EPATS demand to an increase in the unit operating cost of EPATS aircraft. We choose to consider two cases: an increase in the EPATS cost of 20% and an increase of 30%.

Table 3-2 shows the impacts of cost increase on the estimated EPATS traffic level. An increase of 20% in the EPATS cost would lead to a decrease of 15% in the estimated EPATS PKM traffic level while an increase of 30% would lead to a reduction of 29% in this traffic (Figure 3-2). This difference is accentuated when considering the number of passengers since a cost increase of 30% would lead to a reduction in the number of EPATS passengers reaching 40%.

Unit of traffic	Original transport mode	Trip purpose	Basic situation	Cost +20%	Cost +30%
Millions of PKM	ROAD	Business	150 271	127 484	105 894
	AIR	Typical Business	2 961	2 676	2 148
	TOTALPKM		153 232	130 160	108 041
Thousands of PAX	ROAD	Business	315 512	266 450	188 247
	AIR	Typical Business	4 955	4 083	2 706
	TOTAL PAX		320 466	270 533	190 953

Table 3-2 : Impacts of EPATS cost increase on the estimated traffic levels
(Data sources for estimations: ESPON, ASSESS)

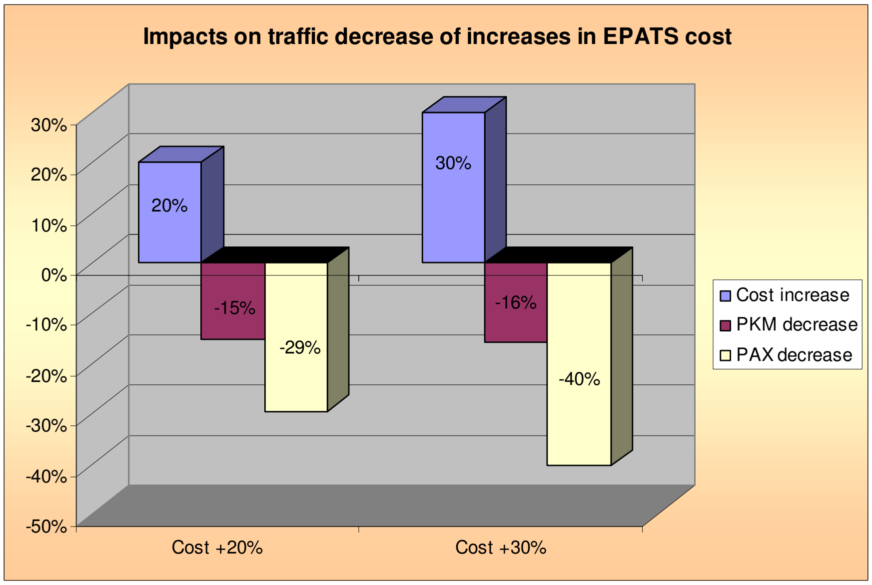


Figure 3-2 : Impacts on traffic decrease of increases in EPATS cost (Data sources for estimations: ESPON, ASSESS)

4. Conclusion

Personal air transport is expected to have a strong development by 2020 due to a high demand of business travellers. Estimations made in the context of the EPATS project indeed show that 152 billion passenger-kilometre what would represent **3% of the total European traffic** (car+aircraft+train traffic in 2020). Several factors can explain the potential high transfer of traffic to personal aircraft:

- Wealthier and more mobile European population;
- Increasing demand in personalized transport;
- Increasing need in high-speed transport modes in remote areas.

As a consequence we estimate that around 90 000 personal aircraft would be use to satisfy such a demand level. This fleet size would then decrease to 25 500 if the operational cost of personal aircraft would increase by 30% (due to for instance new materials in aircraft so as to be compliant with SESAR requirements, or due to new environmental taxes, etc.).

As a consequence, estimations made in the context of the EPATS project not only show the existing potential of market of personal aviation, but also highlight the essential role in the future air transport market that such a new transport mode may play in 2020.

The Challenge of Mobility in Europe

Maciej Mączka, Institute of Aviation, Poland, 2008.

Table of Contents

1. Introduction

Man's natural need to reduce inconveniences effects in action that generates numerous movements. The ever changing, relatively temporal location of agents has been a part of human history and will, most likely, remain until the end of, what we call, the civilization. There are, however, various dimensions, various vehicles and subjects of movement, which we discover, facing the dawn of global information society. Expecting inevitable changes in human nature caused by the emergence of virtual worlds, we spend our lives in millions of traffic jammed cars.

Car luxury or engine power does not please as it did yesterday. Despite the efforts of manufacturers' marketing departments, the prestige attached to road vehicle possession diminishes when a multitude of competing owners struggle for scarce parking places.

The real powers of a mankind for the sake of its survival and prosperity, which are in possession of everyone – creative minds – are in a continuous trial-and-error processes searching for optimal solutions of the day. Imagine a businessman on his five-hundred-kilometer-car-journey for a meeting, controlling time nervously and realizing "if only I had wings…", "why do none of the airlines offer service from my region?", "aren't we here rich enough to be connected to high-speed train network?". The ideas simply spark around…

And – here we are – the **European Personal Air Transportation System** is one of the proposals for the European society to fill the transportation gap that exists on interregional national and European destinations with underdeveloped transport network, where implementation of others modes of fast transport is irrational due to too low flow of passengers. A system that could improve air taxi business services to be more cost-efficient and transform its status to regular product thanks to the economy of scale and net-centric management.

This paper shows the current trends of European mobility focusing on areas where the aforementioned transportation gap occurs.

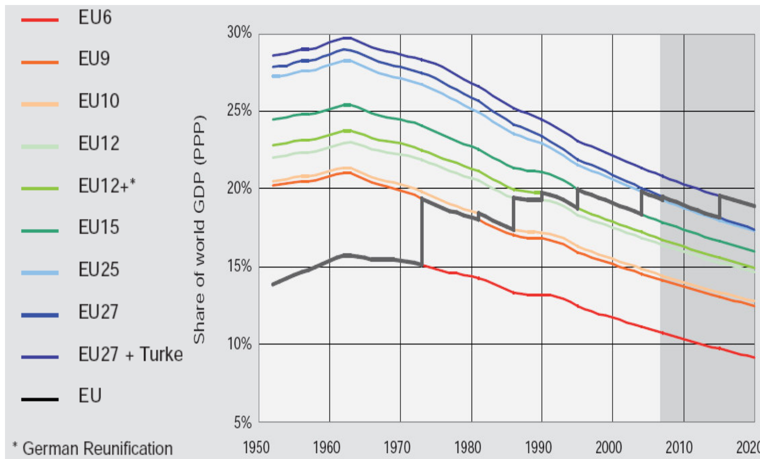
2. European Globalized Economy

The European Union economy holds up relatively well due to sound fundamentals.[1]

European Commission forecasts of the EU economy (*EU economy: 2007 review – Moving Europe's productivity frontier*, EC Directorate-General for Economic and Financial Affairs, COM(2007) 721 final, Brussels, 21 November 2007.)

economic growth (GDP)				consumer price inflation		
2007	2008	2009		2007	2008	2009
2,8%	2,0%	1,8%		2,4%	3,6%	2,4%
labor market (jobs created)				public deficit level		
2006/7	2008/9			2008		2009
7,5M	3M			1,2%		1,2%

In the long term, however, its one of the top positions in global rankings measured by GDP level[2], has experienced a more than a half-age decline, balanced only by means of a reliance on the political dynamic of enlargement.[3] The productivity growth is constrained by restrictions concerning labour and product markets, lack of openness to foreign direct investments and barriers to access or the creation of new technologies and their diffusion, and especially for the near future, the turmoil in the financial markets and oil prices.



GDP (PPP) level in European Union and its predecessors as a share of world GDP [ESPON Project 3.4.1, *Europe in the World: Territorial evidence and visions*, results by autumn 2007, p. 17]

European welfare states stemming from ageing populations need to implement polices, defined by the revised Lisbon Growth and Jobs Strategy, which favors competition-friendly market regulations, R&D activity and the quality of human capital. Globalization and Information and Communication Technology (ICT) revolution proved that small countries or small start-up companies can be technology leaders in specialized fields and international mobility of researchers and financial capital are main vehicles of diffusion.

Knowledge-intensive and technologically advanced services firms offices spatial distribution [ESPON Project 3.4.1, *Europe in the World: Territorial evidence and visions*, results by autumn 2007, p. 29]

"Globalisation tends to increase the economic inequalities between European regions. The metropolitan regions of the Pentagon[4] where the major gateway cities are localised are actually the most likely to benefit from the opening up of EU27 + 2 territory to internationalisation. **But globalisation does not necessarily have negative effects on all peripheral regions.** Depending on their economic specialisation some peripheral

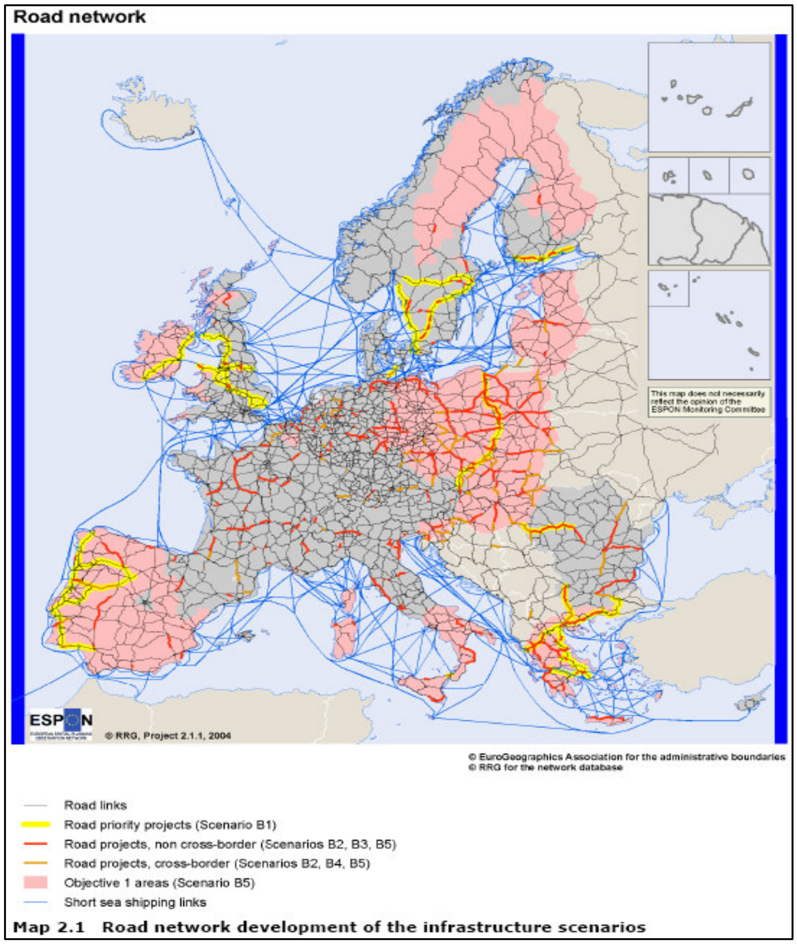
[1] *Economic Forecast*, EC: Directorate-General for Economic and Financial Affairs, Spring 2008, pp. 1, 5, 31, 49.
[2] IMF (2007): EU27 - $14,7 trillion ; USA - $13,8 trillion ; China - $6,99 trillion ; Japan - $4,2 trillion
[3] UMS RIATE/ESPON 3.4.1, 2006 , Vol. 1, p. 205.
[4] defined by the metropolises of London, Paris, Milan, Munich and Hamburg, EPSON Project 2.1.1, p. 211.

regions can benefit from the development of tourist flows or from the relocation of traditional industrial activities for which they display comparative advantages”.[5] Nevertheless, to exploit benefits of comparative advantages of remote regions an effective transportation system is required also there.

3. Transport networks

In 1996, the European Union agreed on 14 priority trans-European networks in the transport sector (TEN-Ts), which are very important pillars securing the free movement of passengers and goods in cross-border links. The main challenges were defined in the so called ‘priority axes’[6]. The revised Lisbon strategy intends to unblock major transport routes and ensure sustainable transport.[7]

This policy direction pointed at the beginning of EUROSTAT’s 2007 *Panorama of Transport* immediately gives a quick image of situation - the European mobility channels are blocked or tend to be blocked, despite one of highest network density in the world. Ground transportation takes c.a. 2% of the EU area and the tendency is to take more, while the existing routes and parking places are becoming congested. There are serious bottlenecks in the air, especially in ECAC core areas caused by the situation where 85% of air activity is generated by 43 main airports and dynamic growth.[8] High-speed



Road network in the EU27+2 prepared by ESPON Project 2.1.1

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[5] ESPON 3.4.1, *Europe in the world*, 2006, Vol. 1, p. 242

[6] Most of these ‘axes’ are at risk of falling behind schedule hampered by procedural, technical problems, and especially the difficulty of raising finance. Completing 30 priority axes will total an estimated €250 billion by 2020 – or €600 billion if non-priority projects are added. The EU’s budget for TEN-Ts projects for the period from 2007 to 2013 amounts to €8 billion. The EU is only allowed to fund 10 to 30 per cent of the costs of construction, that is why funding TEN-Ts still rests with the member-states. The EU and EIB's 'loan guarantee instrument for TEN-Ts projects' (LGTT) is to increase private-sector participation by covering commercial risk during a project's initial phase of operation, when an operator might have difficulties paying back loans on time because of lower than expected revenues. [Barysch K., Tilford S., Whyte P., *THE LISBON SCORECARD VIII - Is Europe ready for an economic storm?*, Centre for European Reform, February 2008, p. 47.]

[7] *Panorama of Transport*, EUROSTAT, 2007, p.2.

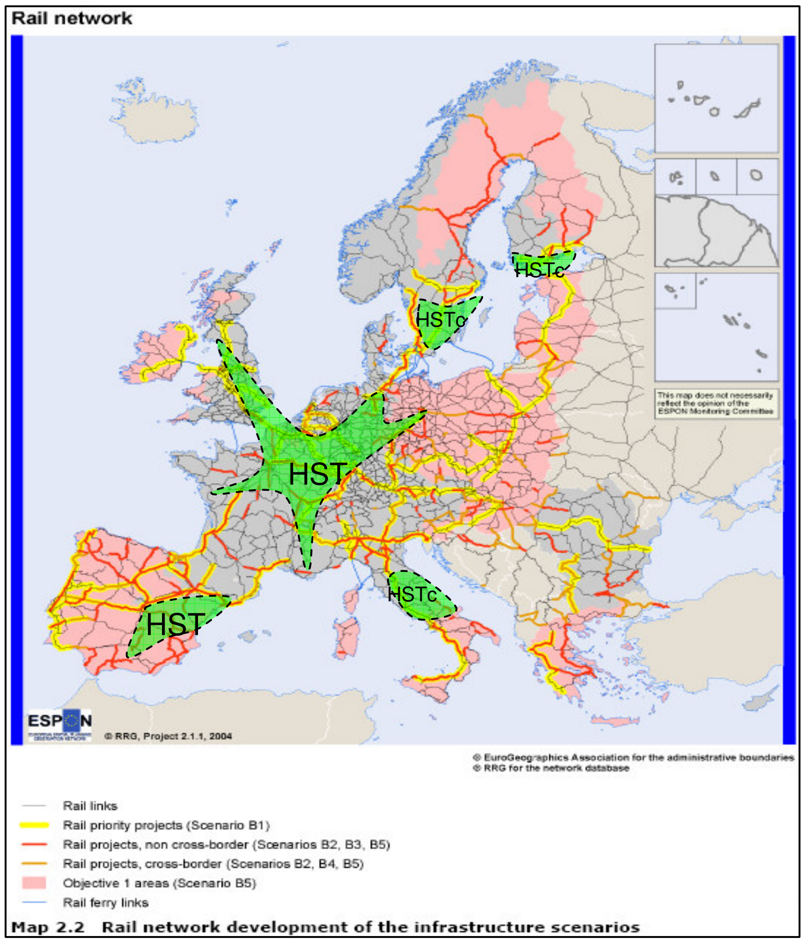
[8] “prices falling dramatically and the number of routes being offered rising sharply”-*LISBON SCORECARD VIII*

rail seems to be an excellent solution to intensive passengers flow routes, however its infrastructure construction is very expensive[9]. There are no serious offers for out-of-core long distance travelers, who are therefore forced to use cars and contribute to congestion in sensitive locations. If we are to be conscious of the scale and shape of the problems we need to focus on respective, main modes of transport separately.

3.1. Road transport

There are more than 4,8 million kilometers of roads and 60 000 km of motorways in the EU.[10] According to Eurostat data a million kilometers of roads have been built during the period of 1990-2003. The ever growing number of cars reaches 220 million and 5 million more vehicles are registered every year. The road transport consumes 83% of total energy used in transport industry.

The ESPON[11] Project 1.2.1 evaluated road infrastructure in Europe as well developed, however distinguished some main bottlenecks. Any increase in terrestrial traffic on connections: Paris – Bilbao, Marseille –Paris, Marseille –Ruhr, London – Manchester – Liverpool – Glasgow and Dublin, Lisbon – Madrid will effect in significant increases in the travel times. There are also recognized two critical passages: Trans-Pyrenees and Trans-Alpine. Greece and Cyprus have worse road density with respect to the EU27+2 average in the Mediterranean area and the infrastructure of Baltic states was recognized to have poor links to the rest of Member States. The Central Area has extremely good road infrastructure, however noise, emissions of pollutants or land fragmentation become serious drawbacks. It is on the extreme to the Eastern Area where the



Railroad network in the EU27+2 [ESPON Project 2.1.1] extended by the up-to-date information on High speed train (HST) [UIC, 02.2008]

[9] **€10 - 30 million** per construction of 1km of high speed rail, International Union of Railways, UIC (Nov 2005), *High Speed Rail's leading asset for customers and society*, http://www.uic.asso.fr/download.php/gv/HighSpeed.pdf, p. 30.
+ **€70 thousand** of upkeep costs per 1km annually, UIC Project - Lasting Infrastructure Cost Benchmarking (LICB) - *LICB Summary Report* UIC C 2006/12/15, p. 7.

[10] (for 2003), *Panorama of Transoport*, Eurostat 2007.

[11] European Spatial Planning and Observatory Network, for more information on ESPON, see: 4.2. ESPON KTEN model outcome O-D flows, p.10 - or - http://www.espon.eu

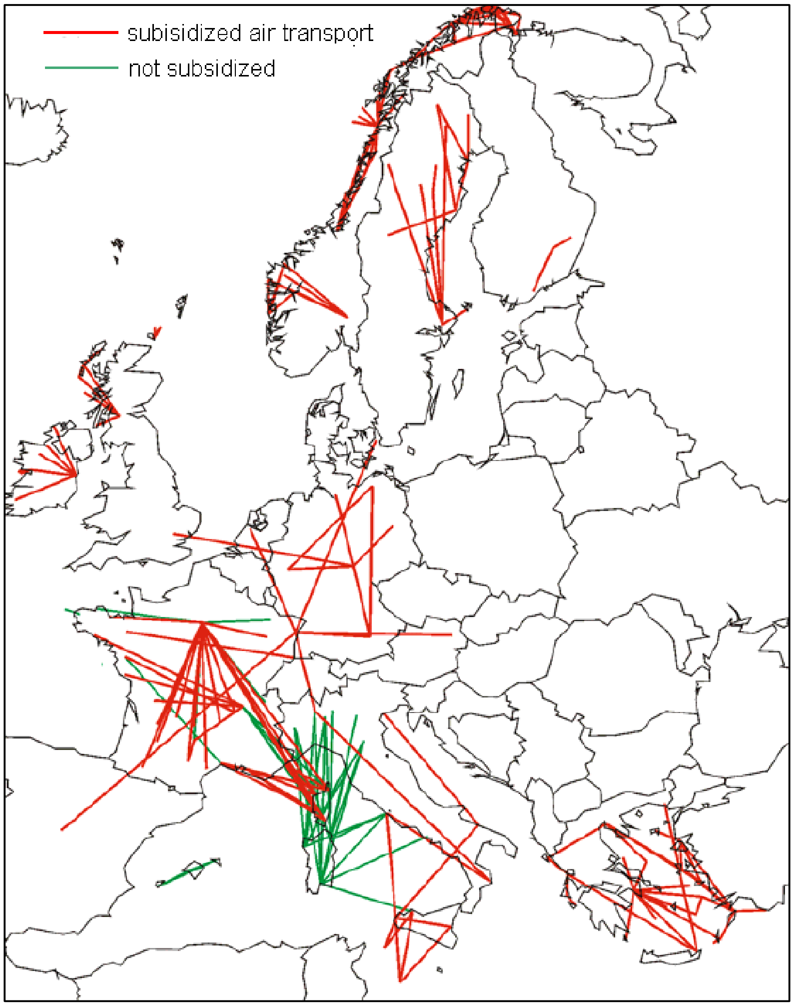
density of motorways and expressways by population is comparatively very low with the European average. There exists not a real motorway network, and its construction costs vary from 5 million Euro per km (to e.g. €20 million as in the case of Poland in Silesia region).[12]

3.2. Rail network

The Eurostat's *Panorama of Transport* says about 199 000 km (2003) of rail tracks with high population density lowland countries like Germany, France and Poland situated at the top of track length list and a country of numerous islands and mountainous regions - Greece - at the bottom. The overall dynamics indicates 8% decrease in network length.

Sacrificing huge amounts of capital (hundreds of billions of Euro[13]) Europe builds its high speed rail network. The situation of certain cities located on high-speed railway lines is a factor favorable. It is clear that the system of relations between Paris, Lyon, Avignon and Marseilles was modified by the high-speed train, including a strong modal shift in favour of rail. This characteristic is going to spread partially with the development of high-speed railway lines in other macro regions. There are regions, where the high speed network is not likely to reach even in many years horizon. E.g. Baltic states experience the same poor situation in rail linkage as in the road infrastructure.

For 50 000 rail cars, crossing a frontier still remains somewhat exceptional, and only a few locomotives are equipped with the multiple systems required to easily cross national borders (e.g. Thalys connecting Paris-Brussels-Amsterdam).[14]



Air transport provided under Public Service Obligation rules,
[Les obligations de services publics aériens en Europe, ou l'intervention résiduelle des États face au libre marché, Frédéric Dobruszkes, 2005.]

3.3. Airspace network

The air network dominates for professional mobility of more than 500km in

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[12] Signaled as the most expensive in Europe. Kraków regional bureau for roads budget, Generalna Dyrekcja Dróg Krajowych i Autostrad (GDDKiA) oddział w Krakowie, http://www.krakow.gddkia.gov.pl/budzet/budzet.htm, 9.05.2008.; http://www.gddkia.gov.pl/

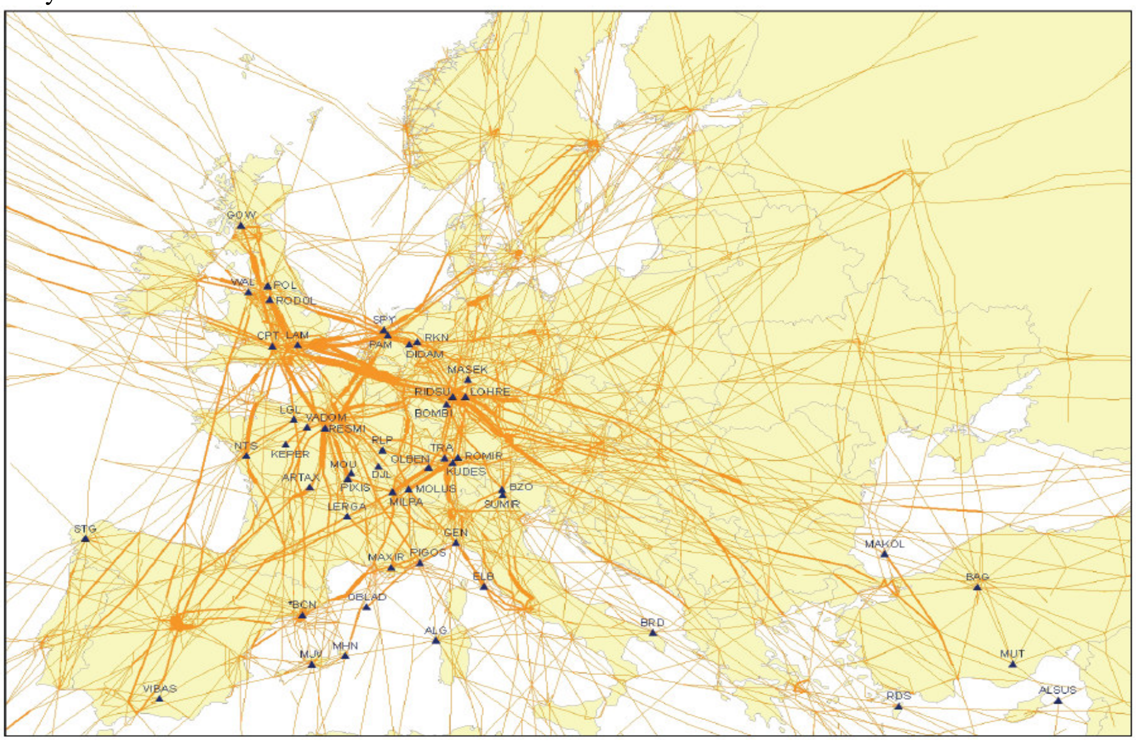
[13] Lines in operation 170 billion Euros (for 8 570 km); Lines under construction 109 billion Euros (for 6 240 km); Planned lines 84 billion Euros (for 3 040 km), *High Speed Rail's leading asset for customers and society*, 2005, p.30.

[14] European Rail Traffic Management System project (ERTMS) - http://www.ertms.com/

the absence of high speed trains.[15] The total gate-to-gate costs of Air Navigation Service provided by EUROCONTROL in 2005 reached €7,1 billion (about 0,8 €/km)[16].

Regions, as for example, Mediterranean islands depend on air transport links operated under Public Service Obligations (PSO) rules[17]. This profile of service exists, however, in whole Europe. Many low-cost carriers (also in the Eastern macro region) use this possibility at the invitation of local authorities, which aid their businesses. The PSO form of activity is very carefully examined and controlled by the European Commission as it breaches the market competition paradigm.

One cannot easily talk about “network length” in aviation. The virtual nature of “air corridors” makes it harder to grasp the image than it is with any other mode. It could be assumed that a working “infrastructure” is given continent-wide (air, airports, air traffic control, aircraft leasing, and financial support). This network is changeable and morphing, according to traffic volume. A classification of airports on the basis of their technical or infrastructural features is not useful for statistical purposes, because airports are by their nature intermodal nodes. Anyway, the most of the traffic is generated at 112 “main” airports[18] with a passenger volume of over 1 500 000 passengers annually and the rest of European airports and landing fields are generally unused (of 2570, according to EPATS[19]). The airspace has its capacity as well. For an Air Traffic Management System it is defined as “the volume of traffic that could be accommodated with 1 minute per flight average delay“[20].



Top 50 most constraining points in European airspace**,** PRR 2006, EUROCONTROL, Annex VI, p.95.

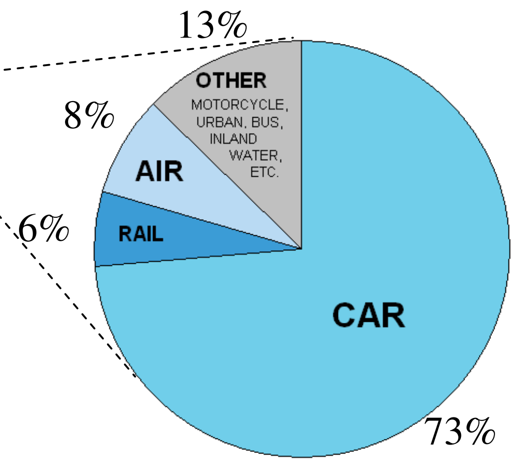
[15] ESPON Project 1.2.1, *Transport services and networks: territorial trends and basic supply of infrastructure for territorial cohesion*, 2004, p. 23.
[16] PRR 2006, EUROCONTROL, p. 72.
[17] According to the EC 2408/92, which, as a result of local authorities initiative and willingness to pay, exempts certain services, due to **socially desirable advantage,** from the EC Treaty general rule (Art. 87): “[…] any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favoring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market.” Jacques Barrot, Commission Vice-President responsible for transport, explained: "[…]those obligations must not improperly close off a viable market from competition[…]", http://europa.eu/rapid EC press release, Reference: IP/07/539 Date: 23/04/2007.
[18] Eurostat for 2004, EU-25
[19] EPATS D1.1 T1.2 EPATS Airports and facilities database
[20] PRR 5, Annex 6, EUROCONTROL, pp. A9-A13

Current capacity of airspace is very much constrained by fragmented approach to ATM – a heritage of national borders. Europe is on its way to reform this architecture within the SESAR Project.[21]

3.4. Volume of transport in Europe

The total volume of passenger-kilometers generated by three main modes of transport reached the level of 5 trillion. Enormous road traffic has increased its volume by nearly 18% during 1995-2004 period. Air transport volume has been the most dynamically growing (by 49%) in the same period, however its share maintains the level only (6-8%). The rail generated passenger-kilometers are in slight decline of share.

year	Car	Rail	Air	Other	TOTAL
2004	4458	352	482	769	**6061**
2003	4399	347	454	755	**5955**
2002	4370	351	435	747	**5903**
2001	4277	355	441	749	**5822**
2000	4196	353	440	744	**5733**
1995	3787	324	324	714	**5149**



Passenger transport performance, by main transport mode, EU-25, 1995-2004 (in billion passenger-kilometers) [*Panorama of Transport*, EUROSTAT, 2007, p.102]

Economy of transport services

The EU-25 1 078 000 transport enterprises reached an annual turnover of €1024,3 billion, out of which 640 rail companies sold services worth €61 billion (6%) and 3200 air carriers sold services worth €100 billion (9,8%). Almost half of transport industry turnover is not generated by physical transport service selling companies, but by the auxiliary surrounding.

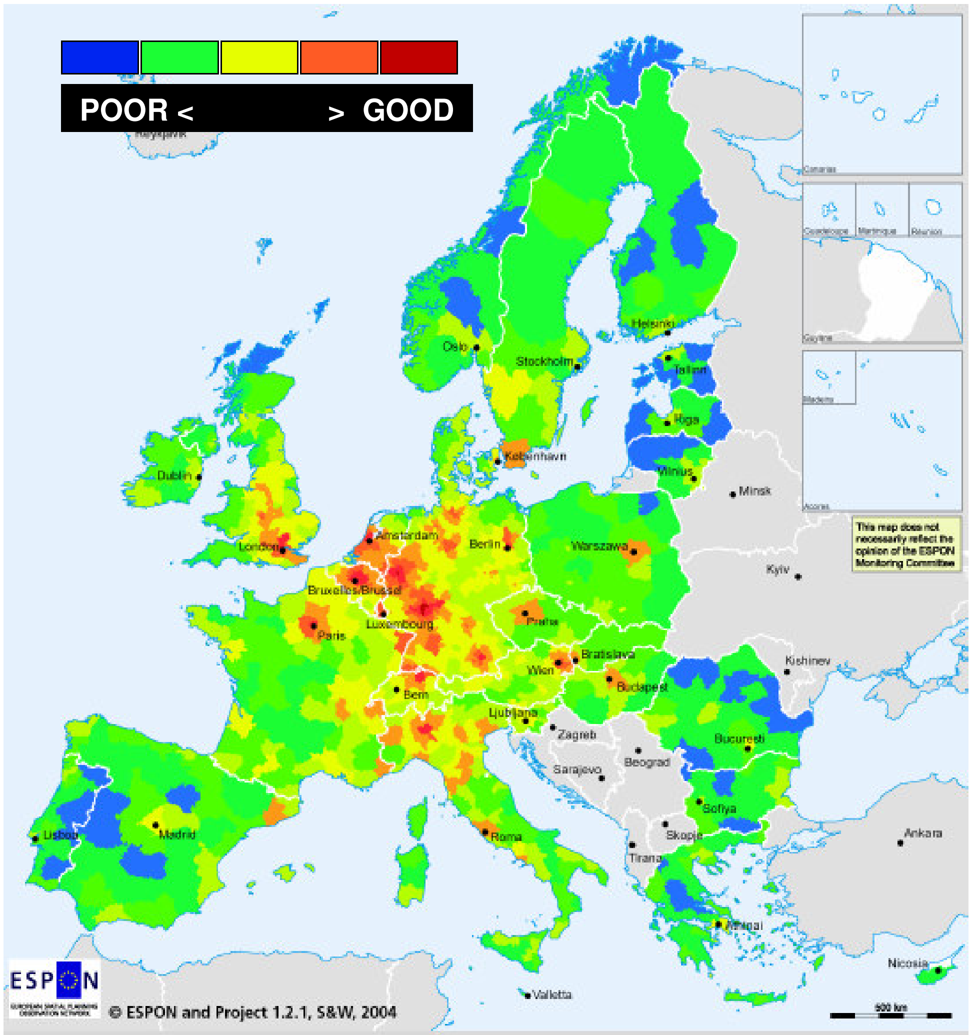
- One employee generated for its rail transport company added value of €37 962 on average, annually.
- One employee generated for its air transport company added value of €74 943 on average, annually.

Panorama of Transport, Eurostat, 2007, p. 55. (data for 2004)

[21] Single European Sky ATM Research, http://www.eurocontrol.int/sesar/public/subsite_homepage/

3.5. Accessibility

A "total track length" unfortunately does not answer the question of transport infrastructure. A major problem with this measure is that it disregards the infrastructure network quality. To overcome these problems, one might weigh infrastructure with certain characteristics in a potential function.



Transport infrastructure quality expressed as summed potential accessibility of road, rail and air transport in the EU27+2, ESPON Project 1.2.1 by S&W, 2004

The **regional accessibility** defined[22] by ESPON Project 2.1.1 for the purpose of the SASI model, takes the following form:

$$A_i = \sum_j (W_j)^{\alpha} e^{-\beta c_{ij}}$$

where Wj denotes the potential of region j, and cij is a measure of 'cost' of travelling between the regions i and j.

[22] The SASI model was build to explain locational structures and locational change in Europe in time-series/cross-section regressions, with accessibility indicators being a subset of a range of explanatory variables. See more: ESPON Project 2.1.1, *Territorial Impact of EU: Transport and TEN Policies*, 2005, p. 73-89

The potentials of the various regions are chosen equal to their populations, which corresponds with the idea that the accessibility to highly populated regions is more relevant than the accessibility to sparsely populated regions. The cost measure can e.g. be based on travel time and political and cultural barriers. The summation is over all possible regions, including the ‘own region’ i.

The travel costs between two regions are composed of four parts:

- the travel times between the regions
- the difference in the level of integration within Europe
- language differences
- cultural differences

The travel times between regions are computed using timetable travel times (rail and air transport) and road-type specific travel speeds (road). Aggregation over different modes (road, rail, air) takes places through the logsum impedance:

$$c_{ij} = -\frac{1}{\lambda}\ln\left[\sum_{m}\exp\left(-\lambda c_{ijm}\right)\right]$$

where cijm equals the travel costs between the regions i and j given that mode m is used. Note that these travel costs consist precisely of the above mentioned components.

The potentials Wj are chosen equal to the population size of the various regions.

Transport infrastructure quality of the EU27+2, expressed as a regional accessibility indicator matrix focusing on lower values of this measure, was taken under consideration in EPATS analysis to find the most possible spatial distribution of potential **transportation gap**.

3.6. A transportation gap

There exists a transportation gap, i.e. a recognized demand, that is not addressed by the transport services supply. The multimodal potential accessibility map helps to identify the spatial distribution of the transportation gap. A sudden decrease in transport infrastructure quality occurs in the Atlantic Arc and Eastern macro region. Most of the Mediterranean and Nordic regions are also unnecessarily contributing to car traffic congestion in long distance journeys.[23]

4. How wide is the transportation gap?

4.1. How to measure the gap?

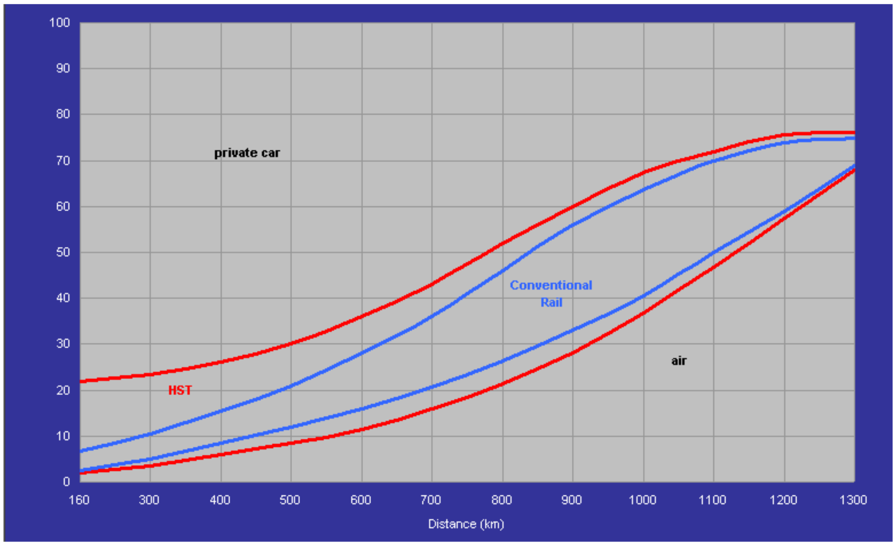
Knowing Origin-Destination passenger flows enables calculations, that could provide a potential estimates of demand for long distance, interregional, pan European, car traffic.

However, it is very difficult or even hardly achievable to gather such complete empirical data. Therefore, a model should be built. Or in case of limited time and resources - an existing model outcomes could be adopted.

[23] See maps. This demand is partially satisfied by the subsidized air transport that already exists there at local airports. A group of air companies (usually local) periodically take part in the run for state benefits, however the service profile seldom allows for transnational door-to-door travels (like in Greece, Sweden or Norway), offers services to one of the hubs only (like in France or Ireland) or could be optimized by certain improvements.

4.2. ESPON KTEN model outcome O-D flows

European Spatial Planning and Observatory Network (ESPON), a multimillion Euro initiative part-financed by the EU within the Interreg III ESPON 2006 Programme, has built, as a part of a large scale macroeconomic benchmarking activity, a passenger and freight traffic forecast meta model called KTEN ("Know trans-European Networks")[24]. KTEN model have been used by ESPON to precise qualitative scenarios into quantitative ones.



Modal split for interregional trips. Source: ESPON Project 1.2.1, Mcrit

Among several other outputs, KTEN provides a multimodal passenger trips forecast between NUTS2, which can be used to build passenger flows matrices, and, consequently to identify the scale of interesting transportation gap.

5. What fits the transportation gap?

5.1. European Personal Air Transportation System (EPATS)

The concept of EPATS is mainly based on[25]:

- Using the already existing local and regional airports network (more than 2000), especially located on the periphery of European main transportation infrastructure in the areas with low level of accessibility indicator;

[24] *Elements of support for the scenario building process*, in: "ESPON Project 3.2 Scenarios, Spatial Scenarios and Orientations in relation to the ESDP and Cohesion Policy", Final Report, Vol. 4, Oct 2006. KTEN is a sequential Four-steps model, with combined modal split and assignment on multimodal networks; assignment of interurban trips and freight between NUTS3 is made without congestion constraints (1 complete run of KTEN takes about 4 days; KTEN is 4GB large in total); KTEN bases on STREAMS project results, WTO data and EUROSTAT Air Traffic OD databases as well as ETIS-BASE freight matrices plus infrastructure regional endowment as output for MASST (another ESPON model), GDP and population predictions from MASST as inputs.

[25] Further details can be fund in: EPATS D1.1 *Report on European Business & Personal Aviation, Data base and Finding*, IoA, December 12th, 2007; *EPATS Roadmap Vision V02c*, IoA, July 2007.

- Using a potential enabled by the opening of Single European Sky and conducted research in the area of management and air traffic control by e.g. SESAR;
- Using new technologies concerning aerodynamics, materials, propulsion, communication, navigation and control based on satellite systems;
- Adjusting aircraft fleet and operational structures to interregional passengers flow, local demand and society needs;
- Increasing economic efficiency of interregional air transport by creating small carriers and private aircraft owners friendly legal and economic conditions, promoting unification, standardization and integration of maintenance networks; and
- Including remote interregional communication networks areas (with low accessibility) into public transport financing.

EPATS is a complex collection of systems, procedures, facilities, aircraft and people. They work together as one system to ensure safe and efficient operation. The system includes:

- Network of all existing and future airports and airfields in Europe satisfying the EPATS requirements, i.e. an EPATS-compliant airport meets a set of desired characteristics appropriate for the community's transportation demand and requirements;
- Pistons, turboprop and jet aircraft, having a capacity from 4 to 19-seats, fulfilling the requirements of FAR-23 or CS-23 and FAR 135 operating regulations;
- Air traffic management and control systems adapted to intensified air traffic generated by the EPATS. They include: radio, TMU and TFM, weather, radar, navigation and en route sites;
- Flight Service Station;
- Internet-based passenger travel booking and demand optimisation, offering transport capacity adjusted to the demand at the lowest price/performance ratio;
- Aircraft maintenance and management companies; and
- Aircraft owners and users associations.
- Aviation authorities;
- Air Navigation Service Providers;
- Flight training schools; and
- Research centres.

Moreover, the system surroundings include public transport powers (adequate local government units), aviation authorities, air traffic managers, aviation schools, aviation industry with its research and development centres. The system aims to operate in the public transport infrastructure framework.

5.2. EPATS volume estimations[26]

The most probable volume of EPATS could reach about 150 billion passenger-kilometers. The EPATS IFR flights are found to grow from less than 1 million (as in 2007) to 3,5 or 3,7 million. The EPATS VFR segment is expected to grow from about 15 million flights a year (as in 2007) to c.a 40 million.

The method and outcomes concerning volume of passenger-kilometers transfer and the respective number of operations may be found in detailed EPATS D2.1 *EPATS Potential transfer of passenger demand to Personal Aviation*. Other information such as the ATM or environmental impact could be found in EPATS D3.2 *Analysis of the Impact of EPATS on ATM Parameters: ATM impact assessment* and D3.2 EPATS *Airports General Requirements including Safety and Environmental Issues*.

[26] EPATS D2.1 *EPATS Potential transfer of passenger demand to Personal Aviation*, M3Systems, Feb 2008.

6. Conclusions

Europe needs a new, supplementary mode of transport. A mode that is harmonized with general trends (door-to-door, intermodality, energy efficiency). A mode that will give us a new tool to manage the challenges of mobility.

The EPATS, most likely, will not change our transportation habits, however it could open another dimension for traveling, revitalize the General Aviation industry and give a strong boost in research and development activity searching for our future personal means of travel.

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10. Dobruszkes, F., *Les obligations de services publics aériens en Europe, ou l'intervention résiduelle des États face au libre marché*, in: "Les politiques publiques à l'épreuve de l'action territoriale", IEP Grenoble, 15-16 juin 2006.
11. Barysch K., Tilford S., Whyte P., *THE LISBON SCORECARD VIII - Is Europe ready for an economic storm?*, Centre for European Reform, February 2008.

Mobility is essential for Europe

Mobility is essential for Europe. The extension of the European Union to 27 members amplifies this fact. However, current transport modes have limitations and suffer from congestion: roads and most large airports are already congested or could quickly reach their maximum capacity. Furthermore, especially in Eastern Europe some areas are hardly accessible.

Moreover, society is evolving : passengers are becoming more demanding in terms of time and cost, but their behavior is also changing: a phenomenon of individualization is taking place little by little, meaning that people want to have a choice.

Most European regions (NUTS-2, NUTS-3) are devoid of High Speed Mode of Transport. They are economically underdeveloped due to, among other reasons, not sufficient transport infrastructure. It deepens existing disparities between regions especially old and new EU members. Future mobility demand cannot be entirely satisfied by current transport systems, such as hubs, railways or highways either because of limited systems capability.

Future mobility therefore cannot be entirely satisfied by current transport systems, such as hubs, railways or highways.

A new additional transport mode is needed, and from this perspective, a new concept, Personal Aviation, has been proposed. It would enable long-distance trips (over 300 KM) in a short time at acceptable cost, thanks to the use of small aircraft (jet, turboprop, pistons) departing from small airports, in poor, remote regions as well. These aircraft would be operating in all weather conditions. The concept of personal aviation implies the development of a system.

This system is called EPATS – "European Personal Air Transportation System" which is a complex collection of systems, procedures, facilities, aircraft and people, working together. EPATS would be developed especially in regions where the airlines are little present and where high-speed trains are not available, due to the low flow of passengers and high cost.

But EPATS is also a means to make a stronger European aeronautics industry base by developing technologies and products needed for this kind of general aviation.

The European Commission funded a study project named EPATS 1 under Framework 6. Although the project has not been entirely finished the first results are very promising.

EPATS 1

The EPATS-STUDY (called EPATS 1) project investigated an alternative transport mode to road transport by offering personal air transport on distances larger than 300 KM.
The modal split for leisure journeys differs from business journeys mainly due to the preference of the car in the main distance categories. The high flexibility of a car compared to the other transport modes explains this predominance up to 800 km. From this distance air transport takes over.

In business travels the individual car dominates the other modes on short distances, i.e. distances comprised between 100 and 400 km. Above this limit of 400 km, businessmen widely prefer aircraft, because of their higher speed which wastes less time. Trains are interesting to a lesser extent for medium distances (200 – 600 km). The other modes (Bus,

coach, ship, ...) are hardly used by the business passengers, due to their low speed and their lack of convenience.

One of the most important EPATS 1 assumptions of the estimations at a European level is the absence of transferred traffic to EPATS (both from road and from air transport mode) for leisure travelers.

Thus, the transfer of traffic to EPATS in 2020 would only concern business passengers. But not all business passengers: transferred traffic would come from current road business passengers and air "Typical business" passengers. Hence it is also interesting to note that no traffic originating in Economy Class Business air passengers would be transferred to EPATS.

Not surprisingly, the highest share of traffic transferred to EPATS would come from road transport. Indeed, regardless of the criterion (number of passengers or numbers of PKm), the traffic transferred from road transport would represent 98% of the total transferred traffic.

The EPATS 1 project analyzed the availability of regional airports.

The analysis showed that there are 2.567 airfields of which 1.270 are ICAO registered airports and nearly 1.300 airstrips.

The analysis showed that :

1. In the most densely populated regions, the nearest airport is situated within a distance of less than 40 km for more than 95 % of population (within less than 20 km for 60 % of population),
2. For most European cities, the nearest airport is located within 15 km (90 % of cities),
3. There are many airports in the vicinity of the largest European cities (not fewer than 10 airports within 50 km radius of each large city) – so passengers can freely choose the most suitable airport,
4. Large part of the European population (potential passengers) live close to airports – approximately, about 1 mln inhabitants within 40 km radius of aerodromes,
5. Most European airports have sufficient technical equipment to be used for normal operational purposes by GA aircrafts (other landing fields should be modernized)

The analysis showed a good coverage of airports related to the 15.223 connections that are relevant for EPATS use.

EPATS 1 made an overview of existing aircraft that will qualify as EPATS aircraft.

EPATS aircraft were defined as aircraft seating between 4-19 passengers, classified under CS-23 EASA requirements.

Current airplanes gathered in the EPATS 1 database were divided into three groups depending on the type of propulsion:

- Pistons: single and multi-engined
- Turbo-props: single and multi-engined
- Jets: single and multi-engined

There are about 120 different airplanes collected in the EPATS database currently.
The use of aircraft was divided into:

- personal use, business use, corporate (FAR 91)
- air taxi and commuter (FAR 135)

It should be noted that a single classification of aircraft does not exist in Europe. It should also be noted that EPATS aircraft are used differently from traditional business aircraft.

All existing aircraft were then evaluated according to a new Customer Choice Index, which includes block speed, comfort in terms of cabin space per passenger and cost (DOC). The best aircraft were identified and chosen as reference EPATS airplanes. The cost of these aircraft were taken as a starting point for further analysis, as a result of transportation cost modeling and forecasted marked demand analysis, taking into account further technology and infrastructure development.

The EPATS Aircraft Missions Characteristics to be used for demand 2020 calculation were elaborated. These characteristics were verified against the data of existing reference EPATS airplanes.

EPATS 1 made estimations about Market Potential of Personal Aviation.

The essential question then arises: what could be the potential substitution of traffic from the existing transports to personal aviation?

The forecasted demand of EPATS aircraft is based on the following assumptions:

- The average traveler has knowledge about available transportation alternatives and makes rational choice in terms of money and time needed to complete the trip.
- The bases of demand prognosis are current and future data concerning: interregional passengers mobility for each mode of transport and particularly car, regional socio-economics data, household income distribution, value of time distribution and transportation system operational and economics characteristics
- The demand model is based on minimization of generalized travel costs for a given level of services.
- Remote regional authorities, social and commercial organizations, and local airports and aircraft owners are interested in air transportation services and are planning development of small aircraft transportation system.
- The EU recognizes the EPATS as “public good” and assists in realization of coherent economic European development. The EU includes the EPATS in the transportation, regional and research programs, as an important element of the European Transportation System

In order to estimate the modal-shift between cars and EPATS aircraft, a new method to compare the transport modes and asses the potential demand of new modes was developed, called the Generalized costs minimization method.

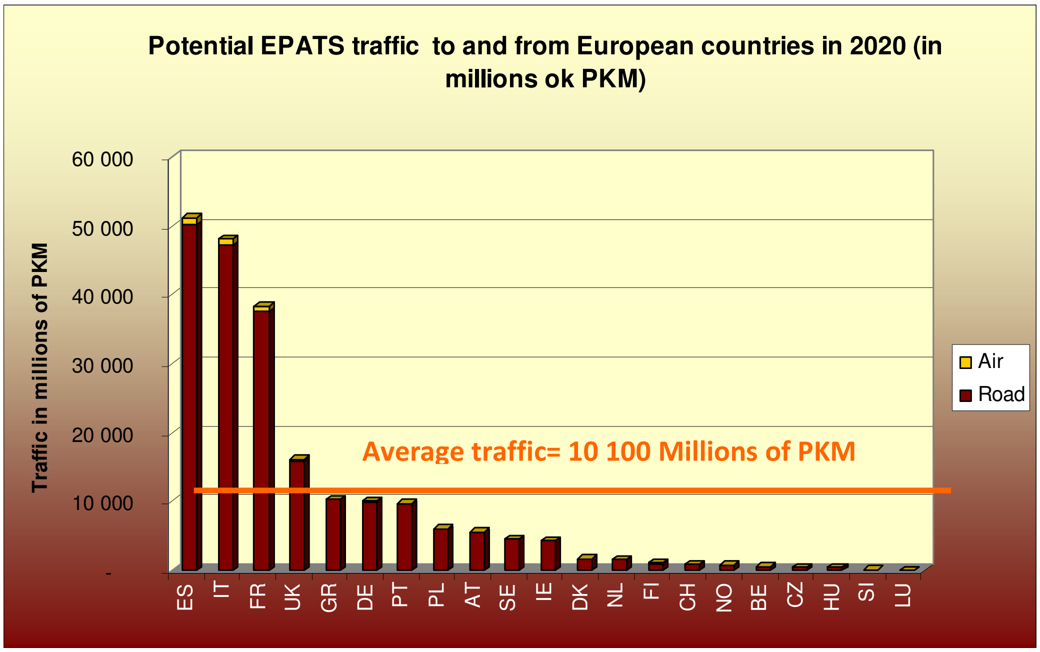
The formula contains cost for transportation as well as the cost based on time and accommodation for the total journey. To this end the time to travel door to door was expressed in terms of cost for the business traveler.

Generalized Cost (**for transport mode i**) = f° (**distance, value of time, accommodation**)

With Value of Time = f° (**income, trip reason**)

In Europe there are 63.429 total regional connections. Using criteria: accessibility, economic attractiveness, current traffic, distance EPATS has obtained 15.223 potential connections for Personal Air Transport (=24% of the total connections). Based on the generalized cost model and potential EPATS connections, the result is a substantial transfer of passenger to EPATS.

The transfer of traffic (to EPATS from AIR and ROAD) would represent 152 billions passengers kilometres or 319 millions passengers (99% of this traffic would come from road transport).



(Data sources for estimations: ESPON, ASSESS)

EPATS estimated fleet:

In total it has estimated that around 90 000 EPATS aircraft would be operated in 2020 where:

- **56% of these aircraft would be piston aircraft**
- **18% of these aircraft would be turboprop aircraft**
- **26% of these aircraft would be jet aircraft**

In total, it has estimated that around 43 million flights will be performed in 2020 where:

- **23 million flights will be performed with twin Piston aircraft**
- **16 million flights will be performed with twin Turboprop aircraft**
- **3.7 million flights will be performed with single or twin Jet aircraft**

All aircraft would be IFR equipped (or new avionics that would have similar capabilities) and all aircraft would fly at FL 250 or above.

Impact of EPATS on ATM

According to the forecasted demand, EPATS traffic would represent around 43 million flights a year by 2020, and would call for 90 000 aircraft. Considering the current initiative for the next generation of the European ATM system – SESAR and its performance target, a first EPATS impact on ATM was performed distinguishing EPATS IFR and EPATS VFR flights.

Considering the SESAR target capacity (3 fold today's traffic of 9.2 million IFR flights in controlled airspace) and considering the SESAR forecast for 2020 (a 73% increase of traffic only due to airport congestion, or 16 million flights), SESAR results indicate that a maximum of only 12 Millions EPATS IFR traffic in controlled airspace could be handled by SESAR in 2020 this from a pure capacity point of view. This would mean that any other EPATS traffic would be flying VFR in uncontrolled airspace only.

The EPATS VFR segment is potentially expected to grow significantly. Today, general aviation (already including some EPATS kind of flights) is about 15 million flights a year (as in 2007) and only with the addition of potential VFR EPATS flight could rise to more than 40 million in 2020. The impact of the EPATS VFR flights on the ATM is unknown today, since these VFR movements are not clearly addressed in the targets for SESAR ATM.

Nevertheless, early investigation showed that personal VFR movements would be flying at lower altitudes and thus would be mixed with traditional arrival / departure flows at the airport vicinities. Therefore, EPATS VFR will affect these regions, and call for advanced methods to cope with the two classes of traffic together (EPATS and traditional). If not feasible, the deviation or the separation of the flights will be needed.

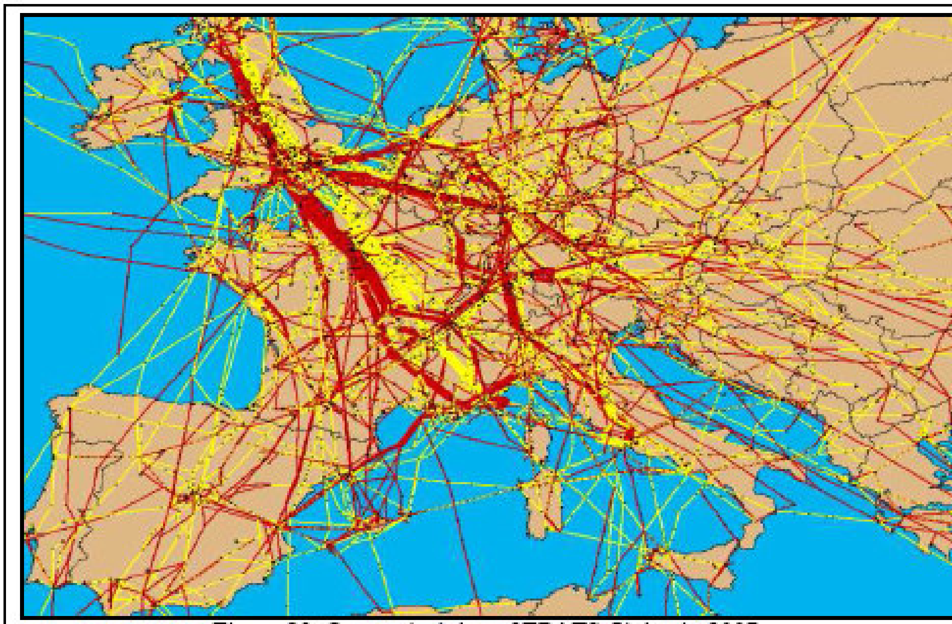


Figure 20. One typical day of EPATS flights in 2007.

With respect to the total EPATS traffic, early investigation showed that the geographical distribution of the envisioned EPATS flights (VFR and IFR) is different from those of the rest of the airspace users. COSAAC simulation for EPATS 2020 scenario showed that EPATS traffic would be highly distributed over Europe and thus would not be impacting the traditional

flights and the most congested airports and waypoints as forecasted by EUROCONTROL for 2020. Nevertheless, some EPATS high density area may result especially in south of Europe. EPATS would be influencing the rest of the airspace users in Italy; Greece; Portugal; Spain; the Southern regions of France, England; the South-Eastern areas of Poland and the North-Western locations of Germany. With respect to the impact of EPATS on the most preferred airports of the traditional flights, Athens, Rome, Madrid Barcelona, Warsaw, London are found to be the most influenced, while the most congested locations such as Frankfurt, Amsterdam or Paris are indicated to be less concerned.

Considering the EPATS aircraft characteristics, both EPATS IFR and VFR traffic might generate further traffic complexities. EPATS aircraft performances/characteristics are different from the traditional airline flights in terms of horizontal and vertical speeds and wake vortex and therefore traffic integration, separation management and conflict avoidance could become more complex. Also, single pilot concept could lead to other issues in terms of ATM integration and management.

Last but not least the EPATS business model tend to favor the flight on request concept which could be problematic with the notion of SESAR Strategic Business Trajectory.

These early findings suggested that future decisions and R&D would be required in terms of:

- SESAR Airspace design for IFR and VFR vs managed and un-managed airspace (vertical (FL) and geographical design – dynamic and morphing)
- SESAR Business Trajectory management for EPATS flight (IFR and VFR?) and EPATS FL allocation (including flight planning and trajectory negotiation and SWIM issues)
- SESAR and VFR flights
- 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 (AMAN, DMAN, SIDs, STARs, CDA concept, Aircraft performances)
- En-Route operation mixing EPATS and traditional flights (Aircraft performances, managed airspace, Routing, separation management)
- EPATS scenarios for traffic assessment: Safety, flight efficiency, cost, effective capacity, complexity, delay

Impact of EPATS on airports, safety and environment

The EPATS 1 project study showed that Europe has a lot of regional airports that could be used for personal air transport. An emerging new personal air transport system could smoothly start to utilize this existing airport infrastructure. Local economy is supposed to invest and benefit from the personal air transport. It will make the personal air transport system possible and no large investments seem to be needed with respect to airports.
The evolution of the personal air transport system, however, should be watched carefully on the aspect of safety and environment. Constraints and friction points will show up and the expected impact on safety and the environment has to be indicated.
The emerging personal air transport system will deserve its topics for the ACARE Research and Development agenda (SRA-3) as they will recommended.

The safety of personal air transport is a matter of safety regulations and training. The EPATS 2 project will monitor the international development of special regulations (EASA) for personal air transport. EPATS 2 will co-ordinate between EPATS Stakeholders and Safety Bodies to promote the interests of personal air transport, to favor safe and economic

transport and to cross feed the knowledge of the newest technologies for safe, clean and punctual personal flight.

It is expected that personal air transport will see the introduction of single pilot operations. It will change the cockpit, the procedures, the certification and licensing. EPATS 2 will co-ordinate for maximum transfer of Research and Development into the personal air transport system. The training for personal transport has to supply a new class of pilots that fly safely and accurately using the newest technologies in all weather conditions. On top of the training, Safety Management and Flight Operations Quality Assurance is needed. EPATS 2 intends to bring all these aspects together and to advise on priorities and further R&D.

Some local airports will evolve into busier aerodromes. An example is an air taxi operator having its home base on such an airport with dozens of air taxi's and maintenance facilities concentrated on the field. Local resistance against the personal air transport system development needs solid arguments to see the emerging new class of silent and clean transport means. EPATS 2 will expose the interest of personal air transport to engine manufacturers working on clean and silent engines. Another topic is the development of silent approach and take off procedures, respecting the interests of communities living close to regional airports.

Impact of EPATS on mission specifications for aircraft

EPATS 1 project analysed both technical and economic parameters of 120 existing airplanes of normal and commuter categories (according to CS-23 regulations) and 3 types of propulsion (pistons, turbo-props and jets).

Analyses were performed in order to evaluate aircraft suitability to fulfil the new personal air transport system tasks – especially connecting small low accessible towns and peripheral regions. Analyses shown that airplane's size and propulsion system should be fitted to expected transportation tasks (range, speed, altitude, etc.). Future airplane specifications and performances were defined. EPATS will take into account expected result of CESAR and requirements of SESAR programs and the progress of CESAR, CREATE and SAFAR will be utilized.

On basis of current calculations it can be shown differences between present (reference) and the future constructions:

1. Single piston-prop (4 seat), R=1000 km
   - Speed: as high as current
   - DOC: -18%
   - SFC: -20%
2. Twin turbo-prop (normal: 8pax), R=2000 km
   - Speed: -17 % , short distance ; as fast as VLJ Eclipse
   - DOC -32 % ; compared to single-engine, slow turbo-prop
   - SFC: -28 % ; compared to single-engine, slow turbo-prop
3. Twin turbo-prop (commuter: 19 pax), R=1000 km
   - Speed: +10 (+17) % , short (long) distance
   - DOC: -15 %
   - SFC: -16 %
4. Twin jet (normal), R=2000 km
   - Speed: as high as current
   - DOC: -23 (-24) % , short (long) distance
   - SCF: -21 %

All above- mentioned airplanes should have SESAR compatible avionics.

EPATS 2 Proposal

A proposal for a follow on project, called EPATS 2 has been made to the European Commission.

The personal air transport system that EPATS 2 is investigating will benefit by coordinating several European initiatives. First there will be the coordination with SESAR. EPATS 1 concluded that 40 million flights per year by IFR equipped aircraft could be possible if the personal air transport system in Europe would be established. It is clear that close coordination with SESAR is called for. Even if some of these flights will be performed in uncontrolled airspace, close coordination with SESAR is needed in view of the proposal to enlarge the TMA's of major airports.

There is a VIP group in Eurocontrol that is looking at the small aircraft movements but this is mainly concerned with the traditional limited number of corporate and business flights, not with air taxi operations. EPATS 2 will coordinate with several start up air taxi companies to see where their requirements are.

A good communication and coordination with Eurocontrol next to SESAR is also needed. Eurocontrol is already looking into some aspects of EPATS traffic. Projects like AVAL (Acas on VLJ and LJ- assessment of safety level) are very important to the future of EPATS.

The safety of personal air transport is a matter of safety regulations and training. The EPATS 2 project will monitor the international development of special regulations (EASA) for personal air transport. EPATS 2 will co-ordinate between EPATS Stakeholders and Safety Bodies to promote the interests of personal air transport, to favor safe and economic transport and to cross feed the knowledge of the newest technologies for safe, clean and punctual personal flight.

It is expected that personal air transport will see the introduction of single pilot operations. It will change the cockpit, the procedures, the certification and licensing. EPATS 2 will co-ordinate for maximum transfer of Research and Development into the personal air transport system. The training for personal transport has to supply a new class of pilots that fly safely and accurately using the newest technologies in all weather conditions. On top of the training, Safety Management and Flight Operations Quality Assurance is needed. EPATS 2 intends to bring all these aspects together and to advise on priorities and further R&D.

Some local airports will evolve into busier aerodromes. An example is an air taxi operator having its home base on such an airport with dozens of air taxi's and maintenance facilities concentrated on the field. Local reservations against the grow of personal air transport needs solid arguments, based on the emerging new class of silent and clean transport means.

EPATS 2 will promote the interest of personal air transport at engine manufacturers working on clean and silent engines. Another topic is the development of silent approach and take off procedures, respecting the interests of communities living close to regional airports.

EPATS will organize a large number of workshops to bring together the relevant stakeholders.
Networking with EU projects will ensure that EPATS 2 can benefit from work already done in the Framework program. If new proposals will be selected in the second call that have a relationship with EPATS, the project team will establish contacts to these projects as well.

EPATS2 should be seen as a true European study, not a study that will benefit a single specific company. Therefore networking and coordination is extremely important and rewarding for all concerned.

EPATS2 will also benefit from contacts to the manufacturers of larger aircraft to understand the benefits of new technologies for these aircraft and the opportunities to scale down the relevant technologies for EPATS aircraft.

The same holds for production methods. EPATS 2 will keep contact to Clean Sky to understand the issues related to environmentally friendly air traffic. One of the issues is the platform on ECO DESIGN.
But all Clean Sky platforms are of relevance to EPATS, including the rotorcraft platform as some EPATS aircraft will be rotorcraft or hybrid flying machines.

In general EPATS 2 will benefit from networking on the following issues:

- European and US studies on small aircraft operations
- European activities to estimate traffic flows
- European and US activities to master advanced technologies
- European certification and safety standards
- European airport classification
- New ideas on EPATS that may evolve over time.

The First issue of EPATS 2 will address is the organization of a number of coordinating workshops to enable a European approach to EPATS .

The workshops will cover a number of issues:

- The classification of EPATS type of aircraft.
  Currently there is no clear definition of EPATS aircraft. Many classifications are used based on parameters such as F(J)AR classification, the actual use of the airplanes, currently available airplanes etc.
  In the Commission staff papers dated February 1st 2007 and the COM(2007) 869 Final by DG TREN dated 11 January 2008, it is acknowledged that no uniform classification exists.
  A workshop will be organized in close cooperation with DG RTD, DG TREN, EASA, ASD, ICAO, aircraft operators, NASA and FAA. The workshop should not only cover the traditional business aviation (where the passenger hires an aircraft or company plane for flights without the presence of other unknown passengers) but focus on the emerging EPATS system (by means of air taxi operations like a regular taxi, including the sharing of trips with other, non related passengers). The outcome of the workshop will be a proposal for classification and a roadmap for quick introduction of a uniform European classification.
- There is a lack of suitable databases on personal air transport in Europe. This not only relates to a central European register of GA aircraft but also to safety statistics at a European level. The workshop will bring together all relevant parties including ECAC working groups, EASA and National State representatives, ACARE, Eurocontrol, DG RTD and DG TREN. The outcome of the workshop will be a recommendation how to organize central European databases for both issues.
- There is a lack of a central database on European Airports. Several studies have been performed including the EPATS 1 study but an official European register of airports and aerodromes is lacking. This makes traffic forecasting and planning very difficult. Also the consequences of future actions in the frame of the Single European Sky and SESAR for the accessibility of these small airports are unknown. The workshop will involve DG RTD, DG TREN, ACI, SESAR, the SSC as well as other relevant organisations. The purpose of

the workshop is to agree on the need to set up a central European register of airports. Furthermore clear recommendations on the way forward and future execution will be looked for.

- The environment, safety and regulation. For EPATS, single pilot operations are essential to reduce the cost. Current air taxi operators in Europe have to use 2 pilots. New technologies are being developed that will enable safe single pilot operations in commercial GA. The issue is to identify the parameters that need to be changed in order to adapt new regulation for EPATS type of operations. The discussions will also address training, safety oversight, maintenance etc. Apart from the Commission and EASA, the operator organizations (like EBAA, ECOGAS, IAOPA etc), insurance companies and the manufacturing industry will be asked to attend. The outcome of the workshop should be recommendations to adapt training, technologies and operations in such a way that single pilot operations are feasible. The workshop outcome is an important parameter for WP 4 and 5.
- Next coordinating workshop will address the need to improve data on the European mobility. Despite statistical information by Eurostat, Eurocontrol and AIS as well as data from research organisations and EU Framework projects (like ESPON, DATALINE, TREMOVE, SCENES, EUNET, ASSESS) EPATS 1 was unable to create a complete overview of interregional traffic in the European Union. There is no compatibility of gathering, storing and formatting of traffic flows in the Member States. No authoritive data on wealth and personal income structure in respective regions exists. There is a lack of information on traffic flows and infrastructure especially in the New Member States. Therefore there is a need to start common initiatives at the level of the European Commission, Member States and regions to plan, coordinate and monitor research into mobility, accessibility and modelling and forecasting of future traffic flows. Special attention should be given to coordinate with ESPRON 2013, SESAR and EPATS. The workshop should result in a roadmap of actions and a recommended mechanism for exchange of information.

The second Issue of EPATS 2 will deal with the coordination of new business models that are emerging and that will enable EPATS in Europe.
Many discussions on European smaller aircraft operations (like in the EUROCONTROL VIP group) deal with the traditional model of business and corporate aviation. There much emphasis is placed on new schemes like Netjets.

However the air taxi business model is completely different. Up to now, the air taxi model has received little interest in Europe, as many believed that air taxi operations are for the US only.

EPATS 1 has demonstrated that the development of air taxi operations in Europe is quite feasible as there is a potential total EPATS requirement for at least 43 million movements per year by 2020.

In fact, recently a new Air Taxi Association (ATXA) has been launched. Its founders are Acceljet, Aircab, Air-Cannes, Bikkair, Blink, Byjets, ETIRC aviation (which ordered 120 Eclipse aircraft recently), Globe Air, Gonow, Jetbird, Jet ready, LEA, Taxijet and Wondair. At present the ATXA organisation is focussing on best practice exchange but it is quite feasible in future that these kind of joint organisations will contribute to a central ''European air taxi operations centre'' that will act as a broker to satisfy the needs of the European traveller in the optimum way. As this kind of air operations is new, the potential is little known yet.

A number of business models will be evaluated. Based on this analysis, a workshop will be organized to evaluate the different business models and make recommendations as an input for the SRA 3.

The third issue of EPATS 2 will address is the coordination with the ATM community (SESAR).
Already during EPATS 1 initial discussions were held with EUROCONTROL and SESAR on the possible consequences of the large scale introduction of EPATS.

The work package will start with capturing the results of EPATS 1.

The ability to integrate a large number of additional flight movements in the European airspace will be of paramount importance to the success of EPATS and SESAR. To accommodate large numbers of small aircraft both in the ''en route'' traffic management and in the arrival and departure management will become a hot issue in the coming years. As many of the small aircraft fly slower than the current generation of airliners, mixing traffic will become more difficult. Some ideas in SESAR like priority lanes for large airliner operations may curtail the development of EPATS. The current D-3 and D-4 deliverables of SESAR do not recognize the substantial fleet of small EPATS aircraft that may fill the European skies in the years to come. SESAR currently only recognizes the very limited number of business aircraft operations, which have an insignificant impact on total air operations.

EPATS 2 will analyse the ATM requirements to fully deploy the EPATS system in Europe. It will compare these requirements with the current SESAR requirements and proposals that will be laid down in the SESAR D1-6 deliverables.
Based on this assessment a document will be produced explaining the consequences of these requirements.
A workshop will be organized to create synergy between SESAR and the EPATS requirements.
The workshop will emphasize the need to create a flexible ATM system in Europe. The workshop will look into the future and focus also on the possible future avionics suit of EPATS aircraft (WP 4). These aircraft will be equipped with advanced ASAS devices to ensure self separation, with ''tunnel in the sky'' flight guidance etc.

It is envisaged that the workshop planned by EPATS 2 will be attended by representatives from Eurocontrol, SESAR, SSC, ICB, EASA, the European Commission, the European Parliament, the manufacturing industry and others. The air taxi sector will also be invited. This workshop will be an essential input for Work package 4.

The fourth issue of EPATS 2 will recommendations for EPATS aircraft technologies.

In the past NASA has been very active in researching new technologies for EPATS type of airplanes. This research has given the US industry a lead in the development of small efficient aircraft. In view of the market potential, Europe should be more pro-active in thinking about future EPATS aircraft and their operations. Only in this way we can assure that the European industry will benefit in the long run from the market opportunities that EPATS will offer.

This work package will start with an overview of the fleet composition and the business models identified in the previous work package.
Next the current technological situation and ongoing technology studies will be analyzed. Next the study will identify new technology requirements needed to develop a new generation of EPATS aircraft. The study will also identify which technologies can be scaled down from the technologies developed for large aircraft.
The EPATS 1 study already concluded that traditional technologies will not enable to exploit the full potential of EPATS aircraft. The costs of these aircraft are high and large production series are needed to enable an acceptable price tag. Innovative solutions are needed.



In EPATS 1 an initial analysis was made on improving current piston-, diesel- and small turboprop and turbo fan engines. Without breakthrough technologies the improvements in propulsion will only be marginal. And improvements are needed to lower the DOC and the environmental effects (noise and emissions) of future EPATS aircraft. The Customer Choice Index developed in EPATS 1 will provide guidance in developing future configurations.

EPATS already addressed the following technology issues:

- Requirements for cost effective and environmentally friendly EPATS aircraft
- Novel future configurations for different classes of personal aircraft, including advanced STOL and VTOL aircraft. A close cooperation with the CESAR project and projects that may come out of the second call in FP 7 on novel personal aircraft will be established.
- Advanced production methods, structures and advanced materials for small aircraft (note that small aircraft production is not just following the big aircraft: The FSW technologies and the assembly line concept used for the Eclipse are ahead of traditional large airliner production methods. The Beech Starship was the first all composite aircraft. Rutan has perfected the composite aircraft technologies ahead of the B-787 and A-350)
- Advanced propulsion systems for small aircraft. The current generation of small aircraft rely on diesel engines and small turbofans developed for UAV's. Novel propulsion systems are needed that will be more fuel efficient, use different fuels and may also use fuel cells and solar cells to generate power. Advanced propulsion systems using electrical power may be feasible. Noise and emissions will be a critical factor for the success of large scale deployment of small aircraft.
- Advanced flight control, ride qualities (needed especially for flying comfortably at lower altitudes) and all weather flight guidance will be needed to make small aircraft operations safe and allow single pilot operations. EPATS 2 will be strongly connected to the SAFAR project funded by the European Commission. The new flight guidance and control equipment will not only have to be reliable and human operator centered but also be low cost, light weight and low volume as well have a low power uptake. At present the avionics cost of small airplanes is about 10% of the total procurement cost.

Projections show that these cost may rise to 50% using state of the art technologies. This shows that a fundamental change in design is needed to satisfy future needs.

- Reduction of environmental impact based both on the noise and emission source. The source and the operational procedures need to be addressed. Security considerations to avoid the misuse of the aircraft for terrorist actions need to be discussed as well. Safety will be one of the most critical factors for the deployment of EPATS.
- The consequences for ground equipment to make optimal use of EPATS aircraft also need attention. Although the novel airplanes will no longer need extensive NAV-AIDS at airports and rely on satellite based CNS, the minimal requirements for airports need to be established.

This EPATS work will be linked closely to the CESAR, SAFAR, SOFIA, CREATE, HAPATS projects funded by the Commission.
The required technologies will be identified and a listing of suggested topics will be provided to the European Commission for consideration for the next calls for proposals in FP 7 and SRA3.

EPATS 2 will enable the coordination of EPATS and the aircraft manufacturing community.
A workshop will be organized to validate of EPATS approach by Aircraft Manufacturers Community. The result of the workshop will be a strategic technology requirements roadmap that can be used by the European Commission and ACARE to develop the next SRA. The report can also be used by the Commission in the discussions on international RTD cooperation with the US, Russia and other countries.

In order to stimulate creative solutions in the industry and research community, the EPATS team would like to organize a European EPATS contest. The EPATS team will investigate how such a contest could best be held. The result of that contest should provide additional technology topics for Europe in addition to the topics that will be identified by the EPATS team itself.

EPATS 2 Proposal Objectives:

6 Coordinating Workshops. The EPATS 2 CSA identifies a number of actions that the European Commission should support. Some of the actions will require coordinating activities with other bodies like ACARE, ECAC, EASA, ASD, Eurocontrol, EUROSTAT, DG TREN etc.; as well as Communities of Users, ATM, Manufactures, Regulators, Researches.

Synergy and creation Personal Transport System Community. Close cooperation with the running SESAR project should stimulate that the ATM community will not forget small aircraft in the European Sky; the cooperation with the CESAR project funded in FP6 and SAFAR and CREATE projects funded in the first call of FP7 is needed to give guidance and to benefit from already research on Personal Transport Systems.

Input to the FP-7. The EPATS 2 project will suggest to adjust the aeronautics work program of the 7th Framework Program in preparation of the third call for proposals. The work program should give more focus on the development of driving and future technologies, adjust business models, and preparation of contest for future EPATS type of airplanes.

Input to SRA-3. The EPATS 2 results will be an important input for the new Group of Personalities that will be initiated at the end of 2009 and deliver recommendations in 2010. Also EPATS 2 will be a valuable input for writing the new Strategic Research Agenda of ACARE which is planned to be published in 2012.