



THE PERSONAL PLANE PROJECT

## Overview of the European PPlane project

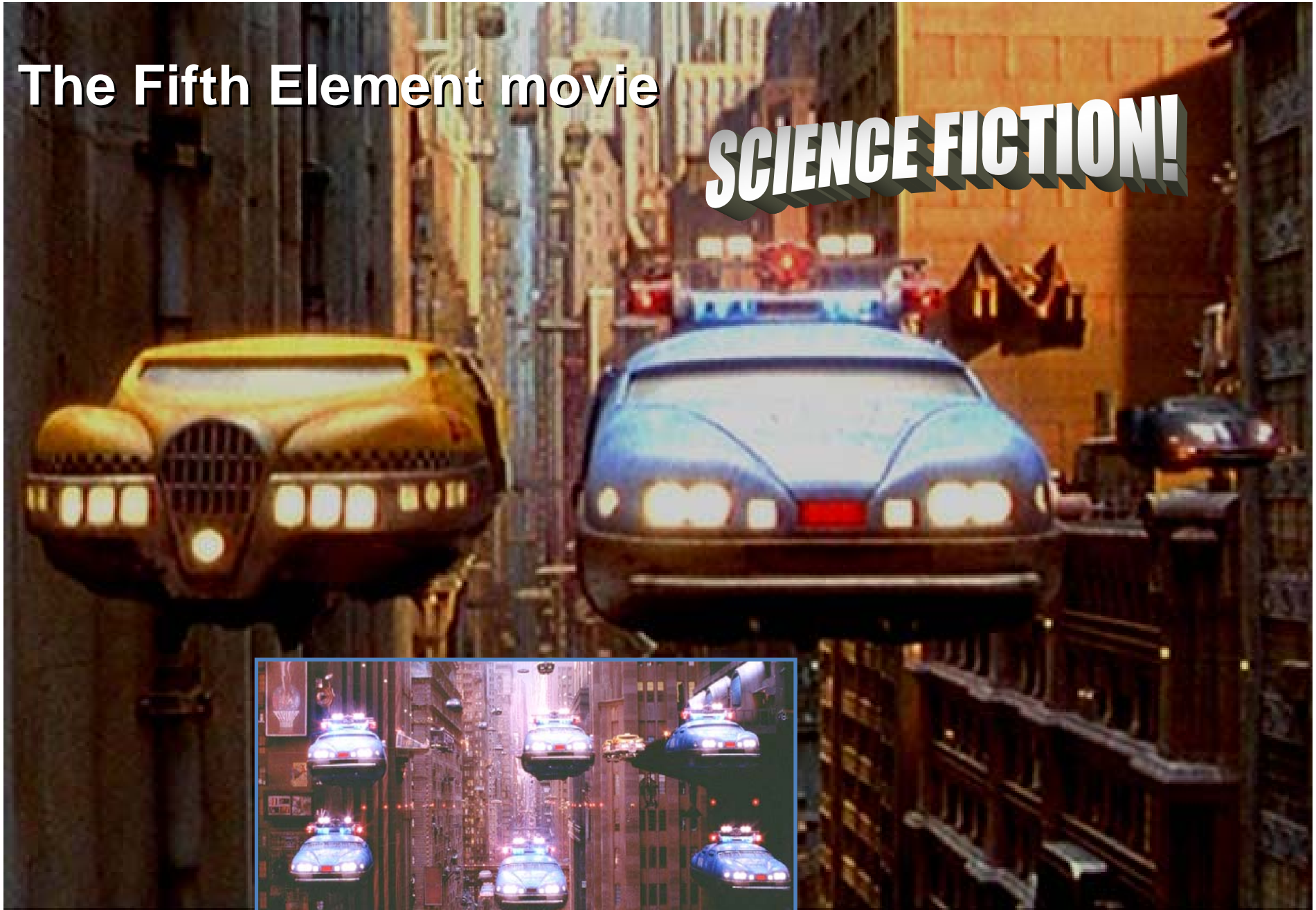
Claude Le Tallec  
Onera - France

Aviation Unleashed - Reaching Beyond Tomorrow  
October 18-20, 2010  
Hampton Roads Convention Center, Hampton, VA



# The Fifth Element movie

**SCIENCE FICTION!**



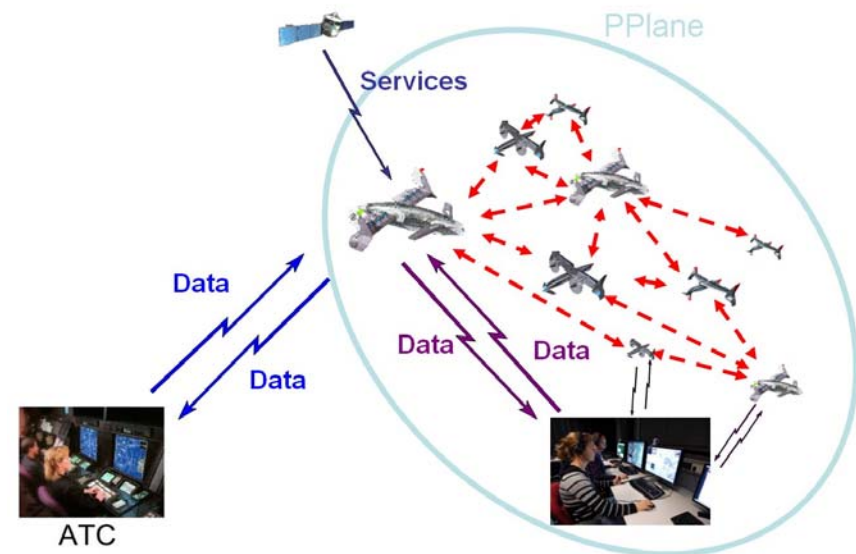
# European Commission “Out of the Box” exercise Project 5 - a personal air transport system (idea 12)

**SCIENCE FICTION?**



# OUTLINE

- European Research Framework
- PPlane Project information
- Methodology of the project
- PPlane systems
- Concepts of operation
- What type of ATM for PPlane?



# European Research Framework

- Knowledge lies at the heart of the European Union's Lisbon Strategy
- Numerous programmes, initiatives and support measures are carried out at EU level in support of knowledge.
- The **Seventh Framework Programme (FP7 2007 - 2013)** bundles all research-related EU initiatives together under a common roof playing a crucial role in reaching the goals of growth, competitiveness and employment
- FP7 budget: over €50 billion

*Additional information about FP7:*

*[http://cordis.europa.eu/fp7/understand\\_en.html](http://cordis.europa.eu/fp7/understand_en.html)*

# PPLANE (The Personal Plane Project)

## Acronym: PPlane

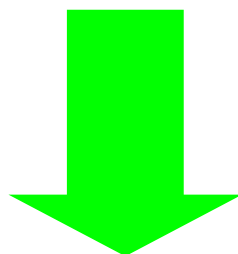
- 7th Framework Programme, second call
- Type of funding scheme:
  - **Collaborative Projects**
  - **Small or medium-scale focused research**
- Work programme topics addressed:
  - **AAT.2008.6.3.3. Personal air transport systems**
- Budget: 4.4 M€ (3.3 M€ from the European Commission)
- Duration: 30 months
- Start date: 1<sup>st</sup> of October, 2009

# Project specific objectives

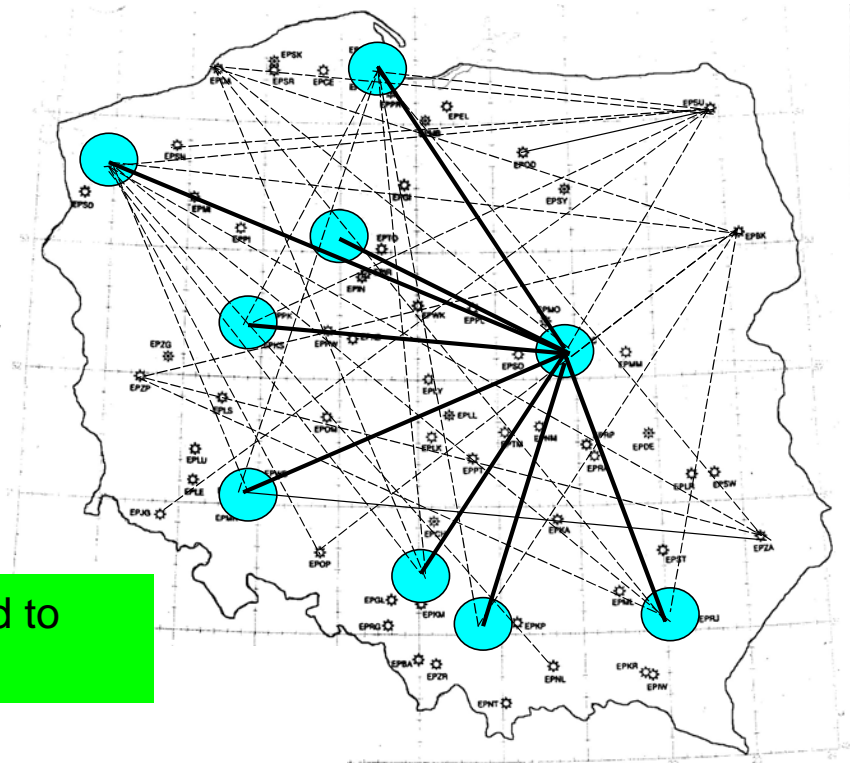
*Aims at developing system ideas to enable individual air transport*

- To avoid the ever increasing congestion on European roads
- To offer an alternative for the current transport system in new European Member States

Estimated foreseen demand of personal transport from the European Personal Air Transportation System (EPATS) Specific Support Action (6th Framework program)



**389,000 personal aircraft** needed to substitute long distance car travel





# Personal Plane ??

## Preliminary thoughts:

- Automatism developed to allow a “regular Joe” to use his own aircraft without any prior expertise
  - In various weather conditions
  - Easy command and control
  - “Push button” navigation including the integration into the airspace (other sky users, class of airspace, Special Use Airspace)
- Aircraft safe in a large flight envelope
- Aircraft is part of a “system” enabling the “pilot” to manage its flight
  - asks for a destination
  - monitors the flight until reaching that destination
  - gets help and information from the ground when, and if, needed



# Project Approach

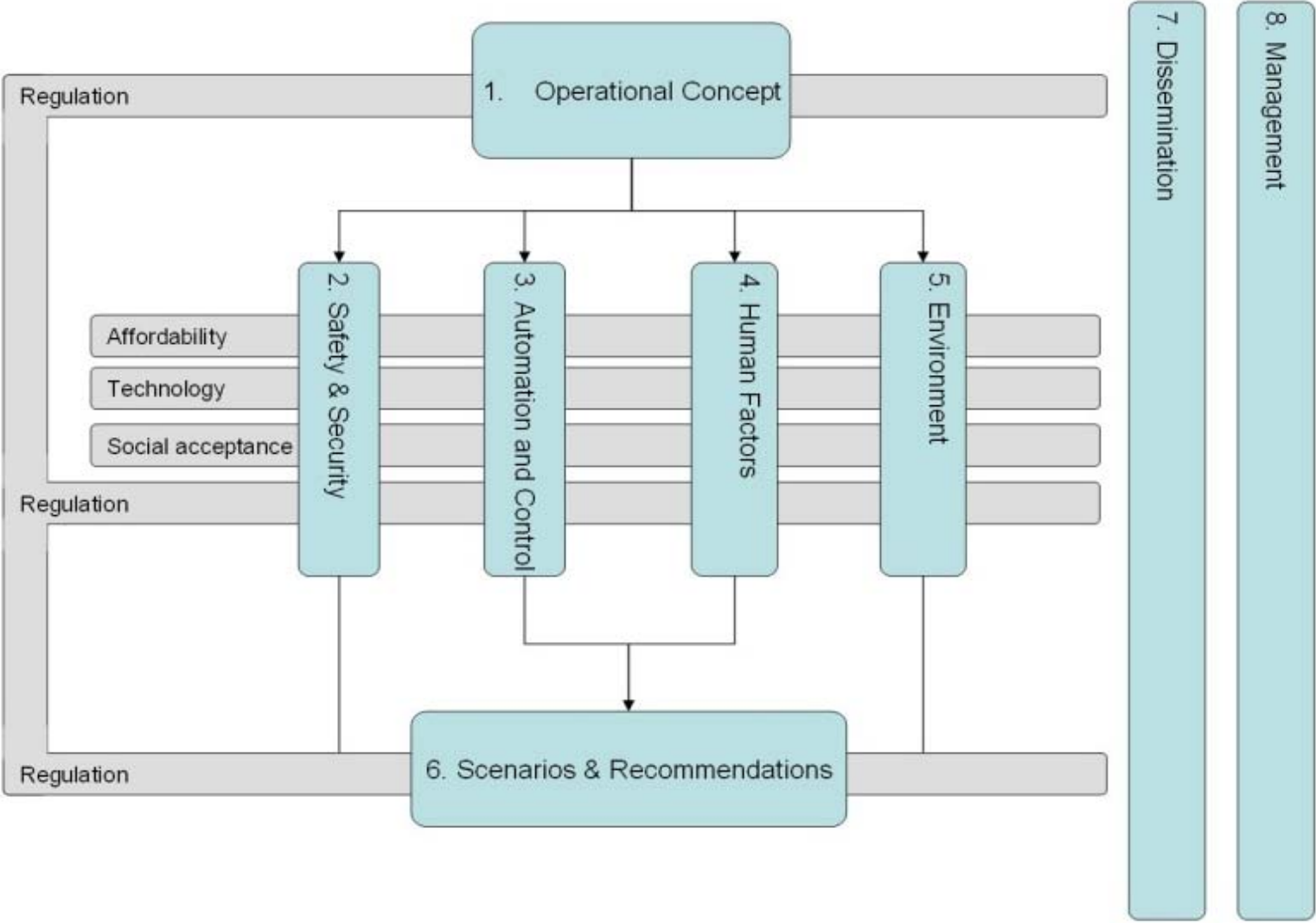
- Implements a systematic approach to propose radical and novel ideas for Personal Air Transport System (PATs):
  - Definition of several operational concepts for the personal air transport system of the future
  - Implementation of an optimisation model including several selection criteria to suggest and analyse these concepts:
    - “Security and safety” (Including Regulatory issues)
    - “Automation and Control”
    - “Environment” (Environmental impact, energy)
    - “Human Factors” (Role of the human in ATM – including pilots, HMI)
  - Consideration of horizontal areas such as technologies, **regulation** and affordability in each of the above criteria
- Resulting concepts are analysed and compared
- Recommendations for implementation across Europe will be provided



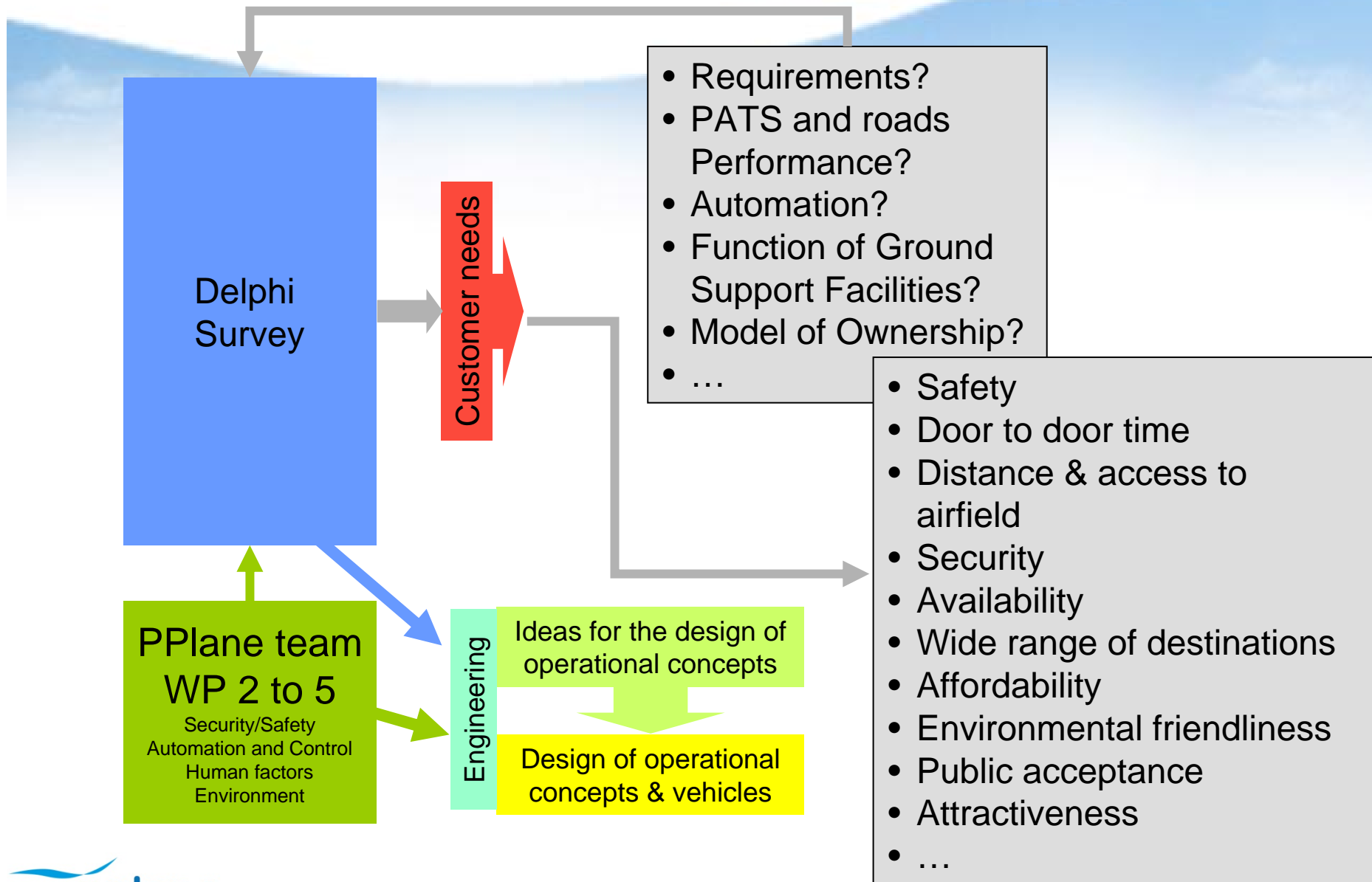
# PPlane Partners

1. French Aerospace Lab	ONERA	France
2. Israel Aerospace Industries	IAI	Israel
3. Airnet	AIR	Slovenia
4. Bologna University	UNIBO	Italy
5. Brno University	BUT	Czech Rep.
6. CIRA	CIRA	Italy
7. Intergam Communications Ltd.	ITG	Israel
8. Warsaw University of Technology	WUT	Poland
9. AT-One, German Aerospace Center	DLR	Germany
10. Instituto Nacional de Técnica Aeroespacial	INTA	Spain
11. AT-One, National Aerospace Laboratory	NLR	Netherlands
12. University of Patras	PAT	Greece
13. REA-TECH Engineering and Architect Ltd.	REA	Hungary

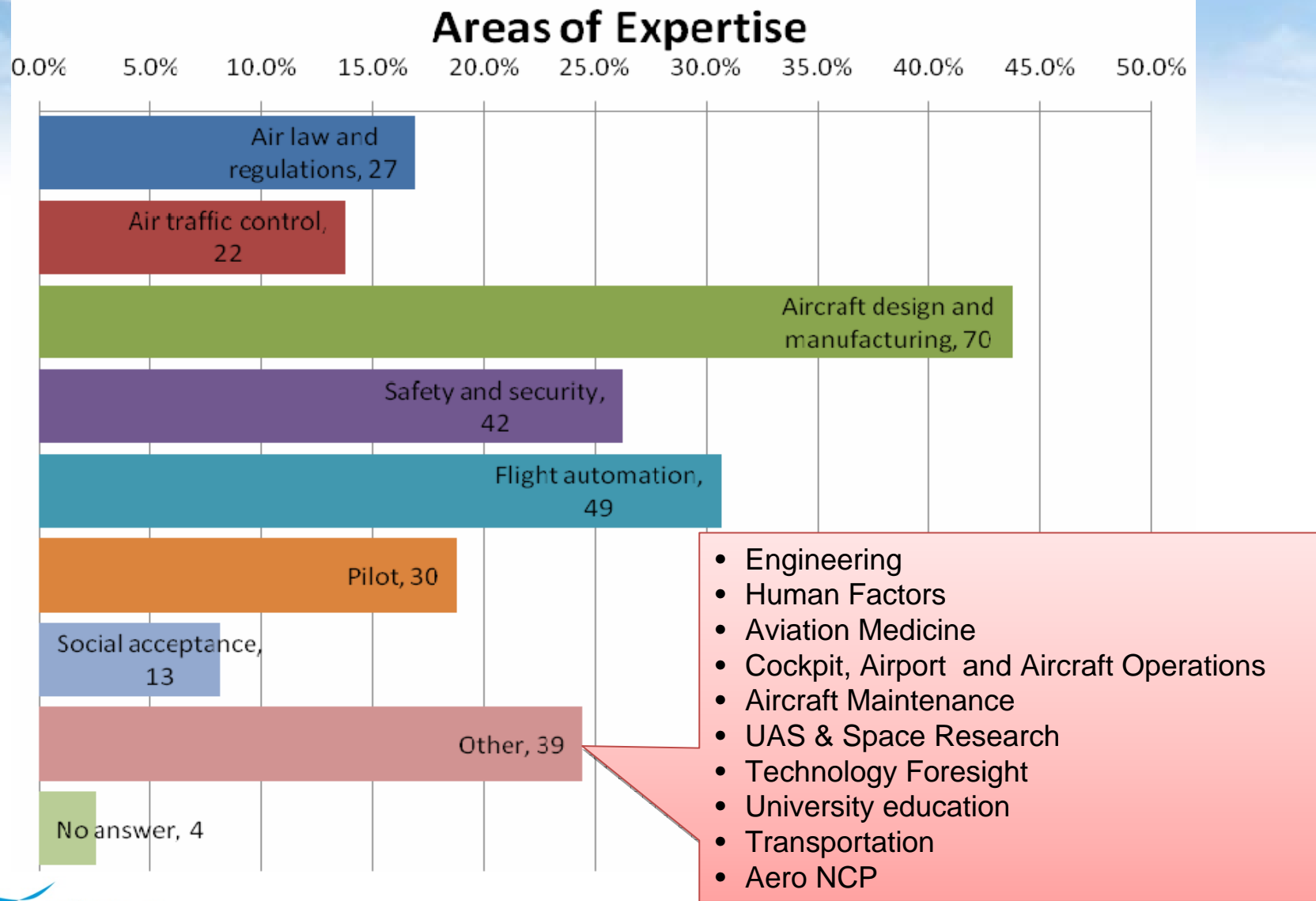
# Workflow



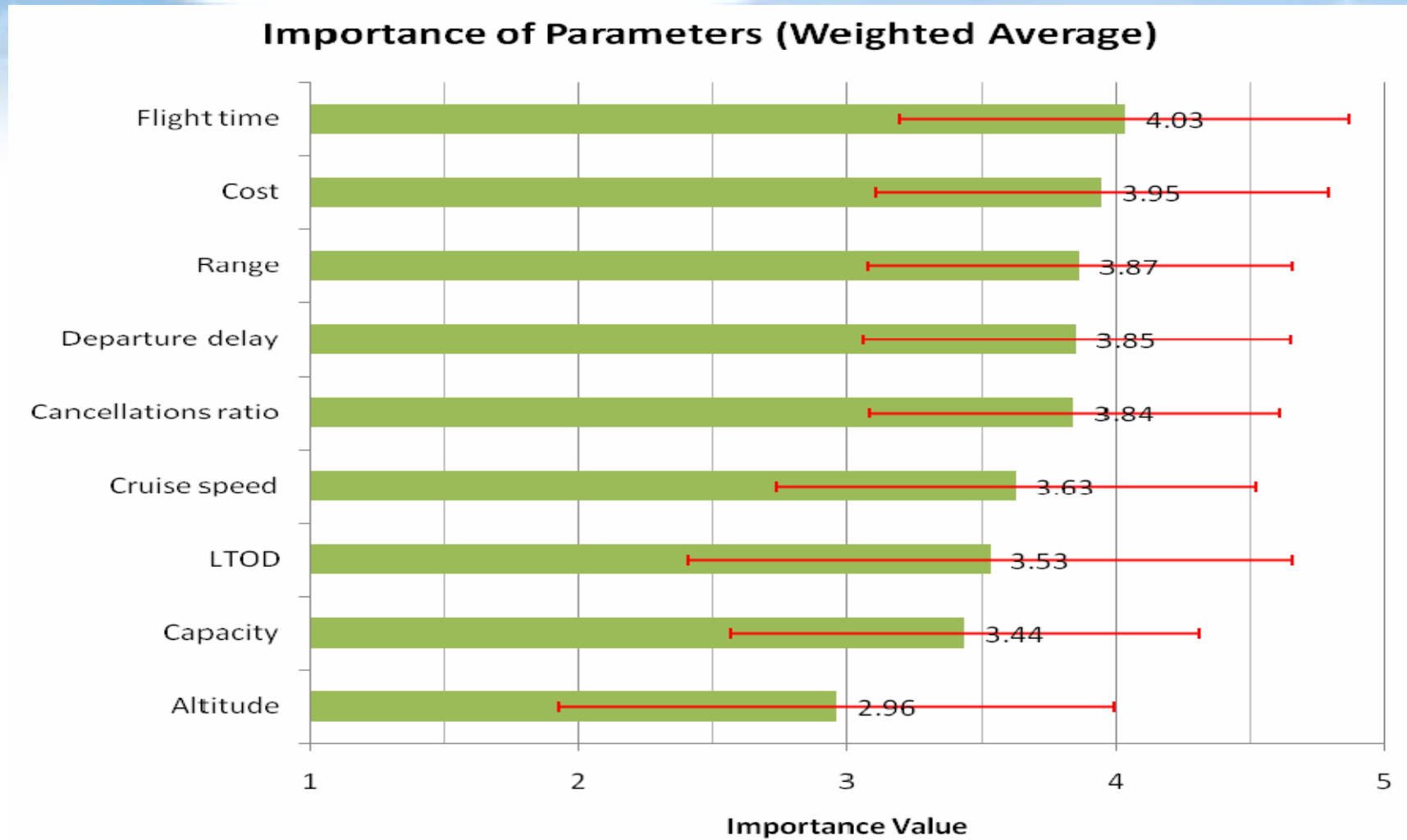
# Project methodology – Delphi survey



# Delphi survey: Experts' Areas of Expertise

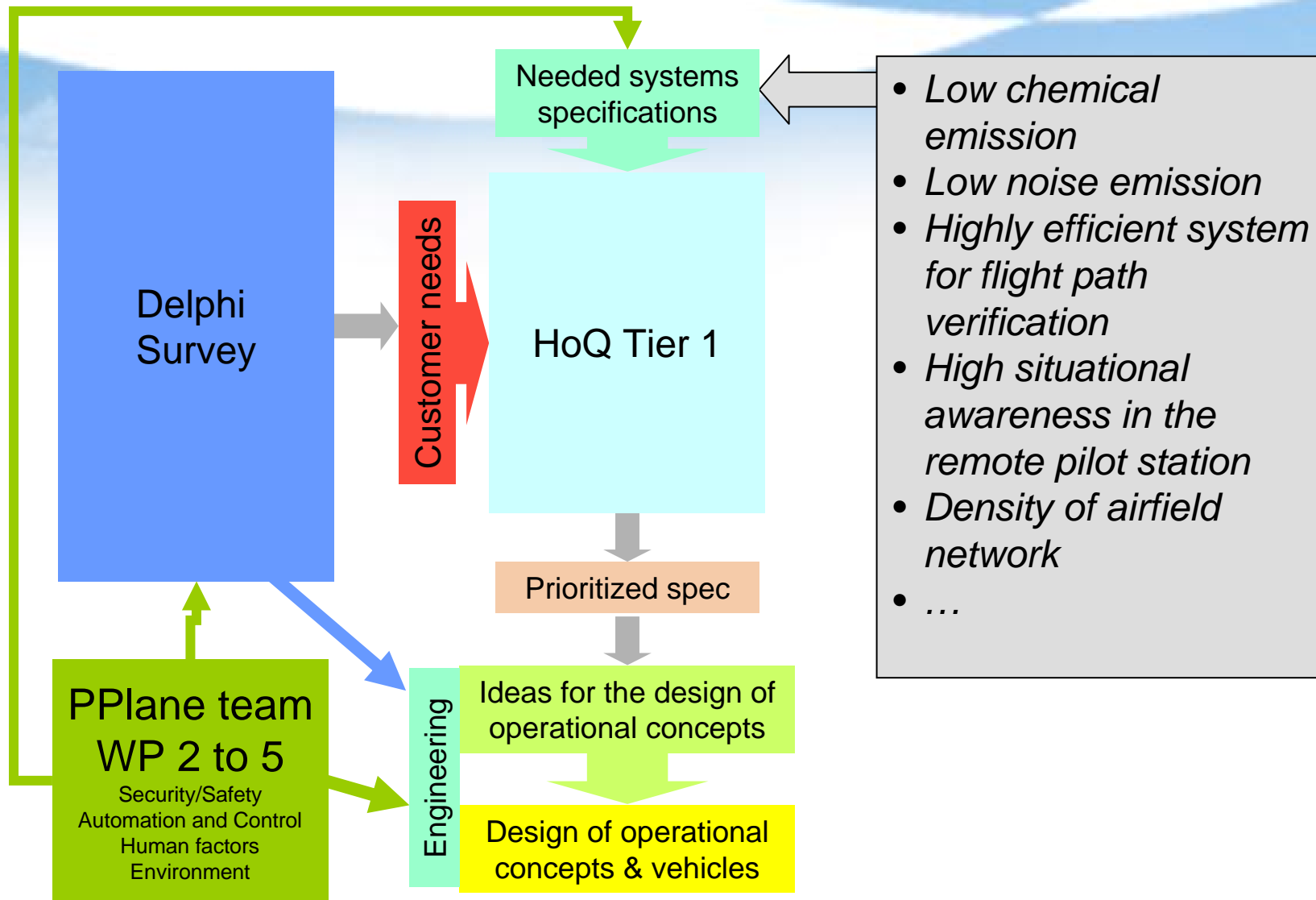


# Delphi output: Performance - importance



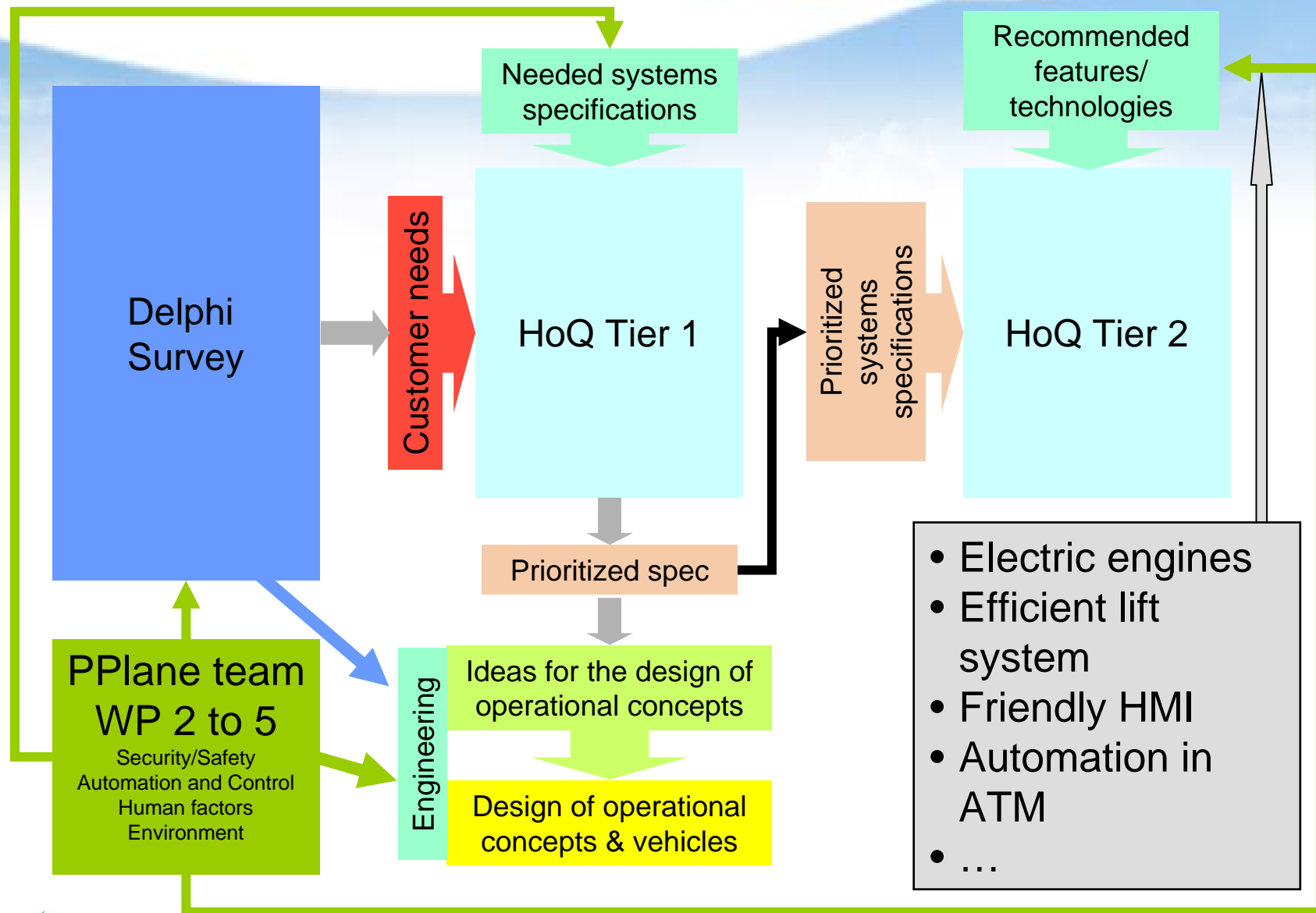


# Project methodology – House of Quality Tier 1





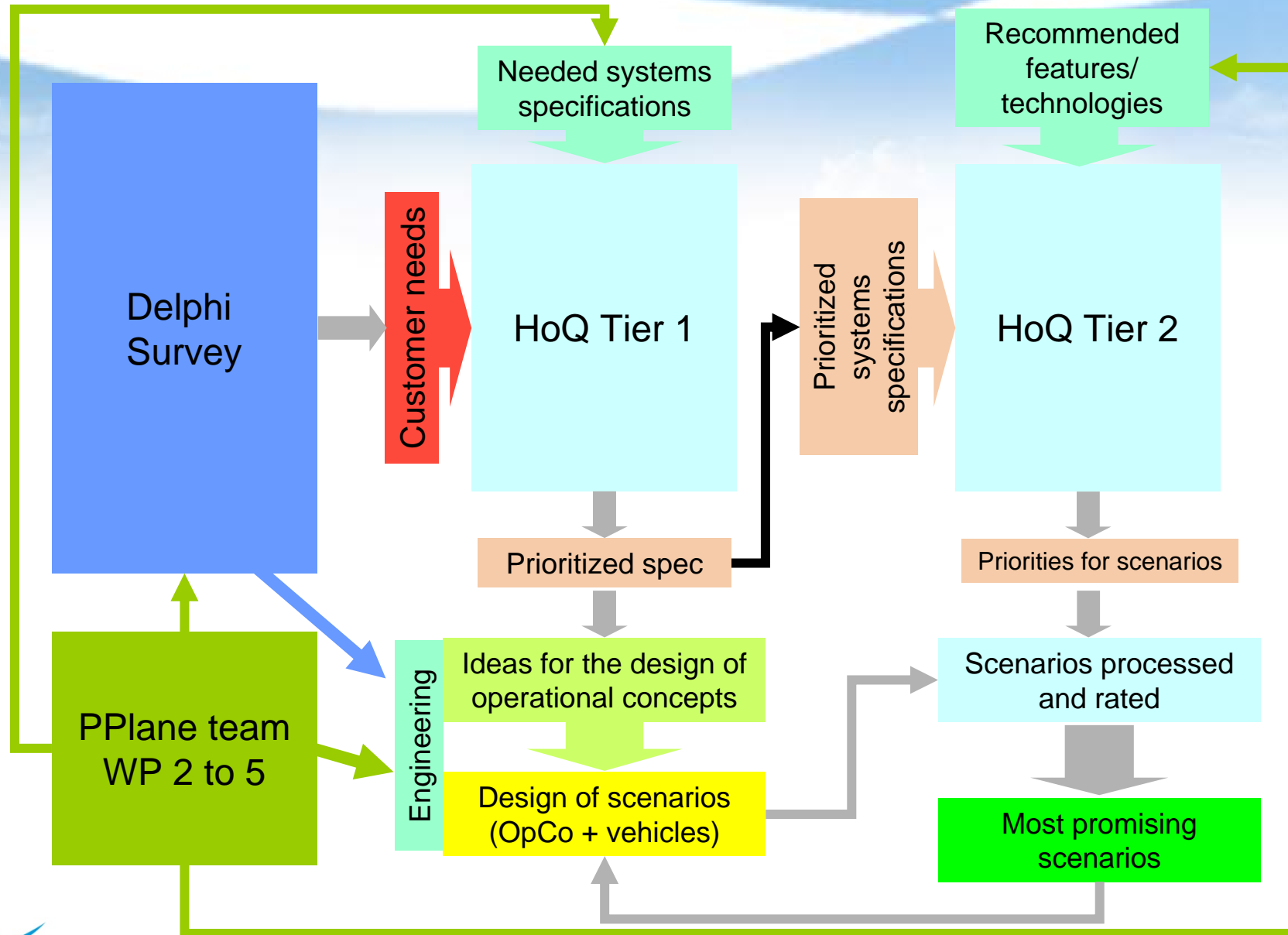
# Project methodology – House of Quality Tier 2







# Project methodology – Ranking scenarios

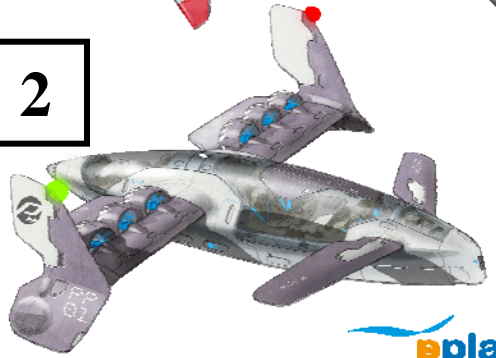


# Potential concepts of PPlane vehicles

1



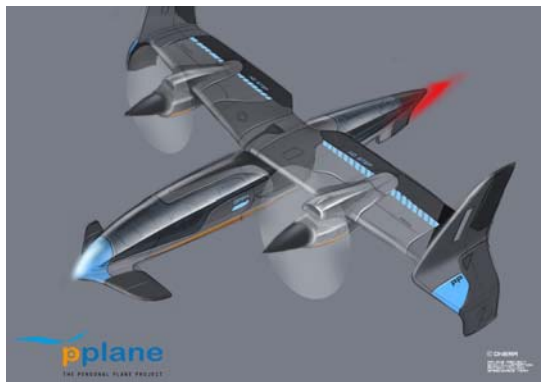
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4



3

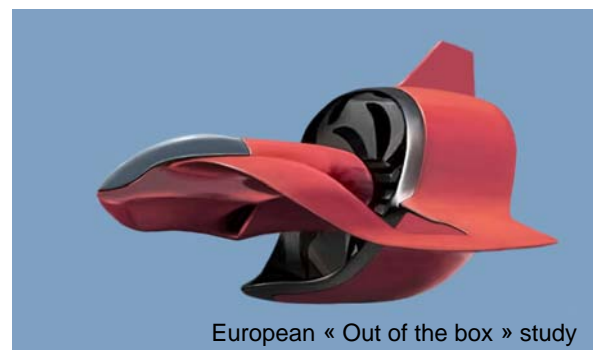


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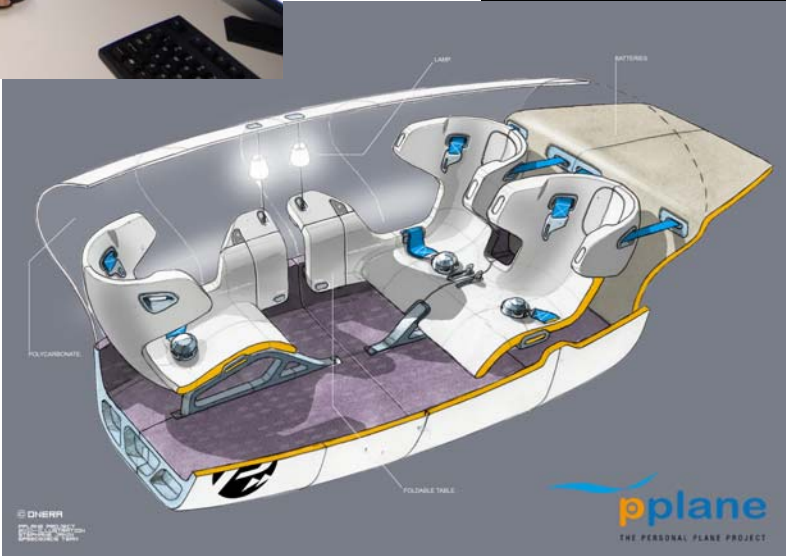


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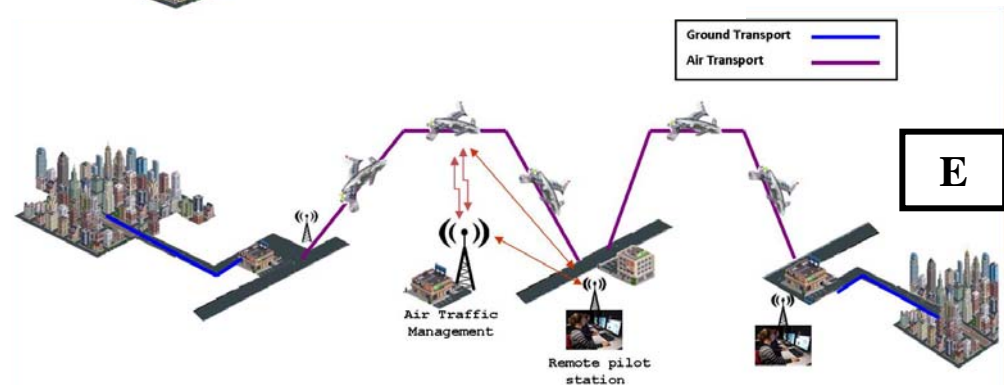
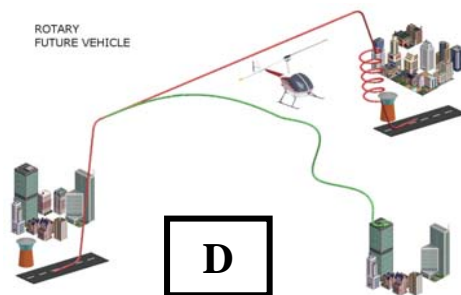
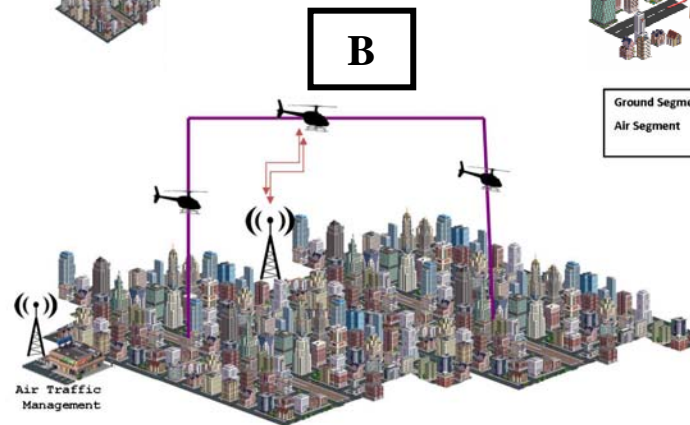
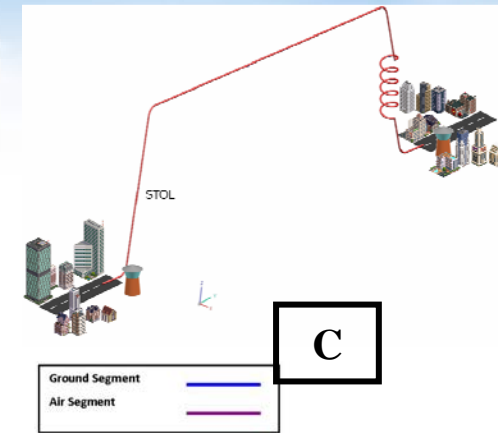
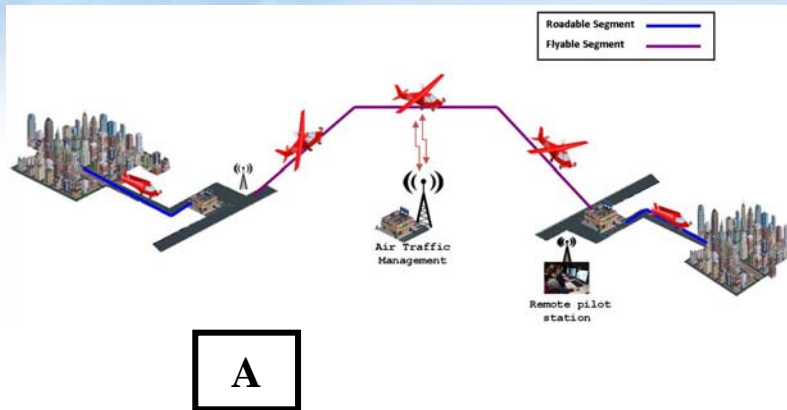


# PPlane ground segment

# PPlane air vehicle cabin/cockpit layout



# PPlane concepts of operation and scenarios



## What type of ATM for PPlane?

- Conventional voice messages between ATCo and pilot are not an option
- 4D trajectory based, preplanned, ATM is needed
- ATC monitoring of aircraft compliance to planned 4D trajectory remains a problem for safety and efficiency
  - Conflict management
  - Uncertainty in aircraft future positioning
  - Latency in aircraft reaction to ATC instructions



***Need for a 4D contract based ATM***

# What type of ATM for PPlane? The 4D trajectory concept



- Being at a given geographical position at a given time
- Already exists and has been widely studied
- Main drawbacks:
  - compliance of the actually flown 4D trajectory with the planned one has to be constantly monitored by the Air Traffic Control (ATC)
  - aircraft 4D trajectory may vary due to e.g. weather conditions
  - regardless if a pilot or a controller is in charge of trying to keep the aircraft on the planned 4D trajectory, this is a challenging task

# What type of ATM for PPlane? Any solution?



- Aircraft automation with a 4D FMS (Flight Management System) partly solves this problem
- Question that still remains is: who will be in charge of maintaining separation between aircraft?
- Predicting the real 4D trajectory from the ground is not an easy job

**The 4D contract concept** has been designed to solve the trajectory prediction problem

# What type of ATM for PPlane?

## The 4D contract concept



- The ground segment of the system is in charge of generating conflict-free 4D trajectories according to the demand and to the airspace and airport capacity
- Aircraft are assigned the resulting 4D contracts
  - The aircraft are in charge of monitoring their own compliance with their own contract
  - They have to stay inside their assigned 4D moving volume, or to ask for a new contract if they cannot
  - Doing so, the aircraft are guaranteed to fly conflict-free trajectories
  - There is no need to predict trajectories on the ground: trajectories will be executed as initially planned, unless a modification is required by the aircraft or by ATC to re-plan



# 4D Contract Guidance and Control project



## Acronym: 4DCo-GC

- 7th Framework Programme, third call
- Type of funding scheme:
  - Collaborative Projects
  - Small or medium-scale focused research
- Work programme topics addressed:
  - AAT.2010.6.2-2 Guidance and Control
- Budget: 5.5 M€ (3.9 M€ from the EC)
- Duration: 36 months
- Start date: 1<sup>st</sup> of November, 2010



# PPlane project expected outputs

## ***PATS operational concepts and scenarios for a safe and efficient operation of personal air vehicles***

- Identification of few fundamentally innovative challenges in air transport
- Processes and procedures for a safe and secure operation of a large number of small aircraft
  - Air vehicles
  - Non-pilot “pilot”
  - Ground segment / ATM
- Proposed ways toward the implementation of PATS

# PPlane project

*Thank you for your attention*  
*Any questions?*

