pplane

THE PERSONAL PLANE PROJECT

SEVENTH FRAMEWORK PROGRAMME

Newsletter #1 01 September, 2011

Overview

The "Personal Plane" project (PPlane) has developed system ideas to enable personal air transport in the long term (2030 and beyond) in Europe and elsewhere (see project website www.pplane-project.org). The preliminary assumption made in the PPlane project was that automation should be developed to allow a "regular Joe" to use a personal aircraft, in various weather conditions, without any command and control difficulties, using a human friendly navigation interface. A systematic and innovative approach has been developed and implemented within the PPlane project in order to understand and analyze customers' needs and to propose novel ideas for a Personal Air Transport System (PATS). This system would satisfy the end users' need, will be affordable, and will respect all environmental and social constraints. Several "Concepts of Operations" have been initially designed followed by an optimization model that applies a number of selection criteria, to define, analyze and prioritize these concepts. The PPlane consortium is coordinated by ONERA (France), administratively supported by Intergam Communications (Israel) and includes leading organizations from 11 European countries and associate states from different aviation domains in industry, research and academy.

The project covers the design of the global personal air transport system that includes air vehicle configurations, ground segment analysis and air transport management system that consists of Remote Pilot Station (RPS) connected with Air Traffic Control ATC (Figure 1).

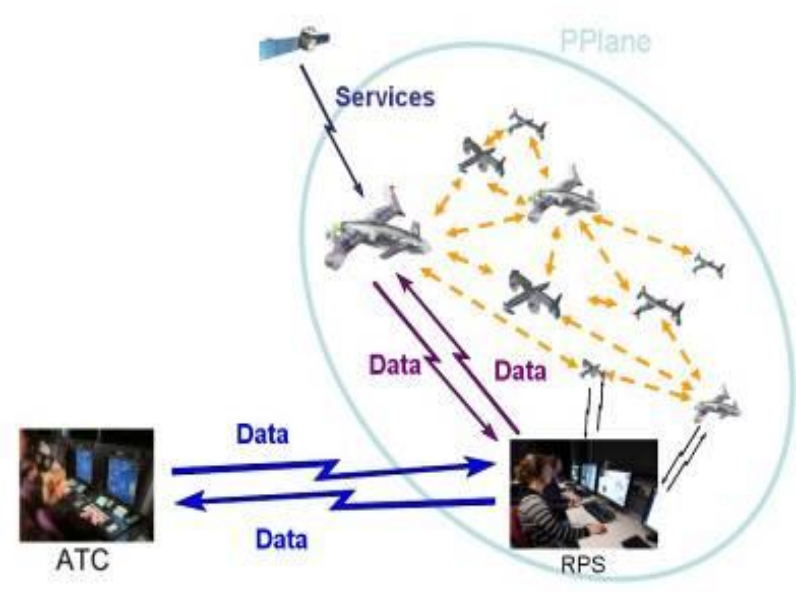

Figure 1: The Personal Plane system architecture concept

Partners

ONERA, France (Coordinator) www.onera.fr

Israel Aerospace Industries, Israel www.iai.co.il

Airnet d.o.o, Slovenia www.airnet.aero

Bologna University, Italy www.eng.unibo.it

Brno University, Czech Republic www.vutbr.cz

CIRA, Italy www.cira.it

Intergam communications Ltd, Israel www.intergamcommunications.com

Warsaw University Of Technology, Poland http://eng.pw.edu.pl

German Aerospace Center, Germany www.dlr.de/en

Instituto Nacional de Técnica Aeroespacial, Spain www.inta.es

National Aerospace Laboratory, Netherlands www.nlr.nl

University of Patras, Greece www.upatras.gr

REA-TECH Engineering and Architect Ltd.

Project Methodology

The project work-plan is based on an innovative and comprehensive methodology that combines two complementary methods: a "Delphi" survey among hundreds of experts and a design engineering tool named "House of Quality" (HoQ). The first phase includes a 2-stage Delphi Survey that was conducted among several hundred external experts in aeronautics and related fields such as regulation, air traffic control, aircraft design and manufacture, safety and security). The experts were asked to suggest and rank operational parameters, technical features and attributes of future PAT systems from the end-user perspective (in the year 2030 and beyond). Some results from the survey are listed in Figure 2.

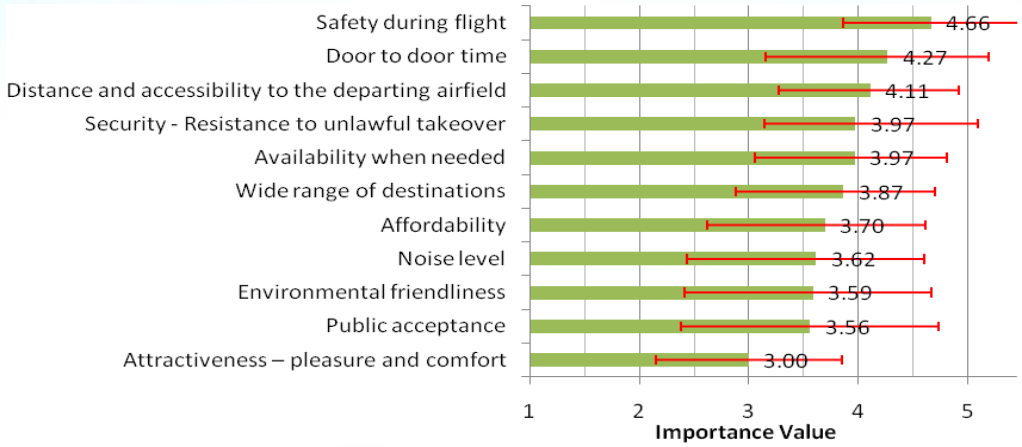

Figure 2: Delphi Survey's "Importance of PPlane attributes"

The survey resulted in a comprehensive set of "customer needs". Interestingly, responders attributed a higher importance to the operational parameters than to the technical features of the aircraft and its performance, which resulted in more freedom for the aircraft designers.

The "House of Quality" method (Tier 1 and Tier 2) was used for the 2nd and 3rd phases. PPlane system attributes were listed and ranked resulting in multiple "concepts of operations" and scenarios. Parameters that were listed and weighted included "Aircraft Characteristics", "Recovery Systems", "Mission", "Type of Runway", "Guidance", "Class of Airspace", "Visibility", "Wind" and many more. This methodology enabled to identify and classify the most promising system concepts and scenarios for further analysis (Figure 3).

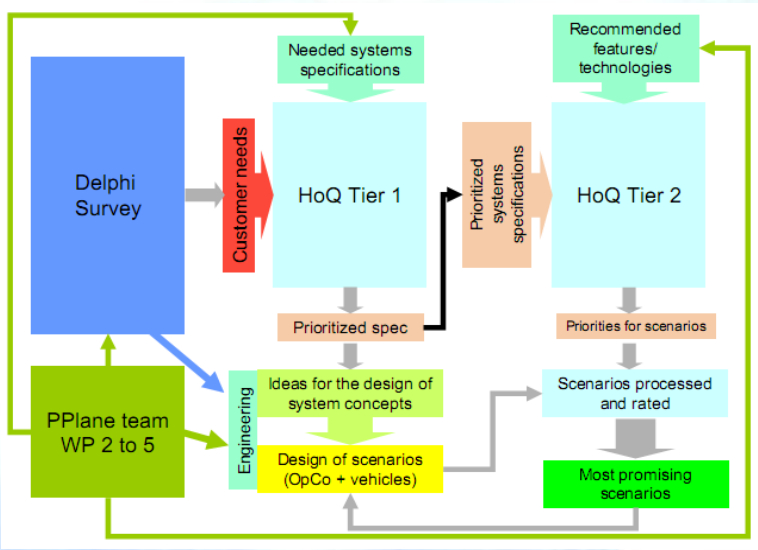

Figure 3: PPlane overall Methodology

Concepts of Operation

Results from the selection process were divided into two categories: roadable and non-roadable personal plane. Figure 4 shows the highest scoring scenario for non-roadable vehicles. In this scenario, PPlane will be used for the air segment only; a ground vehicle would be used for the terrestrial part of the trip. A 4 to 6 seat plane is considered and it could be equipped with 6 electric engines. The trip will include either multiple stopovers or a single leg depending on the distance to be covered and payload to be carried.

The PPlane project results suggest that an electric personal aircraft could become a viable alternative to the current fossil fuel based air transport system. In the future, onboard electricity generation or storage could be made possible for small scale aircraft through other disruptive technologies (e.g. low energy nuclear propulsion).

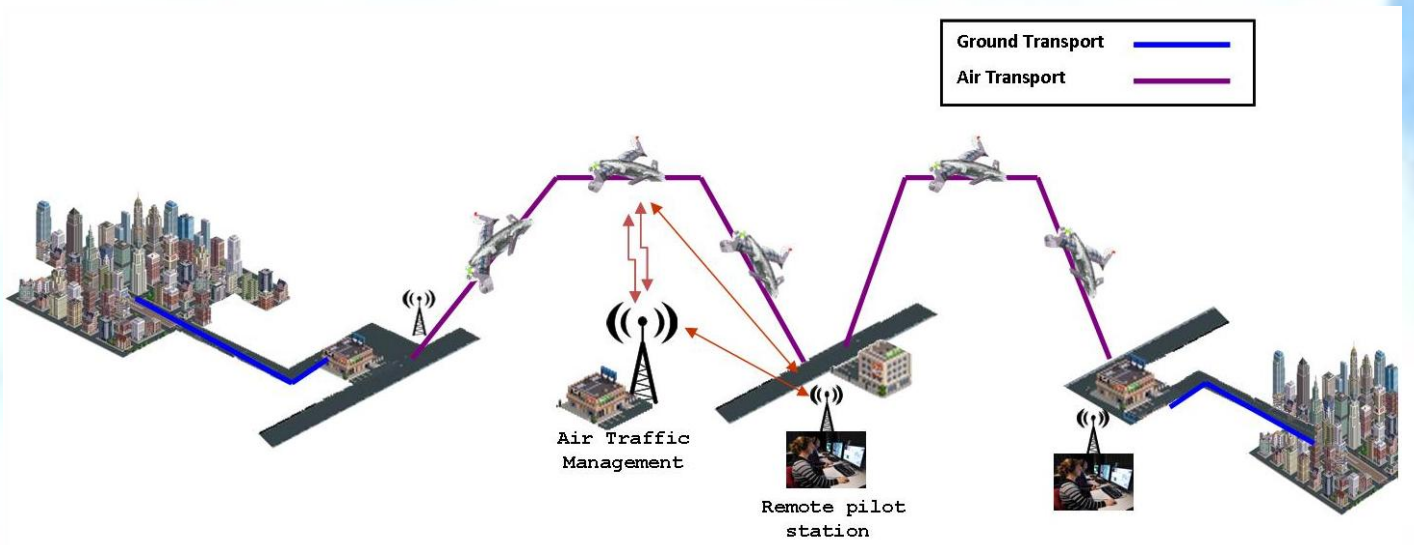

Figure 4: Non-roadable PPlane system

Figure 5 shows the PPlane network architecture. The PPlane vehicles would utilize high density 4D operations airspace, supported by a dense networked environment. This includes an air-to-air network (illustrated in yellow) ground-to-air set of links (illustrated in magenta) and ground to ground set of links (illustrated in blue).

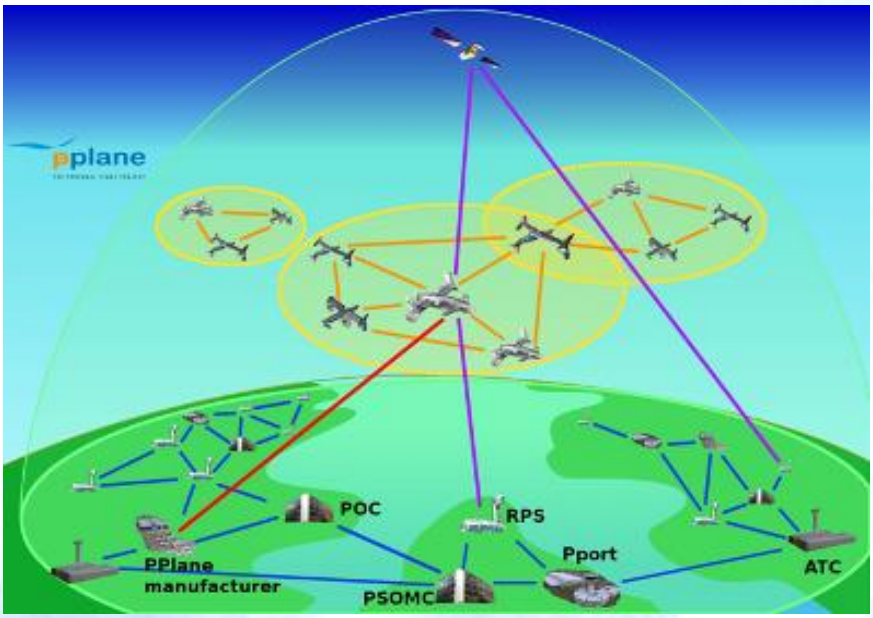

Figure 5: PPlane Network Architecture

Human Factors and Automation

Human Factors (HF) are important and integral parts of the PPlane work-plan. HF are sets of human-specific physical, mental and behavioural properties which can be taken under consideration in the design of human-user oriented equipment. The preliminary Concepts of Operations of PPlane are based on the operation of small automatic aircraft controlled from the ground and designed to carry passengers to their desired destinations. Although the pilot will not be on-board, a large number of human factors issues are associated with PPlane's revolutionary Concepts of Operation and need to be investigated and evaluated. The topics of affordability, technology, social acceptance and regulation with respect to the PPlane systems are discussed and analysed in details. The role of humans changes dramatically with an increasing level of automation. The requirements of the full automation option chosen for PPlane are analysed, together with their consequences on the command and control principles and resulting cockpit.

Safety & Environmentally Friendly

Social acceptance of a transport system depends mainly on actual and perceived safety of the system. Regarding actual safety, it is obvious that such a system needs to be designed according to standards carefully defined to guarantee the level of safety that will be requested by regulation authorities. This requested level of safety will not be lower than the one achieved today in commercial road and rail transportation systems. Higher automation shows promising potential to enhance safety in future transportation systems. Perceived safety is a more complex issue as it deals with human perception based on many types of information, mostly on potential accident rates. These rates need to be kept to a minimum at the early stages in order to build user's confidence in the PPlane system.

Another major requirement is "environmentally friendly" adhering to projected environmental requirements of 2030 and beyond. A new generation of less energetic air vehicles, fitted with more efficient, environmentally friendly and quiet engines is proposed. The engines of these concepts are fully electric or hybrid (electric with traditional engine), which will significantly minimize the chemical emissions and the noise at the airport surroundings as well as during the cruise phase of the flight. Advanced aerodynamic design is also envisioned, which would decrease the aerodynamic noise and the drag, and therefore reduce the fuel consumption and the chemical emissions.

Conclusions

The PPlane project is an important milestone in the long road towards a revolutionary personal air transport system. The analysis results and recommendations from PPlane will be useful to continue the European effort to pioneer the air transport of the future. The details of each of the elements of the recommended PPlane scenarios such as: the network architecture, the plane design, Remote Pilot Stations, safety features need further analysis to get a comprehensive idea of what could be a future personal air transport system. In the long run, the successful introduction of PATS will ensure the mobility of people and goods, fostering safe and secure commuting, while fighting to reduce the unwanted effects of environmental damage, social gap and economic "dysfunctions".

Figure 6: The PPlane team