Grant Agreement number: 265603

Project title: **Small Air Transport - Roadmap**

Instrument: Coordination and Support Action - Support Action (CSA-SA)

SEVENTH FRAMEWORK PROGRAMME

Deliverable reference number and title:

D3.4 European Organization Established

Organization name of lead contractor for this deliverable: **AD Cuenta B.V.**

Date of report preparation: December, 2012	Date of report issue: March 2013
Deliverable: **D3.4 European Organization Established**	Version/Status: **V1** (draft: a,b,c; final: 0,1,2,3)

Approval Status (date, signature)		
Author(s)	WP Manager	Project Coordinator
A de GRAAFF	A de GRAAFF	K. PIWEK

Project coordinator name: **Krzysztof PIWEK**	Start date of project: January 1, 2011
Project coordinator organization name: **INSTITUTE of AVIATION**	Duration: 27 month

Project funded by the European Commission within the Seventh Framework Programme (2007-2013)		
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)	

Document Change Log:

Version	Author /Organisation	Date of Release	Description of the release	Modifications (sections affected and relevant information)
0	A. de Graaff/ AD Cuenta	21 Dec 2012	maiden release	As is
1	A. de Graaff/ AD Cuenta	6 March 2013	Final release	

Document Distribution List:

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Table of Contents:

1 INTRODUCTION 4
2 ACTIONS BY SAT-RDMP CONSORTIUM 4
3 THE NETWORK PROPOSAL 5
4 THE INCENTIVE 5
5 SAT-IN-CS2 INITIATIVE 5
6 CLUSTERING 6
7 CONCLUSION 6
ANNEX 1 7
ANNEX 2 10
ANNEX 3 11
ANNEX 4 42

1 Introduction

The SAT-Rdmp project was also aimed at consolidating the stakeholders in small aircraft operations and production into a network that would support the development of European Small Aircraft Transport System and support the technology development and demonstration activities. It was envisaged that this could result in a separate group in ASD and possibly in an Industrial management group in ASD. A small workshop was planned at ASD.

During the execution of the SAT-Rdmp project a number of developments became clear:

1. A first significant trial to create synergy inside European General Aviation Community was launched at the Workshop "General Aviation and European Air Transport System Third Call FP7" in Warsaw, Institute of Aviation on 7-8 July 2009. The first idea of EGAC is shown in Annex 4. However the initiative received little support.
2. EGAMA (European General Aviation Manufacturers Association) is already closely linked to ASD. In the opinion of the stakeholders a new initiative would be confusing. Therefore a separate group under ASD was not supported.
3. The economic crisis in Europe had hit hard on the small operators of air taxi companies and start up's. Many air taxi operators were discontinued due to the economic crisis.

2 Actions by SAT-Rdmp Consortium

The SAT-Rdmp project held 2 workshop to which a large audience was invited:

- "Common Vision for Small Aircraft Transport Mode" in Brussels on September 28th 2011
- "Technology Roadmap for Small Aircraft Transport Mode" in Brussels on July 20th 2012

It turned out that the biggest interest was shown by the small aircraft industry, and little interest by operators.

The SAT-Rdmp Consortium also held a workshop at ILA 2012 (13^{th} Sept 2012) to disseminate the results of the project. The audience included the small aircraft industries, as well as a number of operators. The idea to start a network of industries, operators and the research community was tabled, but received little support by operators. It became clear that operators are still concerned with their own business and do not want to spend time on future developments at this point of time.

It was concluded that:

1. Operators should be addressed at a later stage when the SAT system will become popular again thanks to growth in GDP. At that time is seems appropriate to consolidate the interests of air taxi operators, EBAA (European business aviation association), AOPA (Aircraft owners and pilots association), Netjets and the air taxi association.
2. To continue to consolidate the small aircraft producers in Europe and create a network to discuss future technology needs.

Political support would also be needed to enable SATs to operate in Europe. A separate action by SAT-Rdmp Consortium was started to contact Members of the European Parliament, partially based on the resolutions accepted by Parliament for support to General Aviation and Regional Airports in Europe. A visit was paid to Parliament Members on October 10, 2012 together with industry representatives.

3 The Network Proposal

SAT-Rdmp Team had prepared an outline for the Terms of Reference for a network, based on the TOR used by the Industrial Management Groups in ASD. The proposal is included in this report as annex 1. The proposal received little attention by the industries as the developments within Clean Sky seemed to offer better perspectives. SAT Roadmap still advocates the establishment of an industrial network amongst others to enable a joint industry approach in Horizon 2020 especially as far as collaborative research is concerned.

4 The Incentive

The deliverable D3.1 “The ROADMAP for technology development for future SAT and its elements” prepared by SAT-Rdmp Consortium included proposed actions for research, integration of technologies as well as demonstration efforts. The aim of the SAT-Rdmp project was to strengthen the role of industry in the process and to make the research community a supporting partner.

The European Commission proposed to have a new JTI Clean Sky, called Clean Sky 2. This was the ideal opportunity to raise the interest of the European SAT industry. The SAT-Rdmp Team called the relevant industries together and proposed RTD activities along the lines of the roadmap that was presented. The industry, and especially Piaggio reacted positively to the initiative. The SAT-Rdmp Team assisted in getting the industries together to discuss a possible approach to be included in the Clean Sky 2 programme. Possible ways how to get involved were discussed (Via ITD’s or a separate IADP).

The SAT-Rdmp Team also consulted the European Commission to seek support for inclusion of activities for small aircraft in CS2. The Commission was positive about the initiative.

An informal industry cluster was formed including Piaggio, Evektor, PZL Mielec, Grob, Diamond as well as interest from Turkey, Pilatus, Honeywell, Siemens and GE-Walter. The original idea was to give priority to the development of a competitive turboprop engine. The PW PT6 is the most used engine in the sector but it is very dated. This would give Europe a unique opportunity to develop a state of the art new turbo prop engine. As it turned out, Walter/GE was very hesitant to join and GE preferred a joint engine development with China rather than Europe.

The SAT-Rdmp Team organized numerous (more than 10 – see annex2) meetings for the Industries, SAT-Rdmp Consortium as well as CSJU representatives to discuss possible actions.

5 SAT-in-CS2 initiative

Meetings were organized with CS2 as it turned out that there was a lot of time pressure to finalize a CS2 proposal for the European Commission. The SAT-Rdmp Team assisted and stimulated the industrial partners to prepare the required documentation and proposals. A draft paper was prepared by SAT-Rdmp Team, which created the basis for the industry statement on required demonstration efforts. SAT Roadmap Team also assisted in telecoms with CS2 management to ensure visibility of the Small Aircraft Industry needs in CS2. As the process to prepare a joint program

for CS2 matured the influence of SAT Roadmap Team was reduced, as the industry was picking up the initiative. A natural way to go. The current industrial statement is included as annex 3.

6 Clustering

It is still unclear what the conditions for participation in CS2 will be for the industry. However a cluster was discussed to represent the small aircraft industries in the governing board of CS2 and possibly as a partner in the CS2 program. SAT-Rdmp Partner AD Cuenta provided to the European SAT industries the statutes of the Dutch cluster that was established in CS1 to facilitate the creation of a new SAT CS2 cluster.

7 Conclusion

Without the SAT-Rdmp project initiatives it is very unlikely, that the small aircraft industries would have been as united, as they are today. The participation in the project, the workshops, the ILA – Berlin SAT Conference and especially the Technology roadmap developed in SAT-Rdmp project stimulated the European industries to become active jointly on the European scene.

The CS 2 discussion proved to be the incentive needed to start cooperation. The CS2 discussions also led to broadening the SAT cooperation with Siemens, Honeywell and possibly Dassault. CS2 promised to have a dedicated event in April 2013 to invite other interested parties to join the SAT activities in CS2. This would automatically broaden the industrial and research base for SATS.

In retrospect it is thanks to the EPATS and SAT-Rdmp projects that European industries are joining their efforts and that the interests of the SAT community is well recognized in Europe.

Annex 1

Terms of reference of the Associated Small Aircraft industrial Platform ASAP

1. Introduction

To be successful, the Aeronautical Industry within the European Union must combine its human and financial resources to carry out strategic research and development within integrated collaborative programmes, constructed by the aircraft, engine and equipment manufacturers receiving funding support from the European Commission via the RTD Programmes (Framework programmes like Horizon 2020).

The European Science, Technology and Innovation programs are additional to the individual national and company research programmes that continue to be essential for the overall success of the industry in the market.

A particular advantage of European collaborative programmes is the ability to involve other companies and other Member States, especially in research related to future small aircraft designed for air transportation services.

The small aircraft Industry within the European Union believes that concerted action is necessary to achieve the above aims. The associated small aircraft Industry platform, (ASAP), under these Terms of Reference, provides the technical input on behalf of the small aircraft industry in the maintenance of these aims.

2. Role of ASAP

The role of the ASAP is as follows:

- to provide the technical interface within the European small aircraft industry with the European Commission, ACARE, the Clean Sky JTI and the ASD/IMG's in order to prepare and to define suitable programmes and subjects for research and demonstration efforts in the field of small aircraft design and operations.
- to facilitate the formation of collaborative groups and the preparation of research and demonstration proposals to ensure that the small aircraft sector receives the maximum recognition, through funding, relative to its economic importance in the EU aeronautics industry.
- to undertake strategic studies and analyses relating to the definition of aeronautical research and demonstration programmes aimed at but not limited to the small aircraft sector.
- to carry out any ancillary procedures necessary for the furtherance of the aforementioned objects
- to coordinate the interested groups of the small aircraft, relevant engine and relevant equipment Industry of different countries.
- to maintain contact and co-ordinate activities with the ASD EGAMA. An EGAMA representative shall be invited to attend ASAP Meetings.

- to coordinate the interests and objectives of the ASAP with the corresponding interests of the aircraft, equipment and aero-engine manufacturers as well as ATM companies through participation of ASAP members in the IMG's and the Clean Sky ITD's.
- to represent the members on such specific issues as may be decided to the European Union.
- to coordinate initiatives of the small aircraft companies with research institutes and universities within the European Union.
- to nominate specialist working groups for specific tasks as directed.

3. Organization

The structure of the ASAP is designed to provide a body which represents the Aeronautical Equipment Industry interests of all the member states of the EU that contribute to the Framework Programmes' budget within a platform that can be effective in pursuing the stated tasks.

The ASAP may, as issues so demand, form Working Group's from within its' membership to undertake specific actions agreed by the ASAP.

4. Membership

The members of the ASAP are the companies or national industrial groups represented by individual persons listed in Appendix I. (note to be included)

Other companies or organizations based within the European Union or Accession States, acting as small aircraft industry representatives, may join the ASAP subject to the unanimous agreement of the current active members.

The membership and all activities are undertaken on a voluntary basis.

Members are expected to participate in the meetings of the ASAP on a regular basis. In this context members have a status as 'active' or 'passive' member. Members who participate regularly in the ASAP meetings are classed as 'active'. Members who don't reply to meeting invitations three times in the row will be set from 'active' to 'passive' by the chairman without any notice. Members who don't participate to regular meetings four times in a row will receive a chairman's notice asking for participation and requesting clarification of their desired status. In the subsequent meeting, the attending members – in the case the relevant member(s) doesn't participate – will decide on its/their status on the basis of the available information. In the case that a members status is changed, the chairman will send a notice to the relevant member(s) to inform about the decision. 'Active' members will get all available information (e.g. Minutes of Meetings, presentations …) whereas 'passive' members will only receive meeting invitations.

Membership of the ASAP does not impart or imply any preferential conditions in respect of specific research projects.

5. Maximum number of 'active' members per country

The maximum number of 'active' members per country is limited to 6 (six).

To switch back from 'passive' to 'active' status, the relevant member(s) must apply to the chairman and be accepted in consensus by the current active members at next meeting or on chairman's request by email. In applying for an active membership 'passive' members are favoured over new members.

6. Officers and Operation

The members will elect officers of the ASAP as follows:

- Chairman.
- Vice-Chairman.

The Chairman may attend the EGAMA meetings. He will also represent ASAP in other external meetings/activities and shall invite (where appropriate) a representative section of the membership to accompany him.

The Chairman shall be responsible for calling the meetings, circulating the agenda and distributing the minutes. He is expected to attend the meetings, however should circumstances prevent his attendance the Vice-Chairman shall assume the Chairman's responsibilities.

The Officers will hold office for one year, the change-over being at the first meeting of the new calendar year.
The nomination for Officers is rotated between active members.

Decisions are reached by consensus, however should a vote be necessary only the physical attending active members at the meeting may register a vote (one vote per company and/or organisation). The Meeting Agenda will indicate those items on which a vote may be necessary.

7. Confidentiality

The proceedings of ASAP are confidential and should not be divulged to a third party, except with the agreement of ASAP.

8. Duration

ASAP will remain in operation until termination by common agreement.

Annex 2

SAT-in-CS2
Outline of SAT Programme Proposal for CS2

Item	When? Where?	What?	Objectives	Subject Owner	Status
A	14th June, Brussels	**Clean Sky 2 Consultation Workshop**	SAT in CS2 - first info	CS, Dautriat	done
B	20th July, Brussels	**SAT roadmap Workshop**	SAT-Roadmap Consortium approach + Community Common Vision	SAT Consortium, Piwek	done
C	26th July, Brussels	**I Small Aviation Industry Working Meeting**	Small Aviation Industry first positions; starting to examine possibility to prepare offer	CS, Podsadowski	done
D	11th Sept, Berlin ILA	**II Small Aviation Industry Working Meeting**	Starting process of "SAT in CS2" offer; Working team, Preliminary Technologies List, Scope of Work (4XL2) , TimeLine, Accession List.	SAI, Piwek	done
E	13th Sept, Berlin ILA	**Small Aircraft Transportation in the Future**	Finalizing SAT-Rdmp Project + SAT in CS2 - wide info about access to work on offer + invitation to cooperation in CS2;	SAT Consortium, A. de Graaff	done
F	4th Oct, Waw	**III Small Aviation Industry Working Meeting**	Participants, Offer Scope, Finances + 1st draft of "Outline"	SAI, Cozzolino, Piwek	done
G	10th Oct, Brussels	**4th European Innovation Summit "A contribution on European Air Transport"**	EuroParliament informed about regulatory up-greading needs	Technology Partners - IoA Granger/ Kośmider/ Galiński/Piwek	done
H	10th Oct, Grob	**ESPOSA Advisory Board - Executive Meeting**	ESPOSA Partners informed about 1st draf of "Outline" - and invited to support	ESPOSA, Żółtak	done
I	10th Oct, Lisbon	**EQ IMG4 - Meeting**	EQ IMG4 informed about 1st draf of "Outline" - and invited to support	Adriaan de Graaff	done
J	25th Oct, Brussels	**IV Small Aviation Industry Working Meeting**	Participants, Offer Scope, Finances, Actions	SAI, Cozzolino	done
K	12th Nov	**SAI Outline Proposal for SAT**	Outline - ready to delivery to CS2	SAI, Paiger, Cozzolino	done

Annex 3

OUTLINE OF THE PARTICIPATION OF SMALL AIRCRAFT INDUSTRY IN THE JTI CLEAN SKY 2

VERSION 2 – 21st DECEMBER 2012

About the Small Aircraft Initiative

The Small Aircraft Initiative in CS2 represents research and technology interests of European aircraft manufacturers of small aircraft used for passenger transport (up to 19 passengers) and for cargo transport, belonging to EASA´s CS-23 regulatory base. The small aircraft community interested in CS2 is a group of more than 40 industrial companies (incl. many SMEs) accompanied by tens of research centres and universities. The community covers the whole supply chain, i.e. aircraft integrators, engine and systems manufacturers and research organizations.

Based on the documents elaborated within the European Framework projects EPATS (European Personal Air Transportation System) and SAT-Rdmp (Small Aircraft Transport – Roadmap) we have selected technical areas which support the achievement of CS2 goals, see also Annex I for the Roadmap.

Our approach takes into account inputs from accomplished or running FP6/FP7 projects. Our serious commitment and operability was proved through past projects (namely level 2 projects CESAR, ESPOSA, level 1 projects SAFAR, CSAs EPATS, SAT-Rdmp etc.).

We established our technical outline in a way to support CS2 goals in a maximum way. Our technologies will be developed, validated and integrated in CS2 ITDs up to highly integrated demonstrators reaching TRL6.

Our ambition is to establish key companies as "named beneficiaries" as well as for others to become respective "core strategic partners". It means that we would like to take reasonable part in CS2 management in respective levels. We have candidates and commitment for all those management levels.

For several countries, the small aircraft initiative is the only way how to notably contribute to CS2.

European Small Aircraft OEM partnership

Piaggio Aero - P180

Mielec – PZL M28

Aircraft Industries L-410

Grob - G 120TP

Evektor EV-55

Diamond – DA42

The small aircraft community covers the whole supply chain, i.e. aircraft integrators, engine, systems and component manufacturers accompanied by research centres and universities.

High level goals defined for small aircraft industry

- **I.** **Multimodality and passenger choice towards Flightpath 2050**
  - **a.** **To provide accessible and affordable high speed mode of transport on European interregional network connections with low-intensity traffic**
  - **b.** **90% of travellers within Europe are able to complete their journey, door-to-door within 4 hours**
- **II.** **Revitalization of European small aircraft industry, more competitive EU**
- **III.** **More safe and more efficient small aircraft operation**
- **IV.** **Lower environmental impact (noise abatement, fuel efficiency, energy saving production)**

Small aircraft industry contribution to CS2 goals and objectives

	CS2 goal No1: Creating resource efficient transport that respects the environment.	*CS2 goal No2:* Ensuring safe and seamless mobility.	*CS2 goal No3:* Win global leadership for European aeronautics with a competitive supply chain, incl. academia, REs and SMEs.
I. Multimodality and passenger choice			
II. Revitalization of European small aircraft industry			
III. More safe and more efficient small aircraft operation			
IV. Lower environmental impact (noise, fuel, energy)			

Major research areas to be addressed:

To date, most key technologies for the future small aircraft have reached an intermediate level of maturity (TRL3-4). They need further efforts to reach a maturity level of TRL5 or TRL6 through both analytical and experimental demonstration. Areas below were defined by aircraft and systems manufacturers who are prepared to develop, validate and integrate mentioned technologies on dedicated ground demonstrators and flying aircraft demonstrators on ITD level up to TRL6.

JTI CS2 - ITD Airframe

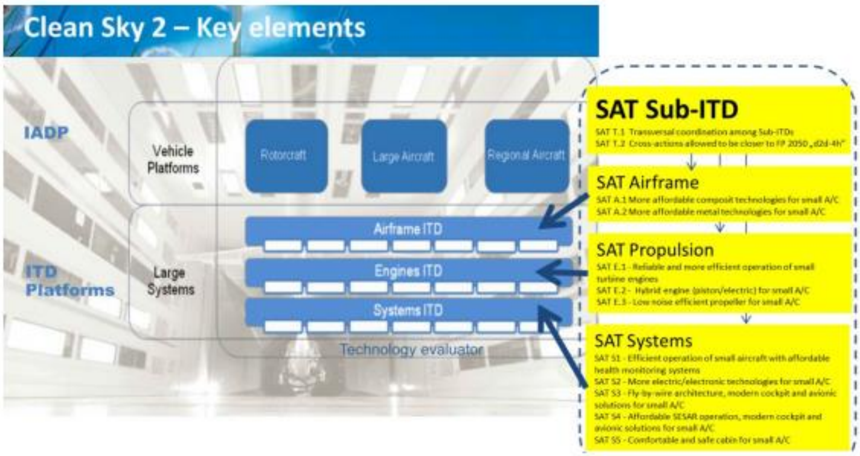
WP A.1 - More affordable and green composite structures for small aircraft
WP A.2 - More affordable and green metal structures for small aircraft

JTI CS2 - ITD Engines (Propulsion)

WP E.1 - Reliable and more efficient operation of small turbine engines
WP E.2 - Hybrid engine (piston/electric engine)
WP E.3 - Light weight and fuel efficient diesel engines
WP E.4 - Low noise efficient propellers *(aimed at hybrid engine/small turbines, diesel engines)*

JTI CS2 - ITD Systems

WP S.1 - Efficient operation of small aircraft with affordable health monitoring systems
WP S.2 - More electric/electronic technologies for small aircraft
WP S.3 - Fly-by-wire architecture for small aircraft
WP S.4 - Affordable SESAR operation, modern cockpit and avionic solutions for small a/c
WP S.5 - Comfortable and safe cabin for small aircraft



Option 1: Based on the recommendations of CS management team the intention of small aircraft industry is to implement addressed technologies through the existing ITDs.

Option 2: Alternatively, a separate IADP dedicated to small aircraft can be also an option. Such an IADP could benefit from technologies available from particular ITDs.

JTI CS2 – Transversal coordination among ITD-WPs oriented on small a/c

This function is intended to be carried out by one of the aircraft OEMs.

Planned funding required for small aircraft in CS2:

Commitment of "Candidate Leaders":	**40 mil EUR - budget** *(i.e. 20 mil EUR of EC contribution)*
Commitment of "Core partners" + Call for proposals partners	**140 mil EUR - budget** *(i.e. 70 mil of EC contribution)*
Total small aircraft related budget envisaged for JTI Clean Sky 2 for 2014-2023	**180 mil EUR - total budget** ***(i.e. 90 mil EUR of EC contribution)***
Distribution among ITDs can be very preliminary like this:	*ITD Airframe: 85 Mio EUR* *ITD Engines: 30 Mio EUR* *ITD Systems: 65 Mio EUR*

Note: Based on the presumption of 50% EC funding and 9 year duration

The budget and technical content was decreased several times to meet limited financial sources available for Small Aircraft Initiative (SAI). Further decrease of the budget indication for SAI will lead to the cancellation of the particular topics for small aircraft.

"Candidate Leaders" for small aircraft

- Evektor (CZ)
- Piaggio (Italy)

The candidates are prepared to start negotiations with the CS2 preparatory team and to sign the Letter of Intent. The envisaged commitment of these two companies totals to 40 mil EUR (20 mil EUR own contribution).

Candidates for "Core Partners"

The small aircraft community comprises respectable candidates for Core strategic partners for the above mentioned WP topics. These candidates are interested in submitting proposals during the envisaged calls for partners/expression of interests for participation in CS2 planned in 2013. These partners will represent broad interests of industrial and research partners in the technologies areas related to small aircraft.

Relevance and contribution of technology areas to CS2 goals

Technical areas to be addressed by CS2	Demonstrators	*CS2 goal No1:* **Creating resource efficient transport that respects the environment.**	*CS2 goal No2:* **Ensuring safe and seamless mobility.**	*CS2 goal No3:* **Win global leadership for European aeronautics** with a competitive supply chain, including academia, research and small and medium size enterprises.
JTI CS2 - ITD Airframe				
WP A.1 - More affordable and green composite structures for small aircraft	Airframe Integrated Structure – ground demonstrator consisting of composite wing and empennage parts, float systems + Airframe Subassemblies demonstrating advanced production processes, production hardware (jigs/tools) and processes itself are part of the demonstration.	Composites enable low weight structure (approx.14% reduction) and better aerodynamic shaping – lower fuel consumption/ lower emissions Low energy production out of autoclave technologies, less number of components	Improved crashworthiness of composite structures Improved small aircraft versatility – water landing.	Composite production of selected parts leads to cost saving (lower DOC by 4-8%), improved competitiveness of small aircraft manufacturers New supply chains for out of autoclave technologies and thermoplastic composites
WP A.2 - More affordable and green metal structures for small aircraft	Airframe Integrated Structure – ground demonstrator consisting of metal fuselage + Airframe Subassemblies and structure health monitoring system demonstrating advanced production processes, production hardware (jigs/tools) and processes itself are part of the demonstration.	Low energy production technologies for metal fuselage structure.	Improved crashworthiness of metal aircraft structures. Structure health monitoring system will improve safety for small aircraft and anticipate critical failures.	More automated metal production - cost saving (lower DOC by 4-8%).
JTI CS2 - ITD Engines				
WP E.1 - Reliable and more efficient operation of small turbine engines	Ground engine test rigs for turbojet and turboshaft Ground testing Engine demo on flying platform from, use of ESPOSA level2 project demonstrators after 2015	Efficient turboprop/turboshaft technologies with moderate fuel consumption Use of alternative fuels Noise footprint – engine start, engine + propeller	New engine segment development (small turbine technology) opens more opportunities for different aircraft configuration, two engine configurations for light helicopters used in urban areas mean safety increase and improved operational possibilities	New engine segment development (small turbine technology) Global leadership in small turbine technology, new supply chain in Europe
WP E.2 - Hybrid engine (piston/electric engine)	Ground and flying demonstrators	Having a very low noise propeller together with an electrical-only take-off mode of an aircraft with hybrid configuration may overcome night flight restrictions in several airports	Future application in urban areas.	New market opportunity for cost efficient and environmentally friendly aircraft

Technical areas to be addressed by CS2	Demonstrators	*CS2 goal No1:* **Creating resource efficient transport that respects the environment.**	*CS2 goal No2:* **Ensuring safe and seamless mobility.**	*CS2 goal No3:* **Win global leadership for European aeronautics** with a competitive supply chain, including academia, research and small and medium size enterprises.
WP E.3 - Light weight and fuel efficient diesel engines	Ground engine test rig Engines ground testing (flying platform)	Very high fuel efficiency	Diesel engine increases versatility of small aircraft and use of aircraft in the remote areas where is the lack of avgas, jet fuel etc.	Lack of certified diesel engine producers in the world market Opportunity for global leadership and great support for European small aircraft producers suffering from absence of diesel engines
WP E.4 – Low noise efficient propellers (aimed at hybrid engine/small turbines, diesel engines)	Production of a low noise demonstrator propellers for ground tests including advanced anti-icing system (ground test bench and flying platform)	Noise abatement is an important goal for small aircraft transport Increase Propeller efficiency by aerodynamic improvements and by advanced electrical anti-icing systems (5% reduced fuel consumption compared to state-of the art propeller with de-/anti-icing boots) Noise abatement is an important goal for small aircraft transport. Reduction of propeller induced noise by 3dB(A) compared to state-of the art propeller	Overall propulsion noise abatement (low noise propeller in conjunction with full-electrical propulsion system (see WP E.2)) to enable additional operation possibilities on noise restricted airports: Increase of take-off slot possibilities by 20%. Reduction of propeller weight by 5% due to advanced anti-icing system	World leading low noise propeller design and production as well as propeller systems supply chain (propeller anti-icing system)
JTI CS2 - ITD Systems				
WP S.1 - Efficient operation of small aircraft with affordable health monitoring systems	Systems Health monitoring system demonstrator based on P180 flying platform	Health monitoring systems prolong intervals for changes of aircraft parts/systems, i.e. energy and material less demanding operation.	Health monitoring system allows a dynamic approach to maintenance based on failure anticipation contributing significantly to improve safety of small aircraft (metal/composite structures, systems and whole aircraft)	Health monitoring systems reduce DOC costs of aircraft operation and directly contribute to the better competiveness of such aircraft. Reduction of the small aircraft Total operative cost of 9% is expected (50% reduction of total maintenance cost)

Outline of the participation of small aircraft industry in JTI Clean Sky 2 *2nd version of 21st December 2012*

Technical areas to be addressed by CS2	**Demonstrators**	*CS2 goal No1:* **Creating resource efficient transport that respects the environment.**	*CS2 goal No2:* **Ensuring safe and seamless mobility.**	*CS2 goal No3:* **Win global leadership for European aeronautics** with a competitive supply chain, including academia, research and small and medium size enterprises.
WP S.2 - More electric/electronic technologies for small aircraft	P180 Piaggio platform (270 VDC Generation & Distribution , 270 VDC to 28 VDC Converter, E-ECS, 270 VDC fuel pumps, low power electro Anti-ice, electrical LG, EMA landing gear) GE Av Sys: scalable 270VDC distribution, use of solid-state switching technology, load management, 28v solid-state switching.	Weight saving/ Fuel saving	More reliable systems, active systems increasing aircraft safety and operational envelope (e.g. anti-icing) Reduction of pilot workload, which is an important issue for small passenger and cargo aircraft	Better aircraft performance, DOC reduction. Low cost system solutions for export beyond Europe. Competitive European supply chain.
WP S.3 - Fly-by-wire architecture for small aircraft	Cost effective highly safe fly-by-wire architecture for small aircraft, Gust alleviation system on flying demonstrator,	Weight saving/ Fuel saving	More reliable and automated control systems, automatic landing systems increasing significantly aircraft safety and security Reduction of pilot workload, which is an important issue for small passenger and cargo aircraft	Better aircraft performance, DOC reduction.
WP S.4 - Affordable SESAR operation, modern cockpit and avionic solutions for small aircraft	Cockpit and Avionics on flying aircraft demonstrator	Weight saving/ Fuel saving	Improved safety by multi sensor based separation and collision avoidance system improve situational awareness, automatic landing system for nominal and emergency conditions, advanced decision support system in normal and emergency conditions Reduction of pilot workload, which is an important issue for small passenger and cargo aircraft	Better aircraft performance, DOC reduction. Low cost avionic platform and solutions for export beyond Europe. Competitive European supply chain.
WP S.5 - Comfortable and safe cabin for small aircraft	Cabin EV55 ground demonstrator, possible integration with ITD Airframe ground demo and/or on flying platforms EV55	Environment friendly material technologies for interiors, improved interiors insulation materials and configuration for noise reduction, new greener lights;	Step change in passenger comfort and safety during flight (noise, vibrations, air condition) Better crashworthiness in case of accidents.	Aircraft with advanced cabin comfort and high safety – a significant competitive advantage

Page 8 of 31

WP DESCRIPTION FOR THE PARTICIPATION OF SMALL AIRCRAFT IN CS2

The high level goals of the CS2 strategy are:

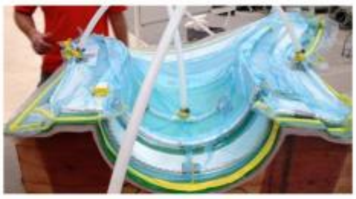
1. *Creating resource efficient transport that respects the environment. Develop innovative energy efficient aircraft that operate worldwide and meet environmental and societal targets for more efficient, safer and environmentally friendly air transport.*
2. *Ensuring safe and seamless mobility. Achieve its strategic social priorities with sustainable growth, creation of wealth and stable employment in fields of high technology.*
3. *Building industrial leadership in Europe. Win global leadership for European aeronautics with a competitive supply chain, including academia, research and small and medium size enterprises.*

JTI CS2 - ITD Airframe

The program objective within this ITD is to research and develop the application of more affordable and green technologies in the area of composite and metal aero structures used for small transport aircraft belonging to CS/FAR23 regulation category. These new technologies together with selected new technologies from the systems (structure health monitoring system) will be integrated and validated on dedicated demonstrators.

The goal of the SAT Airframe ITD is to create the technological baseline for a future small transport aircraft which fits into the extreme cost structure of the small transport aircraft market.

WP A.1 - More affordable and green composite structures for small aircraft



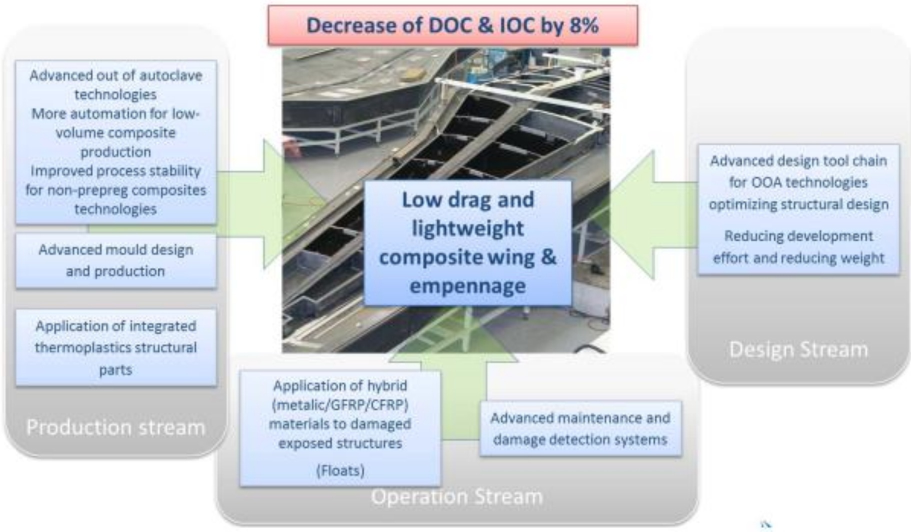
WP A.2 - More affordable and green metal structures for small aircraft

WP A.1 - More affordable and green composite structures for small aircraft

Description of state of the art: Actual wet laminate production methodologies applied for small aircraft has deficiencies in process stability and in subsequent reproducibility of specified shapes. Further on, it is based on manual production and allows limited automation. Target of the WP is to improve production stability by investigating the possibilities of modern out of autoclave technologies like low pressure and low temperature liquid infusion methods with a strong focus on the low cost structure of the CS23 aircraft. Both the reduction of production costs and operating costs must be addressed.

Composite aircraft structures in this WP will concentrate on:

a) the main aircraft structures of wing, empennage and optional floats
b) secondary aircraft structures like cargo pods (under fuselage), engine nacelles, fairings etc.
c) focus on easy in field repair of composite structures



Expl. note: DOC – Direct Operating Costs, IOC – Indirect Operating Costs

The ability to repair composite structures is strongly linked to the design and the materials and processes used to manufacture the original part. A proper design for example takes into account sufficient edge distance to allow installation of oversized, larger repair fasteners, or uses a larger laminate thickness in bonded structures to allow a local bolted repair. However, a major obstacle in the repair of conventional autoclave cured composite parts is the need for high pressure during consolidation of a prepreg repair patch in order to obtain sufficient laminate quality, while in field mostly hot bonders are available which provide heat and vacuum at most. By designing and manufacturing the original composite parts using (Out of Autoclave) OOA prepregs, this mismatch in curing conditions during manufacture or repair is avoided.

- Investigation of exploitation and application of developed technology in out of aeronautics area like wind milling power stations
- Thermoplastic materials
- Automation of process

In the EU project CESAR it was demonstrated that a combination of composites and automation by means of Automated Fibre Placement resulted in both a cost and weight reduction of the redesigned P180 canard wing. Also in the same project it was shown that the use of OOA prepregs resulted in a dramatic part count reduction of the Evektor Cobra canopy structure. The next logical step is to look at the combination and investigate the use of Automated Fibre Placement with OOA prepregs to manufacture cost effective composite structures.

Thermoplastic offers a number of advantages over thermoset composites of which the superior impact and damage resistant properties are perhaps the most relevant to the structural sizing. A disadvantage hampering further widespread use of thermoplastics is their relatively high material price compared to thermosets. Therefore thermoplastics should not be compared one-on-one with thermoset but be used where they offer the most potential of creating a light, cost-effective structure. Combined with possibility to weld thermoplastics, very thin, damage resistant composite structures can be created. So, for example instead of using the light and stiff, but damage sensitive thermoset sandwich concept for flight control surfaces, these could be designed as a welded thermoplastic monolithic laminate structure.

Illustrative picture of big composite structure produced by out of autoclave method

Major technology streams: highly integrated structures, reduction of number of components of composite structures - not "Black Metal", reduction of number of mechanical fasteners, out of autoclave technologies, more automation for low-volume composite production, advanced moulds, repeatability/quality for non-prepreg composite technologies, hybrid structures assembly, hybrid joints, integrated thermoplastic structural parts for small aircraft, robotic/automated composite machining , float systems for water landing;

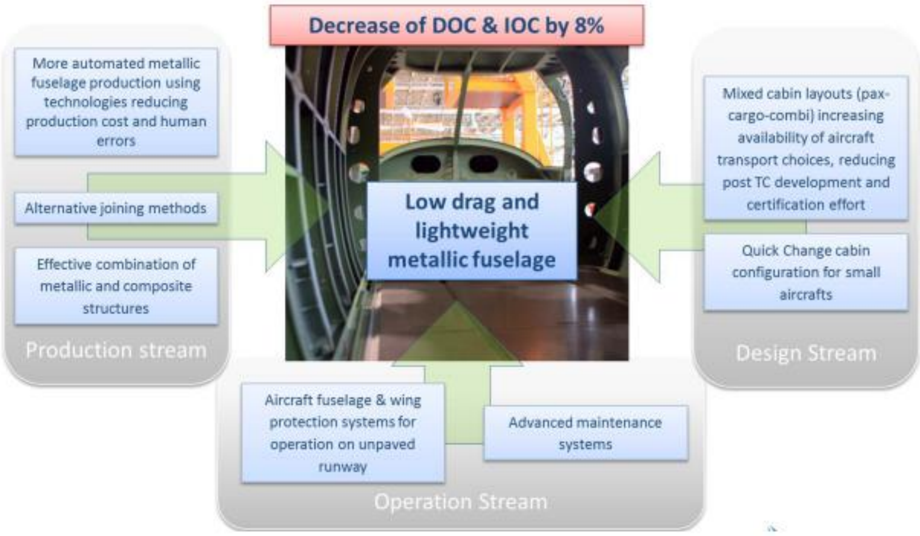
Demonstration activities:

- Airframe Integrated Structure – ground demonstrator consisting of composite wing and empennage parts to concentrate results of individual enabling technologies and SAT technology streams
- Airframe subassemblies demonstrating advanced production processes, production hardware (jigs/tools) and processes itself are parts of the demonstration

WP A.2 - More affordable and green metal structures for small aircraft

The strong need to reduce the cost of currently riveted airframe structure of small aircraft pushes the research need towards the development of advanced metallic airframe and structures prognostic systems with:

- Increased structure performance by means of the latest generation materials tailored for low cost application
- Reduction of manufacturing and assembly cost increasing the application of integral structure concept and use of automated assembly processes (i.e. the friction stir welding, integrated machined parts, alternative joining technologies)
- New concepts of assembly jigs and tools (robotic assisted assembly in low volume production)
- Health monitoring systems for structures maintenance reduction and failures anticipation where the key element is to have an enhanced health system by adjusting the hardware (sensor types, sensors' topology and position) and data analysis methods to the selected damage-scenario of structures



In the EU project WELAIR, the application of FSW to fuselage barrel of P180 aircraft resulted in both cost and weight reduction, demonstrating that FSW welding process can maintain the high strength and fatigue properties of aluminium alloys. However, many challenges have to be managed before fast FSW will play out its advantage on large component assembly like the fuselage, mainly on affordable manufacturing tooling and corrosion resistance.

Major technology streams:

Metal Structure Design & Manufacturing - Reduction of number of components of metal structures, more automation for metal structures, cost effective all-metal structure assembly, optimisation of Friction Stir Welding technologies for specific structural parts, innovations for production rigs/fixtures, reduction of operations / labour consumption, use of new and alternative metal materials for structural parts, optimized processes;

Structural Health Monitoring (SHM) - affordable solution for structural health monitoring systems – metal and composite structures, corrosion monitoring, optimized maintenance system (MRO), monitoring of structural frequency characteristics for operational damage detection, smart and flexible SHM sensors including energy harvesting and wireless;

Demonstration activities:

- Airframe Integrated Structure – ground demonstrator consisting of metal fuselage equipped with sensors and health monitoring system
- Airframe subassemblies demonstrating advanced production processes, production hardware (jigs/tools) and processes itself are parts of the demonstration

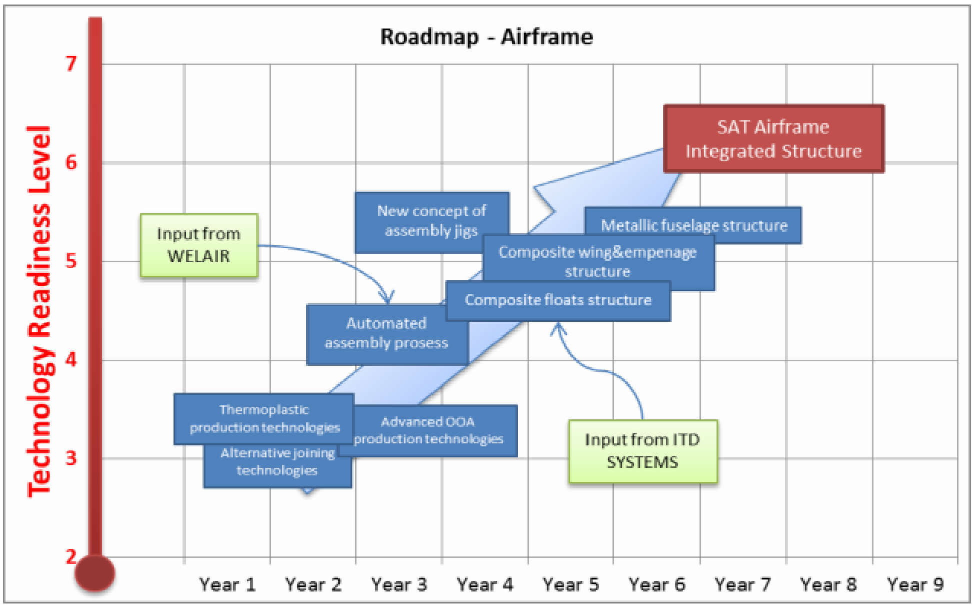
Illustrative picture of metal assembly of small aircraft.

Technical Target contribution to CS2 Goals – ITD Airframe

The aim of small aircraft industry in the airframe ITD is to reach technology maturity, according to the Technology Readiness Level methodology of TRL6, meaning that an airframe structure including fuselage, wing and empennage will be demonstrated in a large scale project as a ground demonstrator (TRL6) in a relevant environment on ground.

Targets	Ways to achieve	Measures/ Quantification
Decrease of DOC	• Low drag and light weight metallic fuselage supported by production automation • Low drag and light weight full composite wing • Low drag and light weight full composite empennage • Low cost and light weight thermoplastic aircraft (secondary) structures reducing maintenance cost • Impact resistant composites for i.e. floats application reducing maintenance cost • Advanced maintenance systems • Innovative Health Monitoring System & Sensors for structures	8%
Decrease of IOC	• Integrated small transport aircraft concept including all aircraft variants and kinds of operation (pax, cargo incl. external cargo bays, mixed configurations, additional fuel tanks, unpaved runway, additional float system, steep approach) reducing post TC development and certification effort. • Automated metallic fuselage production technologies reducing	8%

	production cost • More automated OOA composite wing production technologies reducing production cost • More automated OOA composite empennage production technologies reducing production cost • Thermoplastic production technologies for supporting structures reducing production cost • Alternative joining methods • High temperature composites for engine nacelle application reducing production cost • Effective combination of metallic and composite structures	
Increase PAX choice	• Flexible cabin layout concepts ("seats in a container" configuration) • Mixed cabin layouts (pax-cargo) increasing availability of aircraft transport choices • Quick Change cabin configuration for small aircrafts • Structures for Advanced Float system • Aircraft fuselage & wing protection systems for operation on unpaved runway	
Competitiveness and industrial leadership	• Integrated small transport aircraft concept project • SAI training facilities (*) • Automated production technologies (metallic and composite) • Advanced OOA production technologies	



2. systems – control of engine (dual instruments, power lever), control system, fuel system including combustor
3. engine designs / redesigns – aimed on improvements on engine efficiency, based also on safety analyses to meet safety/reliability requirements
4. engines manufacturing and testing on ground and in flight - validation and integration of used technologies

Demonstration activities:

- Ground engine test rigs for turbojet and turboshaft
- Engines ground testing
- Engine demonstrations on flying platform aircraft.

Innovations/improvements in the area:

- Engine acquisition cost – to be competitive to piston engines, the final price of the small turbine engine must be kept around 60 000 EUR
- Engine availability (improve the engines choice) –there is not much, if any, certified turbine engines in the category up to 180 kW on the market
- Engine reliability and safety – the final engine solution has to meet certification requirements as minimum qualification in terms of safety and reliability

JTI CS2 - ITD Engines (Propulsion)

WP E.1 - Reliable and more efficient operation of small turbine engines

Follow up of ESPOSA L2 project ending in 2015

Rationale:

The gas turbine technology has established the dominance in the aircraft propulsion application due to high power to weight ratio and reliability but its relatively high cost becomes very relevant when the power level decreases up to the small aircraft application (< 1000Kw). Advanced technology in gas turbine of the recent years has concentrated on large engine with a big impact on improving aviation transport efficiency and greening but only a little effort has been made on small gas turbine. The small gas turbine engine is distinguished from large power engine not so much in terms of overall requirements (reliability, relative lower specific fuel consumption etc.) , but rather in the severity of problems associated to achieve these requirements in small dimensions of various engine components. As results, compromise must be made on design architecture, materials selection, manufacturing processes, which are suitable to the particular needs of small turbine engine with reduced overall cost. It is clear that without improvement in small engine components design and material and manufacturing this high level target cannot be obtained.

Major technology streams: The technology streams for the Engine ITD will cover concepts and product (engines) definition and demonstrations, but also component, high productivity manufacturing techniques and innovative systems development, modelling and other enabling capabilities. The interfacing issues with airframes and system components will be managed in interaction with other relevant ITDs.

Thus the major areas of interest can be divided as follows:

1. components - use of new alloys in aircraft engines, new alloys for casting with directed crystallization and monocrystals, heat treatment processes for new/alternative materials, casting technologies for new superalloys, new techniques for casting by directed crystallization with insulations, use of ceramic cores for specific engine components, efficient machining technologies for critical engine parts (compressor, highly accurate gear wheels), optimized machining of heat resistant Ni/Co alloys, unconventional machining methods for metal parts – laser, efficient use of Chemical Vapor Deposition (CVD) coating

2. systems – control of engine (dual instruments, power lever), control system, fuel system including combustor
3. engine designs / redesigns – aimed on improvements on engine efficiency, based also on safety analyses to meet safety/reliability requirements
4. engines manufacturing and testing on ground and in flight - validation and integration of used technologies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Demonstration activities:

- Ground engine test rigs for turbojet and turboshaft
- Engines ground testing
- Engine demonstrations on flying platform aircraft.

Innovations/improvements in the area:

- Engine acquisition cost – to be competitive to piston engines, the final price of the small turbine engine must be kept around 60 000 EUR
- Engine availability (improve the engines choice) –there is not much, if any, certified turbine engines in the category up to 180 kW on the market
- Engine reliability and safety – the final engine solution has to meet certification requirements as minimum qualification in terms of safety and reliability

WP E.2 - Hybrid engine (piston/electric engine)

Rationale:

The main driver of the proposed work is the necessity for the aviation industry to follow the trends in other fields of transport towards the utilization of sustainable energy sources and efficient use of energy. This is even more of a pressing issue in the light aircraft, piston powered segment of the market, where the leading engine manufacturers are providing units whose basic technology, although constantly updated and reliable, is now over 50 years old. Fortunately, it is in the light aviation segment where the application of all-electric aircraft technology, including propulsion, can be best applied and can give significant benefits.

This project concerns the design of components of a serial hybrid propulsion system for small aircraft. A serial hybrid aircraft concept currently represents the best efficiency versus range compromise in the light aviation segment. It can be considered as an electrically powered aircraft, with an on board generator powered by a combustion engine used for extending the range when necessary.

Limitations of current electric energy storage technology make an electric-only propulsion system as yet unsuitable for long range flying, therefore an on board ICE generator provides a weight efficient, if somewhat less energy efficient, power generation solution.

Major technology streams:

The project will involve conceptual design of the hybrid propulsion system components, namely the generator, motor, inverter, batteries and control unit. The components will be sized and designed by considering the performance and energy efficiency of the complete airframe-propulsion system.

Together with the reliability of electrical motors and the use of dual energy sources, safety of flying as provided by a system built upon these components will be improved.

All components will be designed in a way to meet the relevant safety and certification standards. As dedicated regulations are not currently existing for aviation hybrid drive systems, elaborating system architecture in collaboration with the authorities will be an important contribution of the project, paving the way for hybrid and electric technologies to be introduced to the market.

These efforts will help to create a competitive supply chain for hybrid drive components and reduce the time to market of such innovations.

Innovations/improvements in the area:

- Design system components with ultra-light weight e.g. Inverter, E-Motor, E-Generator
- Design energy storage system e.g. battery suitable for airborne system in regards of safety and weight
- Design of ultra-light weight propulsion systems with highest level of system integration
- Applying newest semiconductor technologies to address safety and reliability
- Develop system control platform to utilize maximum system availability
- Develop operational algorithm to maximize system efficiency according to different mission profiles
- Drive market availability of key components e.g. energy storage systems for Aircrafts

Demonstration activities:

- Lab component test and performance evaluation
- Lab system performance test
- Airframe integration evaluation
- Demonstration of system performance in flight test

First hybrid electric motor glider technology demonstrator.

WP E.3 - Light weight and fuel efficient diesel engines

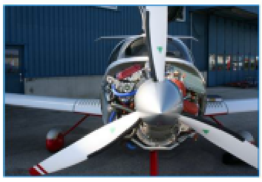


The application of modern light weight diesel engines in aircraft operations brings the important benefit of better fuel efficiency. The widespread presence of diesel fuel over the world is also important especially in the regions where small aircraft are used. The weight optimized diesel engine could be much lighter than current diesel engines. The platform of fuel efficient diesel engines (135HP, 280HP and 550HP) will bring the ecological benefit as well as the better reliability and cost efficient service conditions.

Major technology streams: Development target is to produce effective piston engines in respect to weight, power and fuel consumption. The piston engines require to be redesigned to fulfil the aeronautic requirements and keep the best parameters.

Thus the major areas of interest can be divided as follows:

1. Engine – The engine weight optimization and high energy/mass design
2. Turbocharging – application of new turbocharger design with use of new/alternative materials and environmentally friendly parameters.
3. Systems – control systems and fuel injection system redesign
4. Engines manufacturing and testing on ground and in flight - validation and integration of used technologies



Demonstration activities:

- Ground engine test rig
- Engines ground testing
- Engine demonstrations on flying platform from Diamond aircrafts

Innovations/improvements in the area:

- Engine acquisition cost
- Engine availability
- Engine reliability and safety – the final engine solution has to meet certification requirements as minimum qualification in terms of safety and reliability

WP E.4 - Low noise efficient propeller

Propeller is the most significant source of noise in aircraft operation (except during engine start of turboprop engines). Due to lack of new application of "large" new aircraft projects, the development of new low noise propeller designs suitable for CS-23 aircraft commuter category (5700kg to 8618kg) has been nearly abandoned. Aircraft in the area of UL, LSA and other "very" small aircraft classes have a minor focus on noise issues since these aircraft are mostly operated for sports and private reasons during daylight. Compared to that, the passenger and cargo transport sector is far more sensitive area in terms of noise issues. Noise abatement based on improved and innovative propeller design offer increased flexibility of aircraft transport operation. Combined with an electrical-mechanical hybrid propulsion system it offers following solutions: the possibility of overcoming night flight, better night take-off, restrictions which exist on several airports by performing an electrical take-off only.

Major technology streams: Development of methods and simulation tools for aero-acoustic and performance optimisations of propellers. Application for improvement of existing conventional propeller designs. Investigations in unusual configuration like multi-blade propeller with more than 7 propeller blades and ducted propellers.

Innovations/improvements in the area:

- Noise abatement
- improved aerodynamics for better efficiency and therefore reduced fuel consumption
- advanced propeller a de-icing system for better efficiency and therefore reduced fuel consumption and for reduced propeller system weight
- Improvement of total propulsion efficiency in conjunction with electric drives

Illustrative picture of propeller wireless experiment

Demonstration activities:

Propeller system demonstrator - demonstration of noise abatement and propeller efficiency on ground test bench and in flight.

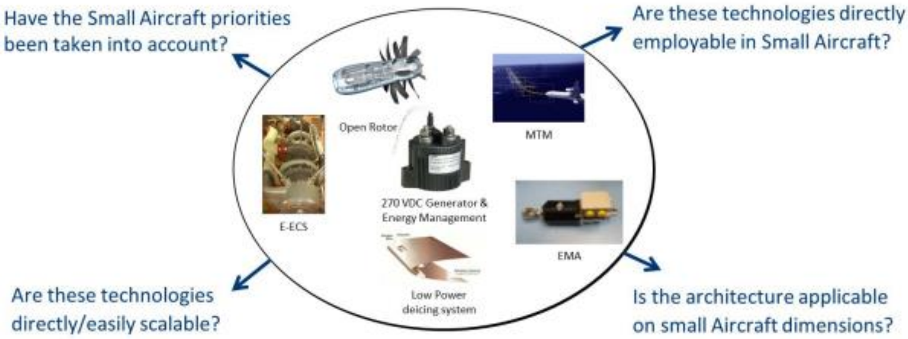
JTI CS2 - ITD Systems

The SAT program objective within this ITD is to research and develop the application of new and cost effective technologies in the area of systems for a future new generation small transport aircraft. The main target is to achieve the high level objectives:

- Reduction in the Operational Costs
- Improved Cabin (noise, Thermal , entertainment) & Flight comfort
- Safety and Security

Small Aircraft Systems Peculiarity

➢ Small aircraft systems are different from large aircraft systems due to the ultimate need for low weight, small dimensions, low cost and the severity to achieve these requirements on small dimension equipments together with reliability and performance.



➢ The answer to most the questions is **NO** that is why there is the need for an independent role in Clean Sky 2 for European Small Aircraft OEM.

WP S.1 - Efficient operation of small aircraft with affordable health monitoring systems

Aircraft manufacturers and aircraft maintenance organizations have been long seeking for an advanced aircraft maintenance system.

Currently industry follows maintenance policy based on manufacturer's guidelines for preventive maintenance intervals (i.e. remove and replace a certain part every given number of hours). During the last 10-15 years, the notion of "Condition Based Maintenance" (CBM) emerged and gained recognition as "maintenance policy", which triggered industry to optimized preventive maintenance intervals according to specific conditions/symptoms/failure modes. The CBM is currently the state-of-the-art in the aviation industry (as well as other industries).

The next step innovation is based on methodology of Prognostic Health Management, which goes beyond the above mentioned state of the art (hence beyond CBM). The main difference between CBM (condition based maintenance) and PHM (prognostic health management) is the PHM's capability of correlating numerous conditions occurring in aircraft systems in order to predict the Remaining Useful Life (RUL) of the system under control, thus triggering preventive maintenance activity. The key element to achieve this high level objective is to have an enhanced health monitoring system by adjusting the hardware (sensor types, sensors' topology and position) and data analysis methods to the selected equipment type of failure.

Major technology streams:

Health Monitoring for Aircraft Systems - engine health monitoring, EHA and EMA health monitoring based on the operational modes, landing gear with health monitoring, optical sensors and systems for HM, smart HM integrated with power distribution system and/or utilizing wireless networks / sensors and energy harvesting

Demonstration activities:

Health monitoring demonstrator based on P180.

WP S.2 - More electric/electronic technologies for small aircraft

Aircraft electrical power consumption has increased dramatically in recent years. Technological advancements have led to the replacement of traditional hydraulic and pneumatic systems with electrically powered devices. In addition, new functions for small aircraft such as digital fly control system, electrical landing gear, de/anti-icing and entertainment systems have been added, which further increases the demand for electrical power. As power needs increase, voltage or current, or both, must be increased. Increased current can be the least desirable result as it leads to larger and heavier wires. To mitigate the issue of wire weight and distribution losses, the latest "More Electric Aircraft" due also to a significant amount of existing electrical aircraft equipment (actuators, pumps, E-ECS etc.) have been designed to use 270 V dc power**.** Increasing use of electrical power is seen as the direction of technological opportunity for aircraft power systems based on rapidly evolving advancements in power electronics with fault tolerant power distribution systems and efficient power management.

Major technology streams: high voltage power generation and distribution, electric power generation, electric system reliability, Electrical-Environmental Control System (E-ECS), hybrid power systems including airworthy batteries and decentralised energy storage (e.g. supercapacitors), fault tolerant battery management and control, electric brake system, full electric extract/retract landing gear, efficient low power anti /de-icing systems, simulation tools and designing methodology in way of EMC/EMI compatibility checks, prevent the impact on aircraft HIRF electromagnetic fields, electrostatic discharges and lighting strikes (simulations and real measurements), technology to simulate aircraft antenna systems.

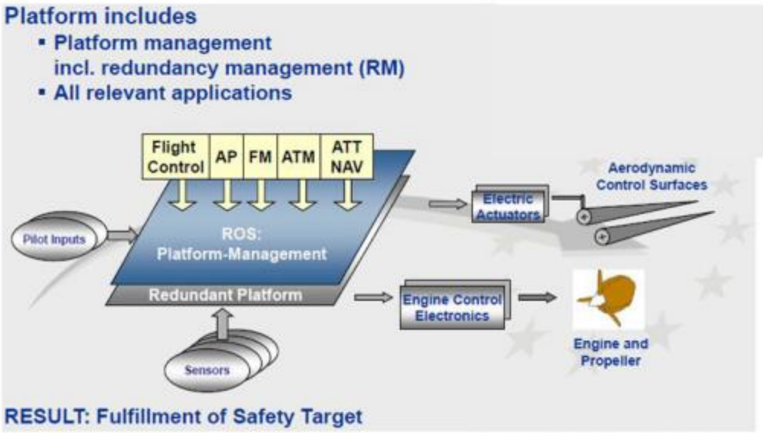
Demonstration activities:
P180 flying platform and dedicated test rigs.

WP S.3 - Fly-by-wire architecture for small aircraft

In order to allow wide social acceptance of small aircraft as transportation means, also acquiring relevant market position, the careful consideration of safety and comfort issues is very relevant.

Safety has to be considered more and more a relevant issue in the project, due to the need of allowing regular people, not provided with high piloting skills, to pilot the aircraft while assuring safety levels not lower than the required ones or even higher. To achieve this result, very relevant effort has to be devoted to provide the vehicle with extensive flight automation capabilities in order to support the pilot in command or even to completely substitute him/her in some nominal conditions and in emergency situations requiring high skill to be managed. The achievement of this required level of safety through automation calls for the implementation of some of the most recent and innovative technologies used in the UAV framework on board of small aircraft. Nevertheless, a "simple" technology transfer from UAV to small aviation is not possible, due not only to technical reasons but mainly to target level of safety of large aircraft and at the same time affordable for the application on small aircraft vehicles.

Major technology streams: Cost effective highly safe fly-by-wire architecture for small aircraft; high reliable electromechanical actuators / control systems (EMA), systems and algorithms to improve safety for small aircraft: innovative cockpit concept and interaction means to reduce pilot workload and improve situational awareness, automatic landing system for nominal and emergency conditions, advanced decision support system in normal and emergency conditions for MFDs, smart autopilot with envelope and failure protection, fully automatic system for mid-air 3D/4D navigation, multi sensor based terrain awareness and avoidance system, multi sensor based separation and collision avoidance system, weather awareness and management system, artificial vision system for all weather all time application; Systems and algorithms to improve comfort for small aircraft: gust alleviation system.



Demonstration activities:

Cost Effective highly safe fly by wire architecture and gust alleviation system for small aircraft tested on flying demonstrator.

WP S.4 - Affordable SESAR operation, modern cockpit and avionic solutions for small aircraft

Goal of this WP is developing universal cockpit which allows effective operation of commuter airplanes dependant on the user needs:

1. Single pilot operations for commercial Cargo and Passenger (up to 9 passengers – current regulations),
2. Dual pilot operations for commercial passenger transport (10 or more passengers),
3. Single pilot operations for Cargo and Passenger (for 10 or more after increasing and proven safety level, pilot workload reduction and control systems enough to change regulations).

Major technology streams:

Affordable SESAR operation, single pilot IFR cockpit, reduce workload by introducing more automation and new modalities into the flight deck (integration of info from various sources), all weather operations at regional airports by increasing autonomy, EFB applications (strategic, all phases of flight), multimodal cockpit (voice control, ATC communication visualisation, trajectory/energy optimization visualization, pilot advisory/monitoring system, etc.), avionics (cost effective navigation systems incl. augmentation for operation in the future ATM environment; on-ground navigation to support gate-to-gate navigation, affordable CPDLC like datalink for operations in future ATM, flexible and scalable avionics (modular distributed avionics, smart redundancy management mechanisms, security mechanisms for distributed avionics).

Demonstration activities:

The safety improvement through the reduction of pilot workload developed by HMI research (software and hardware) on System Integration Lab and proven flying platform.

WP S.5 - Comfortable and safe cabin for small aircraft

The primary objective of this WP is to provide a step change in passenger comfort and safety during flight by providing the technology and knowledge needed to address the acoustic, air conditioning, air distribution, entertainment and crashworthiness issues specifically for small aircraft cabin.

The introduction of smart passive damping devices and noise active control system can reduce significantly vibration and noise in the fuselage structures; this together with multifunction thermo-acoustic cabin interior makes a package to improve cabin comfort focused on small aircraft issue.

Innovative ECS air distribution will address small aircraft cabin environmental control issue improving the passenger individual comfort by appropriate management of cabin airflow and temperature.

The last but not least improving passenger comfort is the IFE system tuned for this size of aircraft operations. Therefore, concepts and technologies will be developed and their proof of principle shown by simulation as well as hardware models in a most realistic test environment (including ground testing)

Major technology streams: smart air distribution of Environmental Control Systems (ECS), active noise control, multifunctional insulation, cabin crashworthiness, lightweight seats, quick conversion from passenger to cargo aircraft, advanced and flexible interior lighting, passengers' wireless connectivity

Evektor EV-55 Platform

Demonstration activities:
Cabin EV55 platform, possible integration with ITD Airframe ground demo and/or on flying platforms EV55

Annex I

Background information

The European Small aircraft industry has a market position on the global general aviation and utility aircraft market, both pistons and turboprops (excluding business jets and new category of Light Sport Aircraft), of around 33% in value (total market 2002-2011 around $20Bn) thanks to the technical excellence resulting from past private investments covering all the segments like single/twin engines pistons and turboprops.

The North America and Europe regions have represented the two primary markets for this aircraft category, and have undergone a period of slow growth due to the global financial crisis and recession. Demand from other areas of the globe with higher economic growth, including emerging economies such as China, India, and Brazil, will grow in the next decades to complement orders from customers in North America and Europe. However, the cost of purchasing, maintaining and operating a small aircraft is a serious obstacle to higher growth in this market aviation sector.

Turboprop manufacturers of small utility/business aircraft have taken advantage of fuel prices increase in recent years, and partially cover the demand of a greater efficiency and lower operating costs aircraft. Although the general aviation/utility market is expected to remain vibrant throughout the next decade period, the development of a larger use of this category of aircraft in the passenger transport services is strongly related to breakthrough technologies in both power plant and airframe that dramatically reduces the impact on cost.

The US small aircraft manufacturers are historically predominant in the market and their positioning inside large companies (Textron, etc.) or acquisition by large non US investors will allow them to operate and ensure continuously financial resources to launch new products development.

EU small aircraft industry invested in own funds in order to acquire a limited knowledge only to improve their current products but they do not have enough R&TD resources capability to launch new products.

The fall of several national aircraft projects in this category have shown that the later development of such an aircraft has to be seen in an overall European context. CS2 is defining the path for the next 9 years in European aeronautical industries and can enable European SAT community to develop jointly a small transport and utility aircraft capitalising the full weight capabilities of the CS23 airworthiness regulations

EU projects activity and progress to date in Small Aircraft R&TD

The dedicated R&TD with focus on small aircraft research projects are only recently part of EU research work plan. The main projects covering development of advanced low cost small aircraft technologies are:

CESAR (Cost Effective Small Aircraft)
The project was, to a certain point, a unique project. It was the first time in the history of the Framework Programmes that a topic concerning small aircraft had been opened to financing and the first time that an integrated project of this scope was led by an organization from a "new" EU member state. The project completed in February 2010 has integrated in small aircraft a certain number of new technologies matured like:

- Design tools for small aircraft (aerodynamic, loads, structure, systems)
- Low cost OOA composite manufacturing
- Automated composite manufacturing using Automated Fibre Placement technology
- Friction Stir Welding fuselage structural component assembly
- Small gas turbine engine components design tools and manufacturing (compressor, turbine, gear box)
- Low noise propeller
- Low cost air conditioning system.

All these technologies were tested on small aircraft contest (Piaggio P180 Avanti, Daher-Socata TBM850) and some of these have demonstrated a cost effectiveness reaching a level of maturity for further investigations to achieve a higher level of the TRL (5-6).

SAFAR (Small Aircraft Future Avionics Architecture)

This project terminated in 2011 was oriented to design, develop and validate avionics architecture for future small aircraft (safe, cost-efficient, extendable and scalable). This will be the basis for a future low capacity air transportation system on which further advanced functionalities can be built.

The baseline of the SAFAR architecture is an advanced safety-critical, fault tolerant, fly-by-wire platform comprising computing resources, a human-machine interface, a mainly satellite-based fault tolerant attitude/navigation system and a safety-critical electric power supply with all-electric actuators.

In order to keep the handling characteristics of the aircraft straightforward and to avoid any pilot training, the fly-by-wire platform must maintain the same handling characteristics and flight protection features, even in cases of platform failures. Significant functional degradations in the handling characteristics, such as degradation to 'direct law', are not acceptable. This requires an all time/full performance/full authority fly-by-wire platform without any mechanical backup.

The activities are completed after an extensive test rig campaign with successful flight test on Diamond DA42 aircraft validating the system architecture. The SAFAR avionics architecture tested has to be improved in terms of reliability of hardware and software components to become the first choice for the avionics of future small business/utility and passenger transport aircraft due to safety levels ranging between 1/1 million up to 1/1 billion and the low-cost approach.

This will allow future implementation of further advanced functionalities to small aircraft, such as automatic take-off and landing or automatic go-home and auto-land functionalities in case of emergency. Advanced ATC and even ATM will be supported by way of maximum on-board automatism. Four-dimensional flight vectoring as a result of the on-board ATM/FM shall be executed automatically.

ESPOSA (Efficient System and Propulsion for Small Aircraft)

The ESPOSA project started in October 2011 has the aim to develop and integrate novel design and manufacture technologies for a range of small gas turbine engines up to approx. 1000 kW.

Research work comprises performance improvements of key engine components, their improved manufacture in terms of costs and quality. New engine component technologies will be backed by novel modern electronic engine control based on COTS, pioneering the engine health monitoring for small engines and providing more advanced electric solutions for fuel and propeller control systems.

The project also addresses problematic design areas connected with turboprop / turboshaft engine installation into airframe structure, including the use of composite materials. The work will be conducted taking into account specifics of different aircraft configurations.

The new engine technologies gained from ESPOSA should deliver 10-14% reduction in direct operating costs (DOCs) and reduce significantly the pilot workload and will be a step forward to the small aircraft passenger transport (under CS-23/FAR23 regulations) operated on the scheduled and non-scheduled flights.

Project activities will include extensive validation on the test rigs. The most appropriate technologies according to value/cost benefit will be selected and integrated into functional complexes and further evaluated on the engine test beds.

The ESPOSA project will also employ those technologies already developed for larger aircraft or those outside of aeronautics to provide affordable technology solutions for small aircraft. The project encourages both aircraft and engine producers in using new technologies for gas turbine engines, in demonstrating their feasibility and in proving their advantages for operators.

EPATS (European Personalized Air Transportation System)

The EPATS (FP6, Support Specific Action, 18 month, started January 1, 2007, finished June 2008, Consortium 10 Partners).

The focus was on the future Highly Customer Oriented and Time, and Cost Efficient Air Transport System. It filled 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 mode - 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 was 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.

SAT-Rdmp (Small Air Transport – Roadmap)

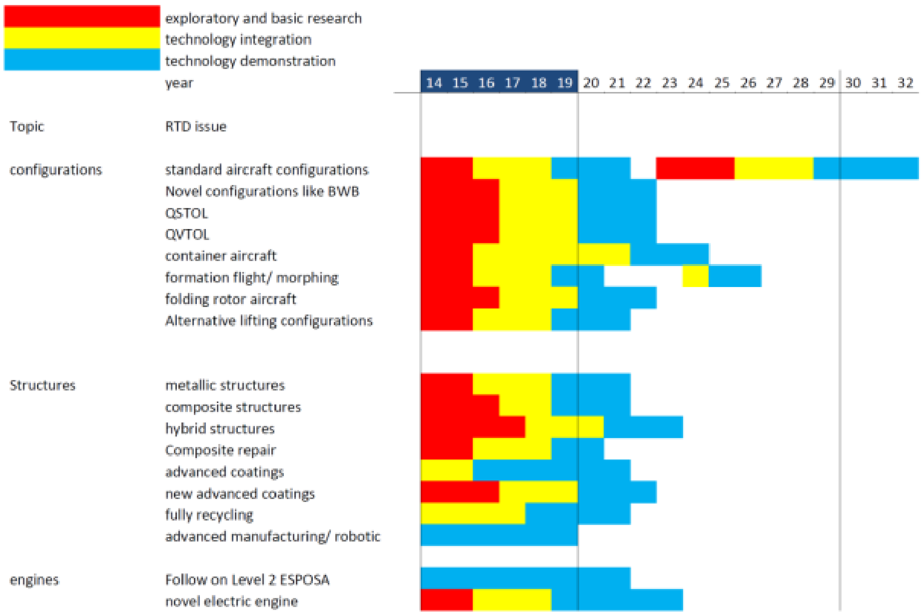
SAT-Rdmp – (FP7, Coordination and Support Actions, 18 month, started January 1, 2011, will finish March 2013, Consortium 14 Partners).

The Small Air Transport (SAT) focuses on the new affordable, accessible, energy effective component of Air Transport System (ATS). It fills niche between Surface Transport and Scheduled Large Aircraft Air Transport.

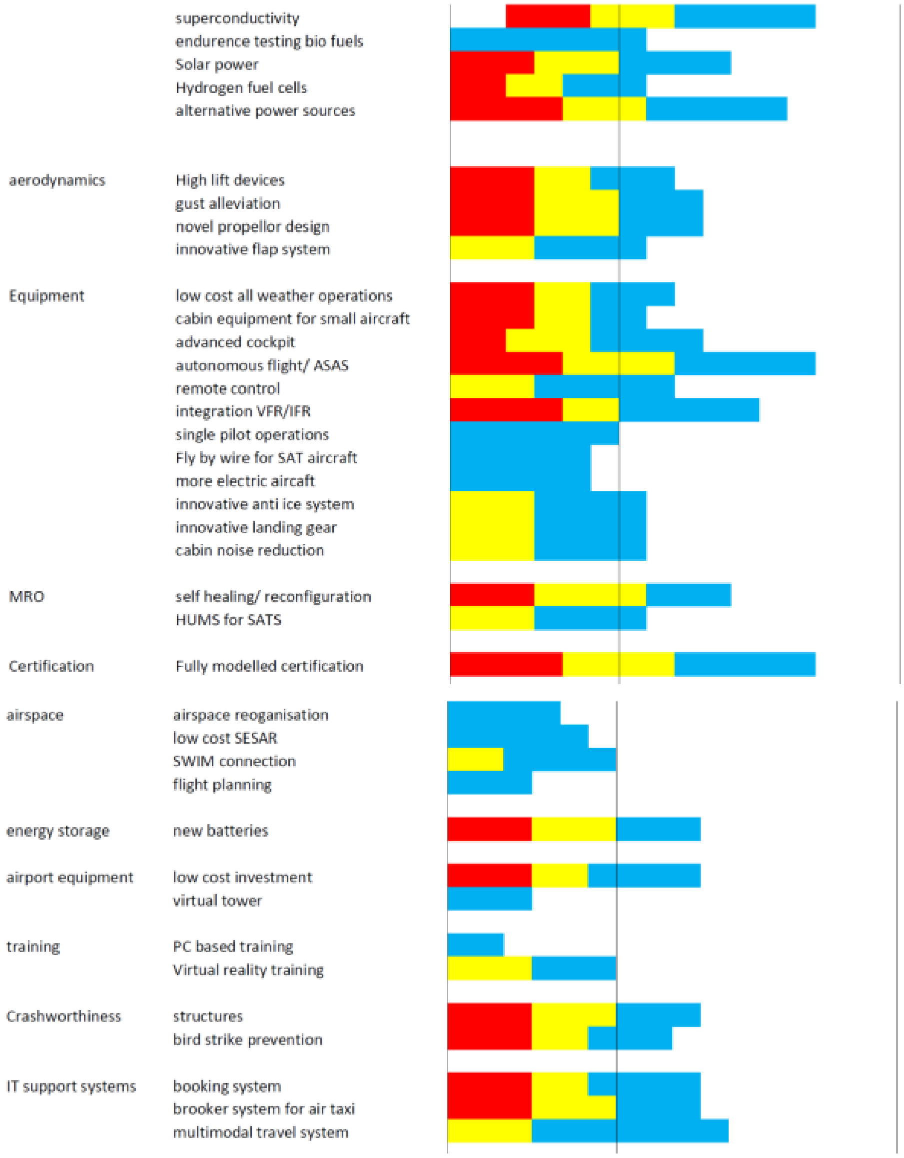
This future SAT system will provide enlarged choice of transportation mode, and the wider use of small aircraft served by small airports will create access to transport to more communities in a cost effective way and in a short time.

The goal of the SAT-Rdmp study (CSA-SA) proposal is to improve the understanding of the commercial role that small-size aircraft operating on scheduled or non-scheduled flights can play as a component of the Air Transport System, in order to satisfy the needs of transportation in regions where transport networks (especially surface transport) are underdeveloped.
The SAT-Rdmp study (CSA-SA) is building the European synergy in that segment of Air Transport System, and will create European General Aviation Community by discussing, agreeing, finding common approach of European Key Players: Users, ATM, Manufactures, Regulators, Research establishments.

SAT Roadmap on the Development of a Small Aircraft Transportation System



Outline of the participation of small aircraft industry in JTI Clean Sky 2 *2nd version of 21st December 2012*



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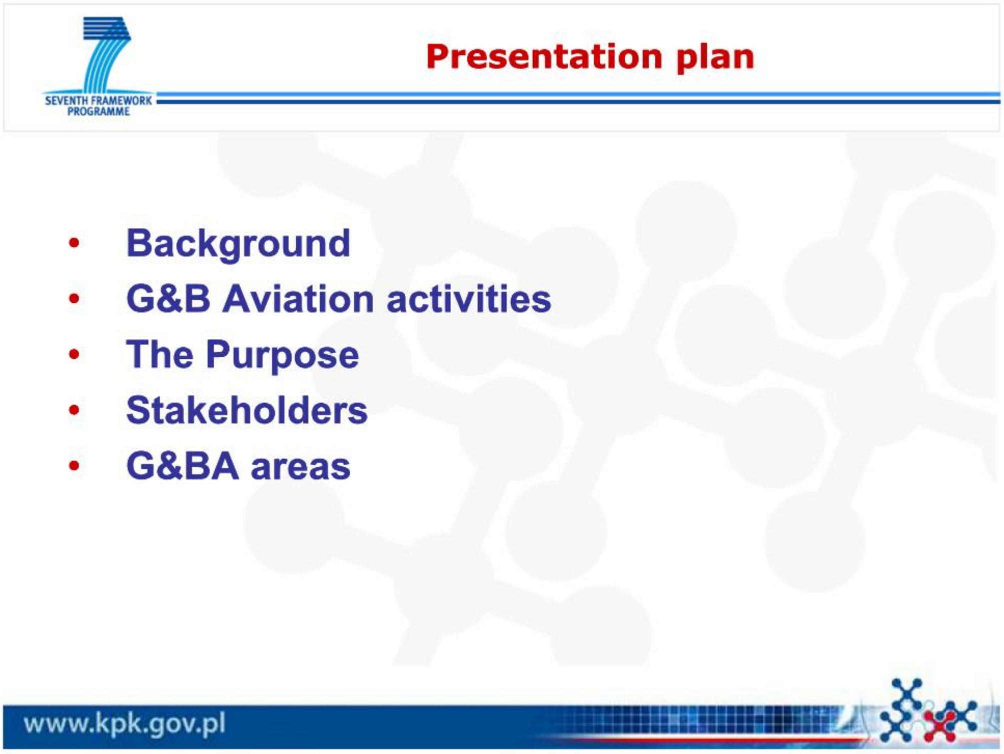
Page 31 of 31

Annex 4


General Aviation and European Air Transport System Third Call FP7
Warsaw, 7-8.07.2009
SEVENTH FRAMEWORK PROGRAMME
Need for EGAC Association
(EG&BAC Association)
Zbigniew Turek
National Contact Point
for the Research Programmes of the EU
Institute of Fundamental Technological Research
Polish Academy of Sciences
www.kpk.gov.pl


SEVENTH FRAMEWORK PROGRAMME
Presentation plan
• Background
• G&B Aviation activities
• The Purpose
• Stakeholders
• G&BA areas
www.kpk.gov.pl


Background
SEVENTH FRAMEWORK PROGRAMME
European Parliament Resolution
EC agenda for GA and BA
EU research projects
SESAR
DG RTD
EU Community expects from the EC implementation of the Agenda and is ready to contribute to it.
www.kpk.gov.pl


Background
SEVENTH FRAMEWORK PROGRAMME
Existing pan-European G&B av. associations in Europe
European Business Aviation Association (1977)
European Council of General Aviation Support (?)
European General Aviation Manufacturing Association (2007)
There is no organization dealing exclusively with GA and whole spectrum of stakeholders interested in that sector
www.kpk.gov.pl

SEVENTH FRAMEWORK PROGRAMME

Background
What is Business Aviation?

Business Aviation is that sector of aviation which concerns the operation or use of aircraft by companies for the carriage of passengers and goods as an aid to the conduct of their business, flown for purposes generally considered not for public hire and piloted by individuals having at the minimum a valid commercial pilot licence with an instrument rating. (IBAC Definition)

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SEVENTH FRAMEWORK PROGRAMME

Background
Business Aviation Community (EBAA)

1. **Industry (EGAMA)**
   - Design & Manufacture
   - Maintanance & Repair
   - Supply
   - ?
2. **Operators**
   - Commercial Operators
   - Fractional Ownership
   - Corporate Operators
   - Service Providers
3. ?

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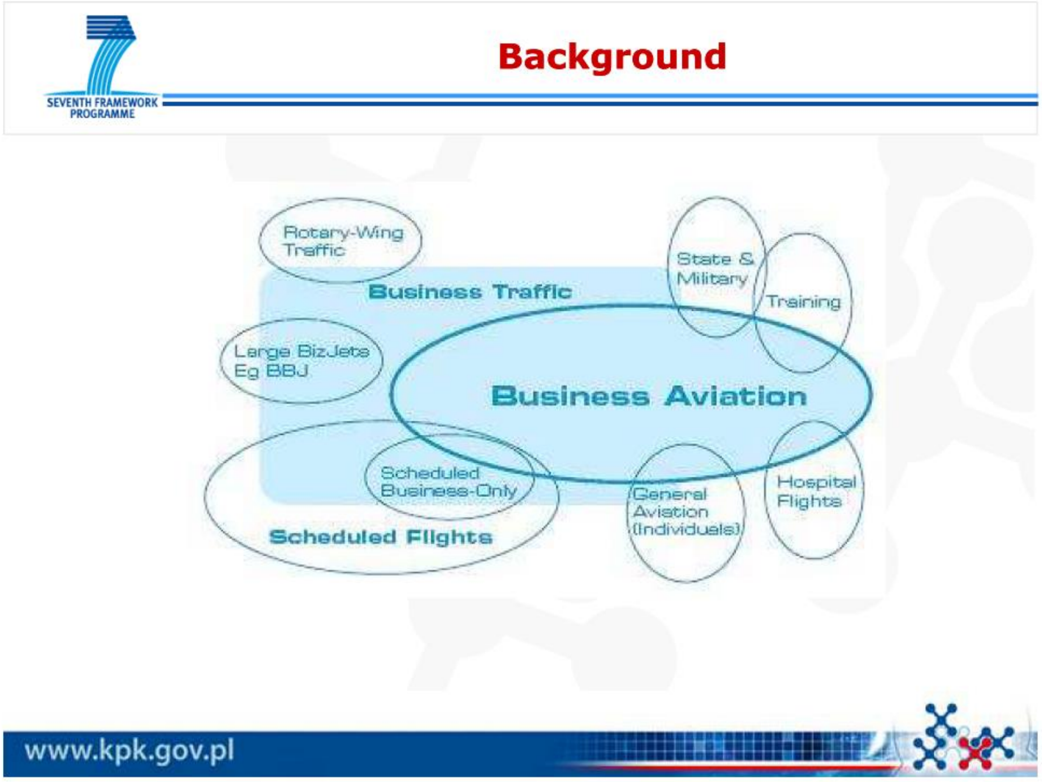
SEVENTH FRAMEWORK PROGRAMME
Background
Rotary-Wing Traffic
Business Traffic
State & Military
Training
Large BizJets Eg BBJ
Business Aviation
Scheduled Business-Only
General Aviation (Individuals)
Hospital Flights
Scheduled Flights
www.kpk.gov.pl


SEVENTH FRAMEWORK PROGRAMME
Why a new association is needed?
www.kpk.gov.pl


SEVENTH FRAMEWORK PROGRAMME
Possible answers
• Need for a roadmap for the implementation of the „Agenda for a Sustainable Future of General and Business Aviation"
• Need for Safe and Efficient European Air Transportation System (incorporating GA)
• Endorsing the Lisbon Strategy by creation of SMEs and giving an opportunity to „small aero countries" for an acces to High tech
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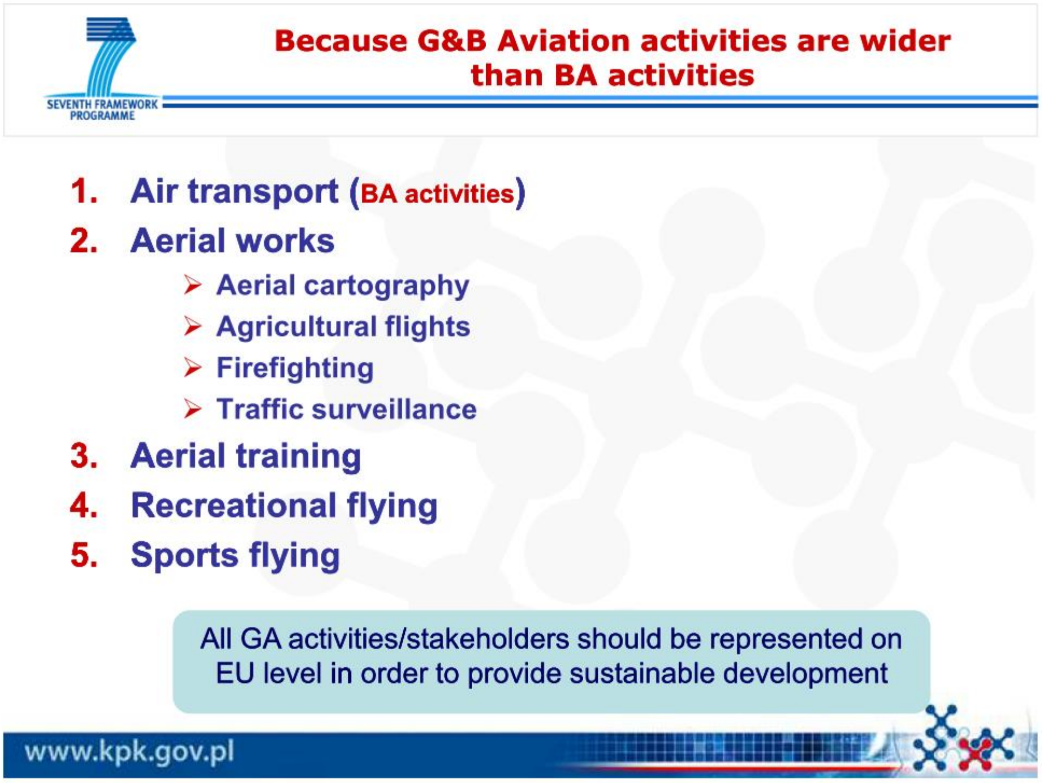
SEVENTH FRAMEWORK PROGRAMME
Because G&B Aviation activities are wider than BA activities
1. Air transport (BA activities)
2. Aerial works
Aerial cartography
Agricultural flights
Firefighting
Traffic surveillance
3. Aerial training
4. Recreational flying
5. Sports flying
All GA activities/stakeholders should be represented on EU level in order to provide sustainable development
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SEVENTH FRAMEWORK PROGRAMME
The Purpose
1. A dialogue with the EC as regards implementation of the "Agenda for sustainable development of G&B Aviation"
2. A forum for a dialogue with the EU institutions and MS and local and regional authorities
3. Pursue a dialogue on the future of G&B sector in Europe.
4. Establishing and maintaining contacts with all relevant national and international authorities and bodies that might influence on he growth possibilities for G&BA
5. Co-operating with manufacturers, suppliers, service providers, R&D units and Academia
6. Establishing and maintaining contacts with all relevant national and international associations e.g. (EBAA, EGAMA, ECOGAS etc.)
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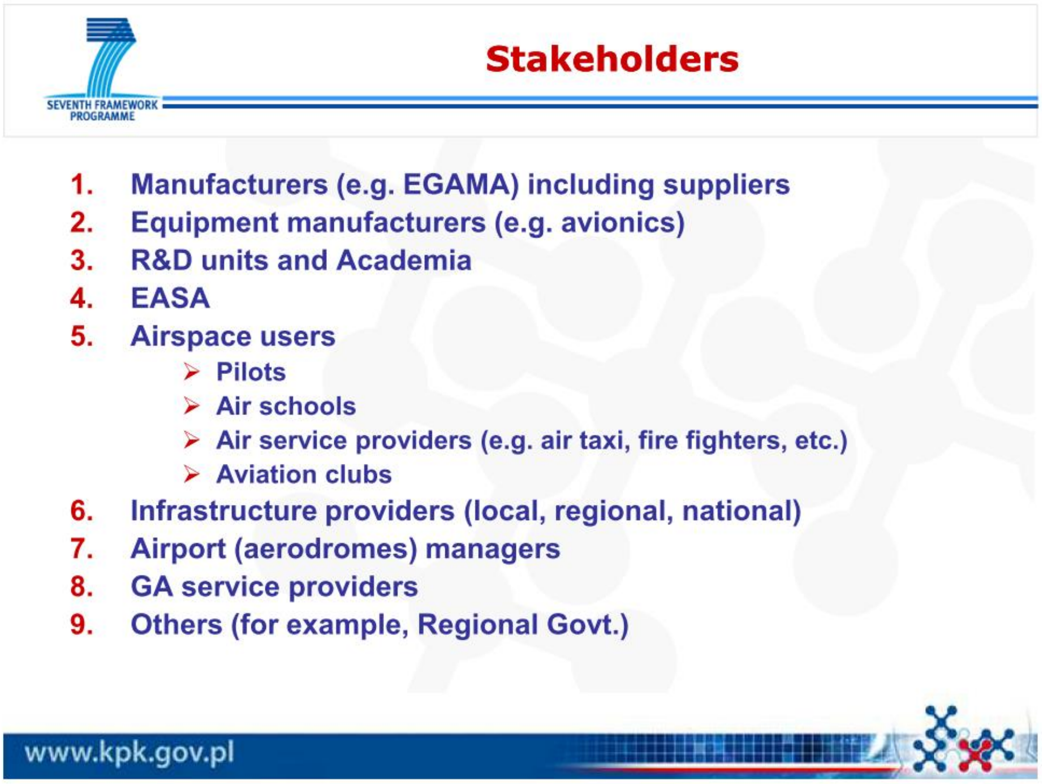
SEVENTH FRAMEWORK PROGRAMME
Stakeholders
1. Manufacturers (e.g. EGAMA) including suppliers
2. Equipment manufacturers (e.g. avionics)
3. R&D units and Academia
4. EASA
5. Airspace users
Pilots
Air schools
Air service providers (e.g. air taxi, fire fighters, etc.)
Aviation clubs
6. Infrastructure providers (local, regional, national)
7. Airport (aerodromes) managers
8. GA service providers
9. Others (for example, Regional Govt.)
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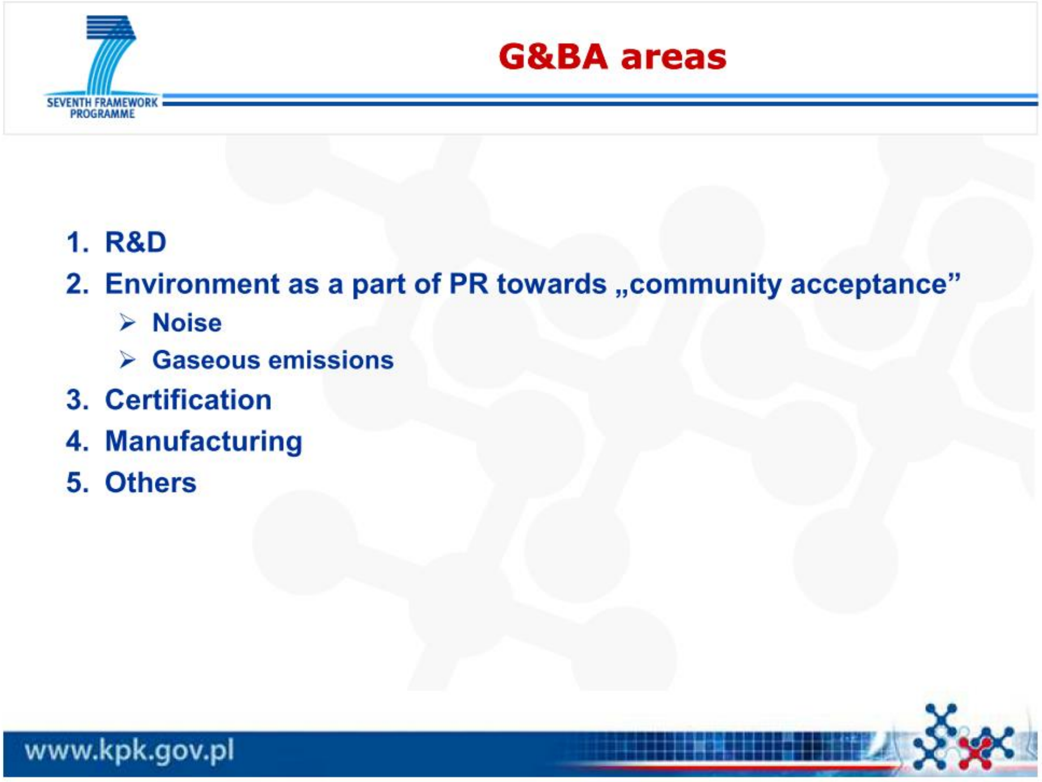
SEVENTH FRAMEWORK PROGRAMME
G&BA areas
1. R&D
2. Environment as a part of PR towards „community acceptance"
Noise
Gaseous emissions
3. Certification
4. Manufacturing
5. Others
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SEVENTH FRAMEWORK PROGRAMME
Thank you for your attention
Zbigniew Turek
tel: +48 22 828 74 83
mob: +48 502 052 241
fax: +48 22 828 53 70
e-mail: zbigniew.turek@kpk.gov.pl
National Contact Point
for the Research Programmes of the EU
Institute of Fundamental Technological Research
Polish Academy of Sciences
ul. Żwirki i Wigury 81
02-091 Warszawa
tel: +48 22 828 74 83
fax: +48 22 828 53 70
e-mail: kpk@kpk.gov.pl
www.kpk.gov.pl