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Executive Summary

WP 3 in SAT-Rdmp Project is dedicated to the identification of the necessary elements of a technology roadmap. This roadmap can be used by a wide range of stakeholders, from the European Commission, the private industry, Member States and networking organizations like ACARE and AirTN Plus to select research and technology topics for future Small Air Transport RTD projects and prioritize funding.

In Task 3.3, based on the Common Vision and the Roadmap developed, recommendations are formulated to the Commission on the potential level 1, level 2 and possibly level 3 projects needed to develop a world leading SAT system using a new generation of small aircraft and new operations. Recommendations are based on the roadmap developed and the mapping of ongoing and planned RTD, so that the output is relevant for on-going FP7 and also for FP Horizon 2020.

Major areas for research and needs for future R&D for year 2020 and in the 2035 perspective are identified. Several reconditions for future research topics, content and timing are presented as follows:

- Continuous incremental R&D developments based on on-going research topics
- New topics for research
- Demonstration activities for SAT system
- Framework and specific instruments for SAT R&D
- Timing for SAT R&D activities
- Synergies

Several suggestions for direct actions in respect to the Common Vision and future SAT development strategy are proposed.

In Annex we present SAT-Rdmp position paper for a Clean Sky 2 in FP Horizon 2020.

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LIST OF ABBREVIATION:

ACARE	Advisory Council for Aeronautical Research in Europe
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Transport System
CAS	Collision Avoidance System
CS	Certification Specification
D2Dt	Door to Door travel time
DOC	Direct Operating Costs
EASA	European Aviation Safety Agency
EU	European Union
FAR	Federal Aviation Regulation
GA	General Aviation
GAS	Gust Alleviation System
IATA	International Air Transport Association
JRI	Joint Research Initiative
JTI	Joint Technology Initiative
NASA	National Aeronautics and Space Administration
SRIA	Strategic Research and Innovation Agenda
SAT	Small aircraft in the air transport system
VLJ	Very light jet
WP	Work package
UL	Ultra-light
US	United States of America

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Introduction

In Task 3.3, based on the Common Vision and the Roadmap developed in the project, we aim to formulate recommendations with respect to the content and the timing for proposed new actions, to be considered by EU Commission and other stakeholders in aeronautics.

The references on the current R&D framework are dependent on a set of instruments, so we will address also potential level 1, level 2 and possibly level 3 type of projects needed to develop a world leading SAT system using a new generation of small aircraft and new operations.

Recommendations are based on the roadmap developed and the mapping of on-going and planned RTD, so that the output is relevant for on-going FP7 and also for FP FP HORIZON 2020.

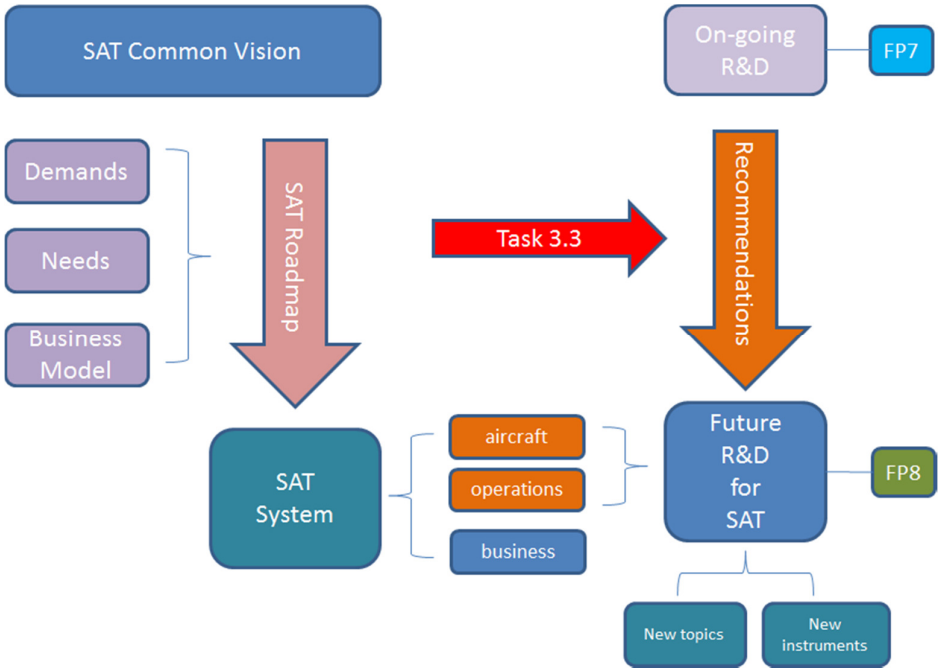

Figure 1 – Task 3.3 basic approach

This aim for interaction with programmatic documents et EU level is performed in order to enable more efficient instruments and activities in current research topics and future research topics for the development of the SATS system.

The SAT Roadmap has identified relevant technologies and relevant means for demonstrations with respect to major high level targets for a successful SAT system.

At the same time, from the recommendations in the new SRIA (Strategic Research and Innovation Agenda) of the new ACARE, we consider the new strategy for RTD activities in the integrated transport activity, where the key areas for integration of SAT activities are:

- SAT alternative/complementary to future multimodal seamless transport chains;
- SAT business model based on a specific passenger demand model;
- Impact of SAT on the environment (greening)
- Visibility by successful large scale system demonstrations;
- Contribution to the EU policy for investment in R&D infrastructure and specific high-tech testing facilities;

A dedicated framework for future SAT development is a real need with increasing support from a growing SAT community in EU.

The current status of FP7 still provides areas for integrating SAT dedicated activities. The 2012/2013 call is a primary target in this direction.

The next FP Horizon 2020 is the major target for implementing new proposed instruments for SAT dedicated activities. Participation to the initiation phase of the new proposed R&D instruments (e.g. Clean Sky 2 or JRIs) is a key factor for SAT success in FP HORIZON 2020.

Part A – Future R&D for SAT – specific needs

From the SAT Roadmap conclusions, we can summarize specific SAT needs for R&D as follows:

- R&D needs from on-going research activities, using current topics and taxonomy.
- New areas for R&D of specific interest for SAT

At the same time, from Common Vision conclusions and Roadmap outputs, a set of priorities for SAT R&D are identified, based on their criticality, as follows:

- SAT integration in the future ATS;
- SAT business model implementation;
- SAT in support for the industrial policy in EU;
- SAT in support of EU regional development policy.

Current state of the art in R&D relevant for SAT is based on ongoing incremental improvement of knowledge and technologies in the relevant domains for aeronautics/aviation:

- Flight physics;
- Airframes and structures;
- Propulsion;
- Systems and avionics
- Materials;
- ATM

The current situation is that most of the activities are primarily focused on the development of large airliners and rotorcraft as well as business aviation, since the business is largely dominated by the big aircraft industry (Airbus). However, the knowledge developed in these RTD activities are accessible for the SAT community, as a logical incremental technological development.

In this line, for continuous incremental knowledge development for the interest of SAT, areas for R&D are:

- At vehicle level :

- Conceptual design – new configurations
- Advanced airframes - structures
- Advanced propulsion and alternative/unconventional power sources
- Full automation
- New generation cockpit and cabin
- Advanced systems and equipment (including ATM)

- At industry/manufacturing level

- Manufacturing processes
- Quality systems
- Repairing technologies
- Recycling technologies

- **At operation level**

- Ground infrastructure development
- Maintenance (on-board, on-ground, fleet)
- Safety and security for SATS operations, emergencies
- ATC
- SAT business model development
- Training systems

However, from the Common Vision and the business model, SAT has specific needs for development and this is only possible by addressing specific topics in new R&D areas and using possible dedicated instruments. It is in the SAT community interest to have direct entries for these topics in future R&D activities in the FP HORIZON 2020 workprogram

In support for SAT developments, most of the generic aeronautical infrastructure (including test facilities like wind tunnels and IT networks) are possible to be used by potential SAT developments.

However, SAT needs also several **dedicated infrastructures**, since most of the advanced developments may be implemented only through dedicated R&D at lower TRL level in dedicated relevant environment.

It is difficult to imagine that such a need is possible t be integrated directly in future FP Horizon 2020. However, a pilot structure for SAT may be considered, mainly in Eastern Europe, as a major contribution towards a regional air transport system using small aircrafts.

At the same time, SAT needs **specific demonstrations** at various TRL levels. There are on-going activities in this area, with high impact and visibility for SAT, as follows:

- Efficient GA engines and low noise efficient propeller (CESAR/ESPOSA projects);
- High voltage power electric generation for more electric aircraft systems (Clean Sky),
- Low cost out-of autoclave composite airframe (Clean Sky, CESAR),
- Advanced, low cost, low weight and small volume GA avionics (SAFAR, ACROSS);
- Fly by wire for small aircraft with EMA (SAFAR, Actuation 2015),
- Single pilot operation (SOFIA, PPlane),

From the Roadmap we have identified a need for new large scale demonstrations to be continued in the benefit of the future ATS. SAT may benefit from these demonstrations, enabling TRL development and dissemination support.

Part B – Recommendation on future SAT R&D - content

R&D activities for development of SAT may be considered based on the specific needs of SAT, as presented before, with a dedicated agenda for critical areas (mainly technologies), or as part of a lager integrated approach in the aviation area (future ATS), trying to benefit from the future Horison 2020 and specific instruments.

According to SATS concept **the development of modular and clean SATS aircraft family** in the framework of Joint Technology Initiative is proposed. In this context:

Modular - means sets of common modules that are shared among an aircraft family;
Clean – means – low energy consumption and improved environmental impact.

The 4- 19 seats modular SATS Aircraft family represents a concept for a next generation of small aircraft highly unified family that could enter into service in 2020-2025 in the Small Air Transport System. It features advanced technologies in almost all sub-systems: modular and low weight structure (composites), extensive use of electrical power in systems, and advanced flight management systems. A substantial reduction of development, production and operational cost of the aircraft as well as the environmental impact will be achievable.

While some technologies can be assessed during their development phase, many key technologies will need to be validated via dedicated test programmes, involving in-flight test and large-scale ground demonstration installations. These demonstrators combine several technologies at a major system or at aircraft level, enabling them to be tested in a relevant operating environment.

The main objectives in manufacturing research were reducing cost and increasing quality by improving tooling processes of new materials, improving production of composite structures, welding, elasto-forming and age-forming processes and increasing automation in the aircraft industry. The same methods must be applied in SATS aircraft family.

Concept studies have been performed with the goal of assessing technologies for saving resources and decreasing impact to the environment, developing sustainable maintenance concepts, developing aircraft concepts for special applications and increasing capacities of the transportation system. The results will be used.

The use of modularity and product platform has been important means for manufacturing companies to design and develop product families. Modular product platform methodology can enhance the competitive advantage for companies by offering multiple benefits including satisfying a variety of market niches, reduced development time, and reduced production cost. The concept and method of the modular product platform will be applied to the problem of SATS aircraft family design. The several issues for aircraft family design will be resolved, including the configuration and layout for aircraft family, aerodynamic design optimization of aircraft family, structural design optimization of aircraft family, and multidisciplinary design optimization for aircraft family.

Aircraft family design and development will be considered from various perspectives as well, such as in the areas of business strategy, marketing, manufacturing and production, customer engineering, information technology, and general management.
It thus becomes imperative to coordinate aircraft and process design of aircraft families within a supply chain framework.

Part C - Recommendation on future SAT R&D – instruments and contents

The interim evaluation of transport research in FP7 pointed out that the Transport theme exhibits a strong European added value (critical mass, avoiding duplication, competition and quality in RTD not achievable at national level, etc.). The Transport program of FP7 has brought together the complementary competencies of the best European RTD&I actors in the field, and provides adequate scale and scope to address key societal challenges in transport and promote innovation in the design and manufacturing of aircraft, vehicles and vessels and in Transport services.

It is of great interest for SAT community to identify their interest and place for direct actions using either available instruments for 2012-2013 and to make sure new instruments in the FP HORIZON 2020 Framework will include area or SAT R&D activities.

C.1 Existing FP7 instruments

From the outset of FP7, the Transport Work Programs (WP) have been aimed at developing greener, safer and smarter pan-European transport systems that will benefit all citizens, while reducing the environmental impact, and increasing the competitiveness of European industries in the global market.

The first two WPs (2007, 2008) covered the full scope of the Transport theme of the "Cooperation" Specific Program. This has led to a good balance between upstream research, technology development and policy driven research.

A multi-annual strategy was proposed for the period 2010-11 to ensure a balanced approach and complementarity among focused calls while respecting the annuality of budget consumption. These calls took into account the evolving policy framework, in particular The mid-term review of the Transport White Paper.

Besides collaborative research projects and coordination and support actions, the Transport theme under FP7 also features a “programming” approach, which increases the leverage of public investment and the European added-value, such as the “Clean Sky” Joint Technology Initiative and the Single European Sky Air Traffic Management Research (SESAR)

New policy elements for the last two years of FP7 (2012-2013)

The Commission Communication Europe 2020 with its flagship initiatives Innovation Union and Resource efficient Europe is of particular relevance to Transport research, so for SAT.

It points at the need to make growth and sustainability compatible, with an objective of decoupling environmental impact from economic growth, whilst setting a target of investing 3% of EU's GDP in R&D by 2020. It underlines the importance of a modernized and sustainable transport system to better address the current challenges the European society has to face. The concept of the Innovation Union recognizes the need of strengthening the innovation chain by pooling efforts and expertise on research and innovation to focus on results, outcomes and impacts and rapid modernization in key transport-related areas such as cities and mobility.

Further, Europe 2020 is supported by important Transport-related policies such as the New White Paper on Transport, the ITS Directive (2010) and its Action Plan, the Strategic goals and recommendations for the EU's maritime transport policy until 2018, the Action Plan on Urban Mobility (2009) and A European strategy on clean and energy efficient vehicles (2010).

In addition, the forthcoming Strategic Transport Technology Plan (STTP) and the Clean Transport Systems Communication will provide the governance frame, implementation strategy and socio-economic goals to be reached by 2020 and beyond, making use of the Framework Programme (FP7/FP Horizon 2020) as well as other sources of EU and national funding. In particular, WP 2013 will ensure the smooth transition into FP Horizon 2020 keeping the above policy framework in focus.

Areas to integrate SAT research are available, mainly as an integration as dedicated aeronautical activities addressing big industry. However, the SAT specific topics and dedicated research areas are not directly visible in these programmatic documents.

Transport R&D Strategy for the period 2012-2013

The strategy for the last two years of FP7 Transport Theme is targeted to promote innovation in the Transport sector based on a coherent integration of research on the most promising technology and policy areas as well as on demand side driven and demonstration aspects. In particular, the work programme contributes to the innovation objective in two ways:

1) by supporting topics aimed at generating knowledge to deliver new and more innovative products, processes and services;
2) by identifying and addressing exploitation issues, such as dissemination, standardization, certification, IPR, etc.

SAT may benefit from both, at product level (e.g. innovative small aircrafts) or at system level (e.g. regional transportation system based on SAT business cases).

This constitutes a significant change to the approach in earlier Work Programmes (2007-2011). The specific research and innovation priorities for 2012-13 are being focused around the following socio-economic challenges:

1) Eco-innovation – The decarbonisation of the transport system and an efficient use of natural resources, i.e. eco-innovation in all transport modes and the further development of clean vehicles and vessels.
2) Safe and seamless mobility – The optimization of the global efficiency, safety and security of the transport system (by application of Intelligent Transport Systems and logistics), making efficient use of infrastructure and network capacity, with the aim of offering safe and seamless transport and mobility to all European citizens, as transport is also crucial for social inclusion.
3) Competitiveness through innovation – The strengthening of the competitiveness of European transport industry through innovation, as competition from developed and emerging economies is intensifying in a global economy.

The results of the 2007- 2011 calls have also been taken into account when the objectives of WP 2012-13 have been prioritized. This strategy has already been applied in WP 2012, where many impacts on innovation in all transport modes (air, road, rail and waterborne) are expected, as a consequence of implementing it. Overall they can by summarized as follows:

- Reduction of emissions of greenhouse gases (particularly CO2) and pollutants, by focusing on developing electric vehicles and infrastructures and by using alternative fuels.
- Easy mobility of passenger and goods, by technical innovation and regulation to improve interoperability and co-modality.
- Increased safety in transport, by e.g. innovative approaches for aircraft under extreme conditions.
- Higher competitiveness of the European transport industry, by fostering innovation on manufacturing, systems, tools and management, and by helping to bring innovative products and services to the market.

As mentioned before, the topics do enable generic R&D for SAT. However, dedicated SAT R&D is not directly presented, so a strong competition is foreseen with big industry at product level and also a major difficulty to introduce SAT as a topic of interest at transport system level.

R&D topics for Aeronautics and Air Transport in 2012 - 2013

Innovation in AAT is being promoted by a coherent set of RD&I actions at various levels of technology readiness going from future technologies (Level-0 – open for the second time in FP7-AAT) via upstream research on specific technologies (Level-1) to technology integration (Level-2) and demonstrators (Level-3: "Clean Sky" and “SESAR”). From research and technology development to market, all actors will be present in project partnerships. The key industrial participants are expected to bring innovative products and services to the market, particularly in downstream research.

Work Programme 2013 will put particular emphasis on technology integration (Level-2) in order to strike an equal balance between focused projects and integrated projects over the entire duration of FP7 (5 – 6 topics foreseen). Topics for addressing the three challenges mentioned above will be selected, complementing the demonstration work in the Clean Sky's Integrated Technology Demonstrators and SESAR. This type of approach is particularly well suited to address the innovation phase (obstacles to exploitation, aspects related to certification, etc.).

Currently, the scope deals with large scale efforts in the field of big aeronautical industry:

- greening, with engine low pressure systems compatible with very high overall pressure ratios for fuel saving and active wing for drag reduction;
- safety and security, with improved avionics, capacity to face volcanic ash and other atmospheric hazards and integrated approach to aircraft security;
- cost efficiency and competitiveness, with integrated approach to maintenance and novel approach to on-board power generation.

For WP 2013 it is very difficult for SAT community to identify a dedicated topic in L2 area. The third scope might be a possibility, but given the relevance of the SAT industrial community and their relevance at EU level, a successful participation is not possible at this moment.

To address challenges 1 (decarbonisation and eco-innovation) and 3 (competitiveness) upstream research (Level-1) will focus mainly on two activities : The Greening of Air Transport, Improving Cost Efficiency and Pioneering the Air Transport of the Future.

Research will focus on lower fuel consumption, lighter and more silent aircraft as well as on intelligent computer based design tools and fast, economic and environmentally friendly manufacturing techniques. These are topics of SAT interest, and potential areas for development at L1 type of instruments are possible.

The other activities, 'Increasing Time Efficiency', 'Customer satisfaction and safety', 'Protection of Aircraft and passengers' (all three related to challenge 2) will be open for a limited number of topics selected from the gap analysis of previous calls and ensuring complementarity with research undertaken in Level-2 and Level-0, also possible for SAT.

Besides general interest topics, there is a possibility for research in several topics of interest for SAT, as follows:

T1 - UAV/UAS and the 'More Autonomous' goal

It's true that such vehicles as UAS/UAV today mostly find their application in the Military/National security domains, and those who have a civil application (surveillance, fire-watching, etc.) don't fit in the true (commercial) Air Transport category, as no application is yet envisaged with (paying-) passengers onboard. However, it could be envisaged to have some research in this field, in order to cover the "More autonomous" ACARE goal (SRA1/2) and continue to work on the field of UAV integration in Air Traffic. For example, a level-1 project could be envisaged on this theme in one of the 2 calls.

T2 - Alternative fuels and energy efficiency

In order to respond to fossil fuel depletion as well as mitigating global warming, all levers must continue to be developed. In the short to medium term, the most promising pillar is RDT in terms of aviation fuel efficiency and consumption reduction technologies (general architecture, airframe, engine, operational measures, optimization of onboard global energy environment, etc.) in order to reduce fuel consumption and emissions. At a longer horizon, new 'drop-in' biofuels could also bring benefits, mainly for small aircrafts.

However, 90%.../95% of the needs and present issues regarding the development of future alternative fuels in our societies (for all today's fuel users) concern investment in biomass and bio refineries development and deployment. These needs and efforts, shared by different fuel users, are not directly relevant to the Aviation community, and are carried in particular by the

Energy (bio refinery) and Agriculture (biomass, forestry waste, algae, etc) domains, and large programmes are being launched in these fields (e.g. EBTP, EIBI, SET Plan). However, it could be envisaged to continue the RDT needs specific to future envisaged aviation 'drop-in' Jetfuels. This theme was also covered in the ACARE SRA addendum (Nov 2008).

T3 - The concept of 'holistic and seamless transport'

This is off course seducing words, but this concept needs to be clarified. In addition, as mentioned by the Commission, 'Seamless transport' relates much more on harmonisation, information exchange, investing money locally in infrastructures, systems and/or logistics, political will to implement and deploy, and not much on research, technology and innovation, as most of the innovative technologies and systems are already identified and validated (RFID, CRS, system/system of system architecture, ICTs, smart corridors, system-wide information system, command-and-control, etc.).

Therefore, this concept is less relevant to FP and RTD that it seems, and SAT could make an entry, launching some further studies on this general concept, in a complementary way with all the different activities that are ongoing on the subject of inter-modality, synchro-modality, co-modality, multi-modality or cross-modality, etc.

T4 - AAT SMEs and Intermediate-sized enterprises (and ISE 'mid-caps')

Since FP6 and in FP7, the SME participation and EC-funding has continuously increased in AAT (as presented in many EC presentation). The trend is generally satisfactory, as compared to FP6, and it is expected to see the SME participation remain high or increase. The efforts towards increasing AAT SMEs' participation are to be continued. In Aeronautics and Aviation, it's also important that SMEs continue to team-up with bigger enterprises to be able to benefit from the long-term/cycle vision of the world's markets and therefore to be able to anticipate and conduct promising RTD.

As the successful SMEs grow into bigger enterprises, SAT might benefit from dedicated support in order to move towards "prime" status for vehicles in CS-23 category.

C.2 FP Horizon 2020 new instruments

SAT community is interested to enable specific/dedicated RD&I activities in future FP Horizon 2020, both at product level (small aircraft, possible CS-23 category) and at transport system level, mainly with respect to the regional transportation alternative for current ATS.

In the next FP Horizon 2020 research will be possible in a generic way as it was the case in FP7, for all areas of potential technological interest for SAT community. However, it is in SAT community interest to identify specific instruments tailored for the specificities of SAT, or the possibility for be part of those instruments where SAT may bring the requested added value, mainly in collaboration with big aircraft industry and future ATS.

Air transport is a major economic asset for Europe. Aviation as a RDT driver is key for Europe's competitiveness, economic growth and social welfare, especially for aviation where a fierce world competition (technology is the major differentiator in the world's competition). Future FP Horizon 2020 will have a special interest un domains like aviation, with the longest cycles (20 to 30 years), and biggest intensities in terms of technologies and capital investments :

- as a tool to foster the integration of the single market
- as a strong global competitor, facing new threats from emerging competitors
- as enabler for an open and inclusive society
- as source of pollution and climate change

Special instruments for R&DTI in next FP Horizon 2020 will have to :

- increase efficiency and value added, improve aviation technology leadership and European competitiveness
- to decouple economic growth and adverse impacts of traffic
- to make "Ultra-Green and efficient Aircraft and seamless aviation" (see 'Flighpath 2050') a fully validated and de-risked option, by demonstrating and validating the breakthrough technologies over many years (continuity is needed)

- to develop quieter, safer, more efficient vehicles and make electric vehicles a fully viable option
- to promote intermodality and effective alternatives to road transport
- to accelerate the deployment of intelligent transport technologies and systems

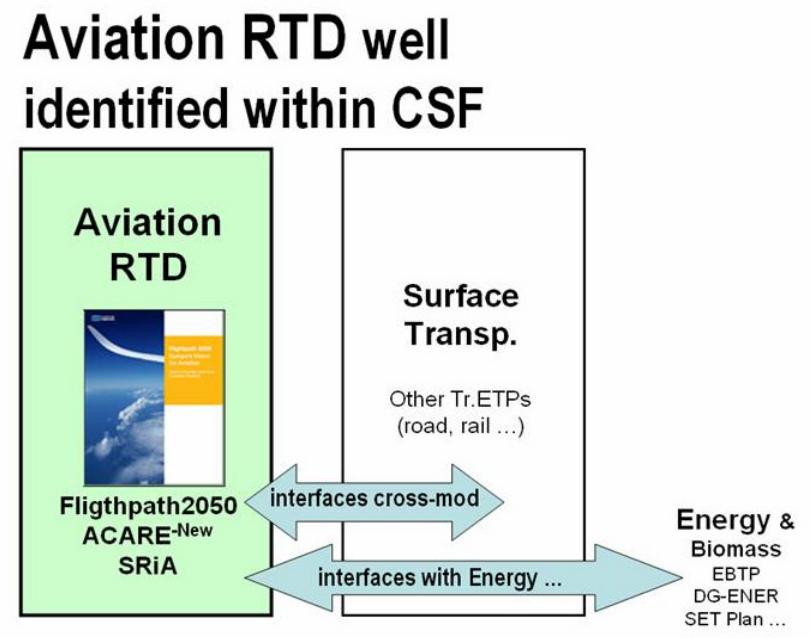

Figure 2 – Aviation research in FP Horizon 2020

In this context, there is a possibility for 2 major instruments to be introduced for SAT community potential interest :

- SAT in Clean Sky 2
- SAT in a JRI

C.3 SAT in future Clean Sky 2

Under Framework Programme 7 the European Commission introduced the Joint Technology Initiative (JTI) as a new instrument to implement the Strategic Research Agendas (SRAs) of a limited number of European Technology Platforms (ETPs). The aim of the JTI instrument is to increase coordination for Research and Technology Demonstration in such a way that it enables the necessary leadership and coordination to achieve ambitious research and technology demonstration objectives.

One of the proposals that the Commission brought to the Council was the Clean Sky JTI. It focuses on the greening of the Air Transport System by speeding up technological developments and shortening the time to market for new solutions to be demonstrated in Integrated Technology Demonstrators (ITDs). Thus Clean Sky aims at covering a significant part of the ACARE Strategic Research Agenda.

Since its beginning the Clean Sky Joint Technology Initiative (JTI) is proving to be an effective instrument to mature and demonstrate promising greening technologies and innovations. Clean Sky brings clear added-value to Europe and involves a wide community of stakeholders across Europe with around 500 partners today and with a very high SME involvement in Calls for Proposals. About 40% of the activities open to calls are won by SMEs.

While improving and opening further CS activities, our general view supports the preparation of a future JTI "Clean Sky 2" within the coming Framework Programme FP Horizon 2020. In the preparation of this future JTI the lessons learned and successes of Clean Sky 1 should be taken into account in order to improve the JTI instrument further.

In the Clean Sky 2 initiative, the content proposed is manly based on the big industry requirements and interests. In order to enable SAT community to participate to future CS2, some recommendations have been provided from the ACARE Member States Group, as follows:

1. The scope of Clean Sky should address the expectations of both the public and private stakeholders. The scope therefore is focused on societal issues as well as competitive issues. Delivering jobs and boosting economic growth, sustainable mobility and green products are considered to be major public issues.

2. During the development phase of CS 2, clear technological targets are set, in line with FP2050 goals.

3. The focus and content is communicated widely to promote its general acceptance. At the moment the visibility of the definition of Clean Sky 2 is growing and a wider audience should be involved.

4. In terms of CS2 structure, advanced (flying) 'air vehicle' technology demonstrators have to be considered as well as cross-cutting demonstrators, thus giving a larger role for first tier supplier companies in decision making positions to drive European competitiveness and the take-up of their systems in the market. For each technology demonstrator a convincing case has to be made for its' overall industrial, economic and societal benefits. Before it starts each technology demonstrator proposal should be assessed against a set of well-defined and appropriate criteria..

5. The number of ITDs could be increased with each ITD focusing on a well-defined and clear demo. **SAT might be a possibility**. In this way the number of Associates could be increased and the overhead be decreased.

6. A more flexible model with some strands lasting less than the full period of CS2 could be envisaged.

7. Clean Sky 2 should accommodate a number of cross cutting short & mid-term technology demonstration topics, thus attracting more industrial partners including SMEs. Product development should be excluded from the CS2 activities.

8. The ITD leaders need to have a stronger role with respect to technical content/targets. Current CS experience shows that meeting technical objectives in specific ITDs is only possible with clear responsibilities and powers at ITD level.

9. The technical content should not be too rigidly defined at the start for the whole 7 years. A clear roadmap of technical progress should be established including decision-making points, technological milestones and activities for the different types of members.

10. It is important that CS2 continues to call for higher TRL topics. These are best suited for the large majority of supply chain SMEs because they are much closer to the market. One partner applications should be continued, as they correspond well to the mode of operation of SMEs.

11. Within CS2 low TRL level topics without probable application or use in Clean Sky should be avoided. Lower TRL level topics should be under the regular H2020 calls (e.g. Collaborative Research). For increased coherence towards ACARE SRIA goal coverage, CS2 could include some lower TRL topics, when directly related to its objectives and scope. Topics, related to but not part of CS2, should be open in Collaborative research.

12. The added benefit of Clean Sky 2 compared to Clean Sky 1 needs to be clear. As in CS1, the CS2 JTI should fulfill all of the following criteria:

- give added value at Union level;
- impact industrial competitiveness, sustainable growth and socio-economic issues;
- the long-term commitment from all partners based on a shared vision and clearly defined objectives;
- have the scale to match the resources involved and the ability to leverage additional investments in research and innovation;

SAT proposed integration in future Clean Sky 2 is presented in ANNEX

C.4 SAT as a JRI in FP Horizon 2020

A JRI – Joint Research Initiative in the light of FP Horizon 2020 is a new instrument motivated by the real need in the R&D community. The JRI as an instrument was already investigated by several aeronautical associations (e.g. EREA) with the following arguments:

- Currently a lot of organizations in but also outside aeronautics are bringing arguments towards European Parliament and Council that apart from the intermodal approach also a modal specific approach is necessary in the transport challenge in FP Horizon 2020. The partial agreement decided on 31 May 2012 by the European Council on Competitiveness includes the intermodal as well as the modal specific approach for transport. Therefore it is most likely that in FP Horizon 2020 still mode specific (in particular aeronautics specific) actions will be included in the Work Programmes, even if and when there is no dedicated aeronautical budget line (as already experienced in FP2, FP3 and FP4). In that sense the JRI approach is not limited to aeronautics.

- In general the JRI should work on long term solutions for societal demands in aviation (e.g. safety, eco-innovation, seamless mobility,…).

- The perimeter of the JRI for aviation should cover the entire Air Transport System and its integration into the global transport system, in particular addressing inter-modality in terms of interfaces. This is in line with the Societal Challenge smart, green and integrated Transport under FP Horizon 2020.

- The Council proposes the continuation of the current FP instruments. These already give the possibility to include the JRI into FP Horizon 2020 as a complementary instrument to the industry focused JTI instrument. Nationally funded research organizations are envisaged to have a similar role in a JRI like industry has in a JTI.

- A Joint Research Initiative for aviation should focus mainly on the lower technology readiness levels (TRLs 1-2-3-4), whereas the Joint Technology Initiatives already focus mainly on the higher TRLs.

- The idea of a JRI is not new and similar initiatives already exist under FP7. Similar approaches are in the Energy sector, Future and Emerging Technologies (FET) - Flagships and AERTOs as a more general example. But further JRI related approaches are known from surface transport (ECTRI), environment (ECRA) and health.

- A Joint Research Initiative for aviation should propagate the knowledge available within aviation and aeronautics that could also be of use for other modalities. In establishing links with other modalities, aviation should be taken as the starting point.

A SAT JRI is a viable option, as long as research proposed fulfill these criteria:

- The topic is in line with Flight Path 2050 and the ACARE SRIA.
- The topic fits in FP Horizon 2020.
- The topic does not duplicate other EU initiatives or National Programmes.
- There has to be a long term scientific need.
- Technology integration in a product has to be feasible.
- There has to be a long term industrial need.
- There has to be a critical mass in term of participation.
- Participants should be able commit resources over 5 or 7 years with mid-terms checks (stop or go).
- The joint programme should aim at TRL 4.

Some of the participants in SAT-Rdmp project are already members of associations like EREA. Results from earlier studies (E4U, EREA ATS studies etc.) may be considered as a guideline to identify research topics and to enable a SAT JRI.

Part D - Recommendation on future SAT R&D - timing

Calls in current FP7 EU Framework is a primary objective for future SAT related activities. Future Horizon 2020 is a framework for strategic partnerships and long term planning. The Workprogram 2013 was under preparation using the basic procedures and timing from the Commission, starting end 2011. It was a major opportunity for stakeholders in SAT area to enable a discussion and to influence the content.

The Commission has released for dissemination the Issues Paper: Towards Work Programmes 2012-13 for Transport and basic content for WP 2013 'Skeleton' – Overview of Topics – a list of topics which were open for being placed in the upcoming call for the Work Programme 2013. On the numerous topics listed, there was also some room for a constructive discussion in the Transport Programme Committee for SAT topics.

From the all 4 type of instruments in the complete RDI chain (L0, L1, L2, L3), specific targeted areas of major interest for SAT are linked to L0 instrument.

L0 – This specific open Call targets breakthrough technologies and concepts that have a potential to bring step changes in Aeronautics and Air Transport. The Call covers exclusively Activity 6: Pioneering the Air Transport of the Future i.e. technologies and concepts that have the potential to bring step changes to European aeronautics and air transport in the second half of this century and beyond.

Since this instrument is based on reduced budget, the interest for SAT was to clearly differentiate between L0s and L1s 'pioneering', and to really target upstream R&T, which is much less costly than higher TRL projects. SAT was considered an area to benefit from this instrument.

Also, L0s topics should be opened to all contributions, as 'brilliant ideas' can emerge from all kinds of organisations or individuals: industries' concept & innovation departments, research establishments (EREA), aeronautics SME as well as individual researchers or organisation, from academia, laboratories, thus contributing to a critical mass in SAT community.

A second reference in the calendar is linked to Innovation.

Following the Commission's Communication on the Innovation Union, the Innovation dimension has been introduced in a selected number of Topics of this Work Programme.
Specifically in Aeronautics and Air Transport, the following Topics for Support Actions are addressing Innovation:

AAT.2012.7-XX. Identifying barriers to innovation in aeronautics and air transport.
AAT.2012.7-XX. Fostering innovation in Framework Programme funded research projects.

In addition, specific recommendations were made to identify bottlenecks preventing innovation in some specific Topics such as:

AAT..2012.1.1-6. Biofuels for aviation
AAT.2012.3.x.x. Integrated approach to safe operations under crew peak workload / reduced crew configuration (L2)
AAT.2012.4.x-x. Integrated approach to lean manufacturing of composite and hybrid aircraft / engine structures (L2)
AAT.2012.x.x Enhancing strategic international cooperation with Japan in the field of intelligent icing detection.

Major potential area of interest was for “Cross-cutting activities”. Topics with relevance for SAT :

- Support for Innovation in AAT
- Insertion of UAS in the Air transport system
- The passenger centred time efficient airport
- Co-modality from the Air transport perspective
- Facilitating access to aircraft for disabled people (in particular with wheelchair).
- Attracting/Awareness of future engineers to carriers in the field of aeronautics through research

A special interest in the R&D agenda is for a very important action initiated as: JOINT CALL WITH ENERGY ON ALTERNATIVE FUELS FOR AVIATION.

In the text of the call we have clear reference for a SAT topic : "Sustainable alternative fuels for aviation: Production of alternative fuels, engine demonstration (i.e. compatibility with aircraft engine and emission regulations), barriers to use of alternative fuels in aviation (Innovation)"

There is a unique opportunity for SAT community to participate with a dedicated demonstration in an area of high impact and potential new developments.

Conclusions

Major areas for research and needs for future R&D for year 2020 and in the 2035 perspective are identified. Several reconditions for future research topics, content and timing have been presented for:

- Continuous incremental R&D developments based on on-going research topics
- New topics for research
- Demonstration activities for SAT system
- Framework and specific instruments for SAT R&D
- Timing for SAT R&D activities
- Synergies

Several suggestions for direct actions in respect to the Common Vision and future SAT development strategy have been proposed. They are based on current structure of the FP Horizon 2020 and major topics.

SAT will continue to be supported by the basic R&D instruments, as a continuous development in aeronautics and ATS. In this context, SAT will have its needs included in the topics of interest and will benefit from relevant synergies.

SAT community has a potential to be part of future instruments in FP Horizon 2020. This is mainly linked to the following areas:

- SAT to be part of future Clean Sky 2
- SAT as a JRI

Successful integration of SAT community at this level, however, is strongly dependent on the successful dissemination of major potential benefits of SAT and the increasing level of support in the industry.

REFERENCES

1. Future Framework Programme for Research and Innovation in the EU: CSF (Common Strategic Framework for Research and innovation).
2. Flightpath 2050
3. FP Horizon 2020

ANNEX

Position paper on Clean Sky 2 by the SAT Roadmap Team

Version 11 June 2012

Position paper on Clean Sky 2 by the SAT Roadmap Team

Version 11 June 2012

1. Focus

The current Clean Sky focus is on large aircraft, regional aircraft and rotorcraft, as well as engines, systems and green design and production.

In view of the goals of the Commission and the Transport Sector to achieve environmentally friendly multimodal trips door-to-door within 4 hours in Europe, the SAT Roadmap (Small Aircraft Transport – Roadmap) Team proposes to continue research and technology development in Horizon 2020 and to introduce in Clean Sky 2 demonstration and validation activities for innovative small commercial aircraft (fixed wing and and rotorcraft) technologies and small aircraft operations, as an option of the Green Regional Aircraft ITD extension.

As it is envisaged in the Flight Path 2050 and the new SRIA, 4hour door to door challenge is a goal for the future multimodal transport system and an opportunity for new innovative air services in an intermodal transport environment; as a consequence a variety of transport services tailored to individual needs should be developed.

A fully developed small aircraft transportation mode (for both passenger and freight) will be able to ensure **4 hour environmentally friendly trips** on thin routes, to open up regions in Europe that have a bad surface transport infrastructure (including Mediterranean Sea areas) enabling accessibility to transport and economic growth. The SAT system will partially substitute car travel (for passengers) and small truck transport (for regional freight transport), and alleviate some of the serious European road congestion problems in the future; this transport mode substitution will ensure a much lower environmental impact. A specific activity should be introduced also in the Technology Evaluator looking to this new component of the transport mode. Small aircraft transport is a new component of the European Air Transport System and complementing existing ATS service and not a competing mode. It responds to further market segmentation by offering local and regional air transport services at a

competitive price. The services will be provided by a family of small aircraft (e.g. from 4 to 19 seats) operating in appropriate business models (scheduled air transport services, per seat on demand (shared trips), per aircraft on demand (air-taxi)).

Small aircraft transportation will enable the use of local and regional airfields in Europe (more than 2500 airfields) which are easily accessible to a large set of European population. New vertiports can be established. Also hydro planes can be built at a low costs to serve Europe's extensive shores.

Small aircraft transportation will be a customer-oriented system fulfilling expectations of future travellers which include **personalized travel**, with individual tailoring of the travelling experience.

Ensuring R&TD, demonstration and validation activities for small aircraft design and production (both fixed wing, rotorcraft and advanced novel configurations) as well as for ICT systems, enabling a seamless, green, integration with other transport modes will stimulate the revitalisation of the relevant European manufacturing industry and will help to improve the European trade balance, creating a level playing field with US industry which is able to capture large part of the European market. As the Chinese industry has a focus on small aircraft development, as well and stiff competition is expected from other continents, Europe needs to secure its place in this segment.

As there is a clear case of market failure, public support is justified.

Small aircraft need their own research and technology focus, as these aircraft have a different spectrum of usage and operations with respect to large commercial aircraft.

Small Aircraft Transport development faces big challenges: a key point is the capability for low cost solutions and this will be obtained by a system approach. The fleet of the SAT might consists of unified and modular families of 4-19 seats fixed wing aircraft, and rotorcraft designed to serve markets with services on diverse and low-density routes. Aircraft configurations will be designed also to fulfill low noise foot print (e.g. QVTOL/QSTOL) and low emissions. Aircraft propulsion (including electric propulsion) is optimized for designated mission. Aircraft maintenance and airworthiness is carried out within a joint system of services. Aircraft and crews are deployed so as to ensure minimum number of empty flights and greater operating flexibility and effectiveness of the system; the transport of freight (e.g. parcels, small pallets) during night or mixed with passenger is a possible approach to increase the load factor. Fleet and transport services management will be net-centric and automated. Advanced low cost, low weight and small volume avionics will ensure future small aircraft to fly adverse weather conditions, during night and in general in IMC, thus ensuring safety and reliability of service.

Future small aircraft will be operated by a single pilot in IMC conditions, may be remotely piloted or in the long term be fully autonomous. Specific avionics for small aircraft is one of the focus for future activities in CS2.

Currently SESAR is focused on demonstrating technologies for large airliners and scheduled flights. At this point in time it does not take fully into account the introduction of a small aircraft transport mode. As a consequence ATM for small aircraft operations should be part of Clean Sky2 unless the concept of operations of SESAR is changed.

History has shown that small aircraft are often at the forefront of technology. Modern small aircraft are in many respects more advanced that larger planes. (Laminar flow is already used in business jets, very advanced avionics including enhanced vision systems are already used in small aircraft).

The SAT roadmap project has shown that there is a substantial market for small aircraft operations in Europe. It has also identified in which areas integrated technology validation and demonstration needs to be done to allow the European industry to gain a world leading position. Demonstration projects are needed both in the area of aircraft technologies and X-planes as well as in the area of novel business models.

2. European small aircraft industry

In the SAT project the capabilities for small aircraft production, airframes (wings) and small engines , exploitable within the scope of door-to-door transport, are assessed.

The analysis shows:

- 17 manufacturers of small aircraft according to CS-23, CS-27 and CS-29 (5 manufactures of helicopters),
- 16 manufacturers ultra-light aircraft (1 manufacture of UL helicopter),
- 17 manufacturers of piston engines (1 manufacture of Wankel engine),
- 5 manufacturers of turboprop engines,
- 6 manufacturers of jet engines,
- 11 manufacturers focused on production of airframe parts for GA aircraft,
- 2 manufacturers focused on production of engine parts for GA aircraft

SAT consortium (14 Partners) include following industrial Partners:

- **Evektor, spol. s r. o (EV) – Czech Republic**
- **Piaggio Aero Industries (PIAGGIO) – Italy**
- **Polskie Zakłady Lotnicze sp. z o.o. w Mielcu (PZL M) – Poland**

It should be mentioned that European small aircraft manufacturers are often firms of long tradition. Successful implementation of small aircraft transport in Europe would strengthen them, focusing them around modern, large in amount products, enabling business stabilization. So, it will be significant factor of European economy growth.