

# **Creative thinking about the future of civil aviation; The CREATE project**

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## **Abstract**

Aviation is facing new challenges that require step changes as in the past. To stimulate the generation of novel, creative ideas that may lead to these step changes, the Create project proposed a process to generate, develop, assess and incubate novel ideas. The process was proposed to the European Commission as some public support will be needed to develop these ideas, since these would lead to market innovations only after a considerable time. And it is unlikely that private persons or organisations will devote resources to developments that will provide a return on investment only after a long period. In the 5th call for proposals the European Commission plans to support some elements of the Create process. European and Russian organisations are encouraged to respond to that opportunity.

## **1. Introduction**

In the past the development of air transport was basically driven by the desire to fly faster, further and with more payload. Critical elements were aircraft weight, drag reduction and improved engines. The development was characterized by step changes like the metal airplane, the jet engine, wide body airplanes and supersonic transport.

Although the global demand for air transport is primarily determined by the increase of global GDP, the aviation sector tried to stimulate demand by lowering the ticket cost. This was initially accomplished by increasing productivity of aircraft (speed, capacity and utilization). As increasing productivity became more difficult to accomplish ( the sound barrier, the 80x80 box at airports etc.) and fuel cost were increasing, new initiatives were taken by the sector to reduce cost. Efficient aircraft, efficient flight operations (like ETOPS) and new business models (like Low Cost Carriers) were developed to reduce the cost side of the equation. In the past 40 years research was primarily aimed at cost reduction.

New challenges have emerged in the mean time: Congestion, environmental concerns, scarce resources, security, more customer friendly orientation and global competition. These challenges have to be addressed in the context of a globalised, increasingly competitive and highly integrated seamless air transport system. As current technology does not seem to provide sufficient solutions to respond to all these new challenges: new step changes in air transport are needed. However the financial pressures on the aviation market mean that the focus in the sector is increasingly short term, risk averse and oriented to parts of the total air transport system only. Innovative ideas that may lead to step changes generally do not find support because they are often long term and carry high risks. This constitutes a market failure in the sector. How to break the mould of the past?

## **2. Thinking Out of the Box**

In 2006 the European Commission supported a small project that aimed at generating novel ideas for the air transport of the future by organizing workshops to which different stakeholders were invited. After classification of the ideas, the ideas were assessed and the best ideas were proposed to the Commission for research funding under the Seventh Framework program of the EU. The results of the Out of the Box project were widely disseminated. During the EUCASS conference in 2007, a status report was given on the results obtained. The results were also provided to EREA, the association of European research establishments, universities and the European industry. Considerable interest in the press also helped to disseminate the results. Since 2008, several EU research projects were based on the ideas generated in the Out of the Box project. And the stakeholders started to realize that creative thinking is

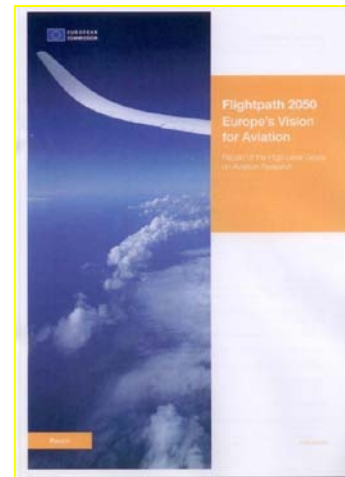
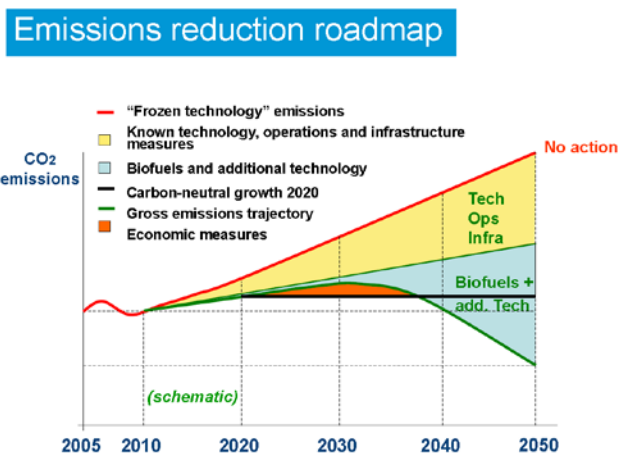
needed to prepare the future. Even in the US, people started to question if aeronautical engineers were still able to dream and come up with unconventional ideas for the future. By now all stakeholders seem to be convinced that incremental changes in technologies will be insufficient to solve the problems in the future. Many are now trying to set creative thinking in motion again.

### 3. The Create project

The European Commission supported a follow-on project called CREATE to develop a system approach that will stimulate the preparation of innovative and creative ideas for the future air transport system. In the CREATE project several partners participated including ASD, QuinetiQ, NIVR, Dieter Schmitt, Bauhaus, TU Munchen as well as Trevor Truman and Adriaan de Graaff. The last two initiated the Out of the Box workshops in Europe. The Create project was executed between 2008 and 2010.

The relevance of the CREATE project became even more clear after the publication in 2011 of the new European vision for aviation in 2050 ( The Flight path 2050 document). Several exiting goals were formulated by a high level group of European stakeholders.

One of the most demanding is the reduction of CO2 emissions from air transport by 75% compared to the emission level of the year 2000.



But the vision also demands seamless door to door travel, using intermodal transport chains in which aviation should be fully integrated.

In addition the Vision advocates a very safe and secure air transport system.

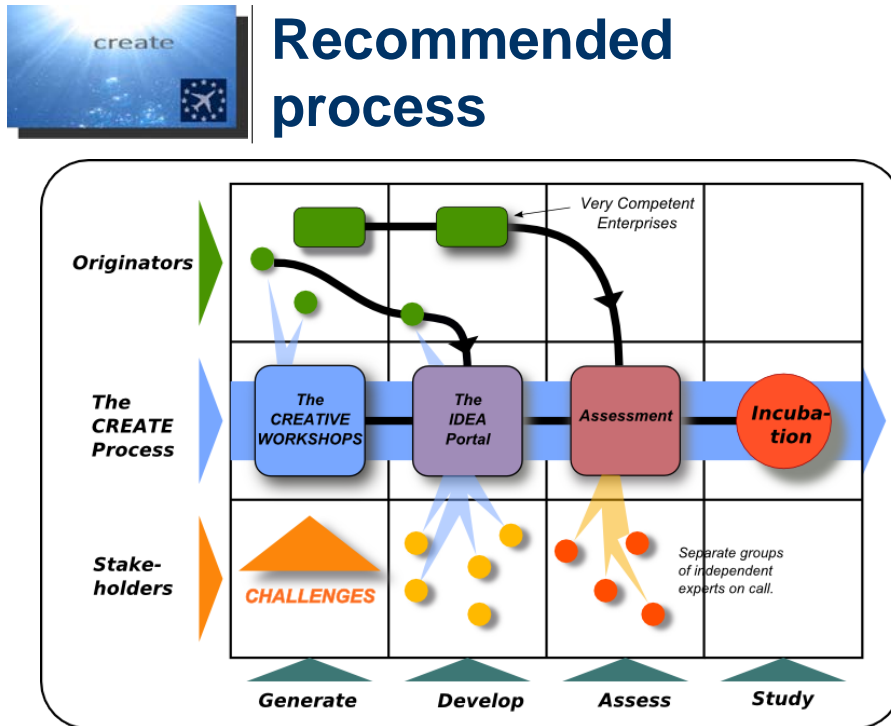
These and other goals identified are a real challenge for the aviation community. Solutions cannot be found by relying on incremental improvement in current research: totally new creative solutions are needed to comply with these far reaching goals.

The **CREATE process** is specifically aimed at encouraging the generation of original ideas for new concepts and breakthrough technologies, the selection of the most promising ideas and a mechanism to fund the initial development of the ideas with support of the European Union's Framework Program.

Major elements of the process are

- Generating ideas: this can be stimulated by organizing more creative workshops on Out of the Box thinking
- Developing initial ideas so that proposals for research projects can be made ( the idea portal)
- Evaluation of proposals by a new assessment method and based on appropriate criteria
- Incubation funding: fund the initial development of a proposed solution so that the proposal can become robust. Incubation is like the nursery of a child that needs a protected environment to grow in the initial

phases of life. After a short incubation phase the project - if successful- can be developed into a regular research activity that can compete with more incremental research proposals.



It is to be expected that large companies (like Airbus) will be able to formulate their own long term ideas for future concepts and technologies. So they may not want to use workshops and the Idea portal to develop these ideas up to a stage where a project proposal can be formulated. However, innovative ideas often originate in small companies and by individuals. They may need some assistance from other stakeholders to make a robust proposal before assessment. This is especially so because a coherent view on the total air transport system is often missing: each part of the air transport system is optimizing its own objective for their subsystem (airlines, airports, ATM, the aircraft industry etc) but the solutions that are implemented may not lead to an optimized total system. It is that total system approach that the Idea portal is trying to stimulate with the help of stakeholders coming from different stakeholder communities. The original Vision 2020 that gave guidance to air transport and aeronautics research in Europe contained several targets that could be competing with each other. An ultra green air transport system would probably not lead to an ultra efficient air transport system for instance. If aviation is to be part of a true intermodal transport chain, aircraft would probably need to be adapted to serve that chain. So there are many trade off's to be made and the Idea portal would help the originators of ideas to look beyond the fence and make those trade off's at an early stage of the research.

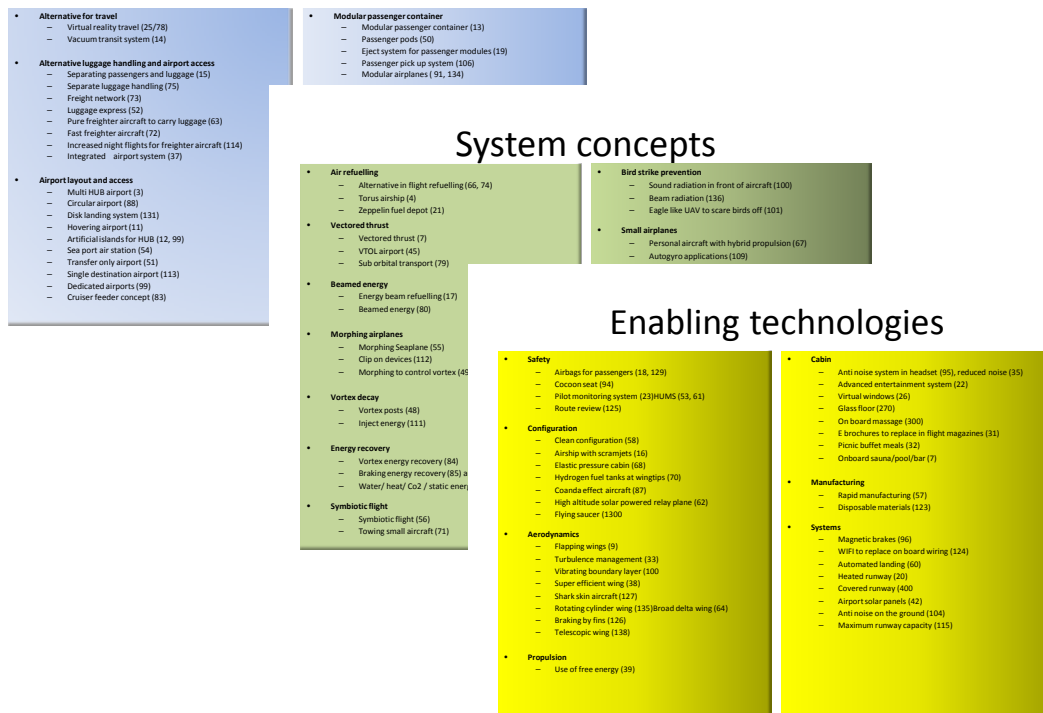
The Create project demonstrated the added value of this approach: during a trial assessment many issues came up that needed more attention and should have been looked at in a Idea portal already.

#### 4. The Create workshop

As part of the Create project another Out of the Box workshop was organized. It was decided to try another approach than in the previous one. Rather than inviting a large number of different stakeholders to a three day workshop, the Create project invited European PhD students for the workshop. It was hoped that these students would be able to generate ideas free from short term pressures as exist in industry and research organisations to make short term

returns on investments. Although some 130 ideas were tabled, many of them proved to be short term practical solutions that would not create a step change in aviation. It seems that workshops need to be composed of both young and experienced people coming from different backgrounds to obtain the best results.

## System of system concepts



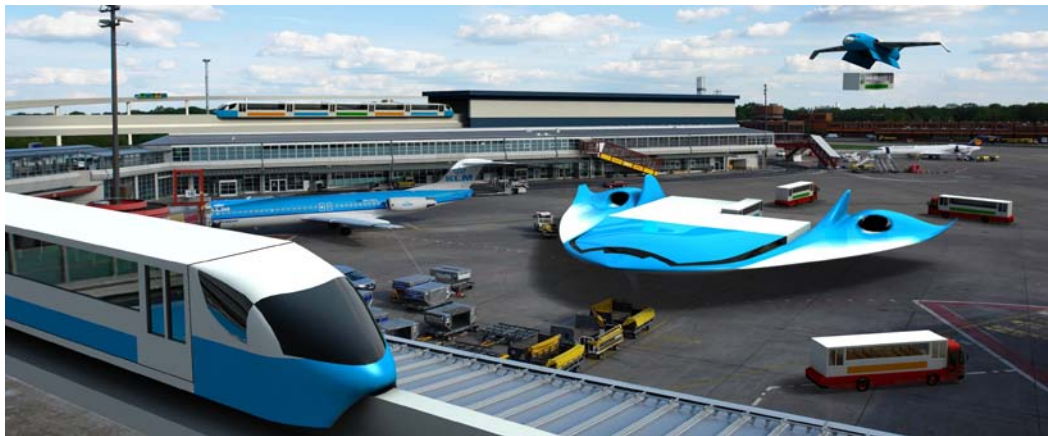
The ideas brought forward in the workshop were classified as addressing the air transport system as a whole, being a system of systems, the system concepts and enabling technologies.

Apart from discussing novel IT technologies that may make travel for leisure less desirable in the future, many discussions were focused on improving the link between passengers and the aircraft in a multi modal transport chain. One of the most promising ideas is to use universal travelling pods or containers that can be used on surface transport means and on aircraft. These would facilitate the transfer between different transport modes. A similar system could be used for cargo, if appropriate containers were to be used. As air cargo containers would need to be lightweight, the size of these containers would be slightly smaller than those used for road transport and shipping so that the lightweight containers would fit into the standard steel containers used today.

Another issue was the future layout of airports. Ideas like a slowly turning terminal apron, vertiports, heliports etc. were developed. Overall the emphasis was on serving the passenger much more than is practice today. Yet another topic was the alternative way to launch aircraft to reduce energy and noise at airports. Optimized flight by the optimal use of formation flying was another topic discussed.

Advanced cabin layout, alternative aircraft configurations, wing in ground effect aircraft, and supersonic flight was also addressed. Alternative propulsion options were discussed. A major focus was on novel ideas for small aircraft and personal aircraft to complement the current air transport system.

The enabling technologies focused amongst others on the recovery of vortex energy during flight, as well as the recovery of CO<sub>2</sub> and water from the engines. Below are illustrations that show some of the ideas generated during the workshop.



The Create project recommended that the European Commission would fund future workshops. There could be a workshop every year although the focus of these workshops could differ. It could mean that some workshops will address a specific topic rather than the current broad approach.

### **5 The Idea portal**

Although the Idea portal was not fully tested during the Create project, the experience gained was very promising. Especially the contact to experts coming from different backgrounds helped to strengthen the initial ideas and make these more robust. The issue of IRP was discussed during the Create project but it looks as if IPR is not a real issue as the creative ideas still have a long way to go before they can be implemented into the air transport system and lead

to real innovations. The Create project recommended that the European commission would support the Idea portal activities to ensure that sufficiently mature proposals would be submitted on European or national level.

## **6 Technology Watch and Innopedia**

The Create project examined if a technology watch facility at European scale would be worthwhile. Two different approaches were tested. The first is a generic search function where the aviation community at large would be alerted to relevant developments in other technology domains. The second option was the technology watch based on a search system on demand of individual organisations. Although the technology watch function proved its value during the project, it was not recommended to the European commission to set up a publicly funded process.

An alert system for aviation would be very difficult to establish. To do so would require a large Technology watch activity across many disciplines and sectors. The return on investment for the Commission would probably be very low.

It is feasible to establish a search based technology watch system. The collaboration between the user as domain expert and the information scientist as operator of the system would be vital. The Create project did not recommend to the Commission to start a publicly funded search based technology watch either as this would only mirror existing commercial facilities. The project did however recommend that Small and Medium sized Enterprises (SME's) could be assisted by public means to use search based technology watch facilities as these are often too expensive for small companies to use.

The Create project also tested the possibility to use a dedicated website to collect innovative ideas in aviation. The web portal called Innopedia was set up and experienced a good number of visitors. However very few novel ideas were submitted to the website and discussions amongst visitors of the website were very limited. The key parameter of achieving confirmation that an innopedia site could attract a sufficient number of members to sustain a lively discussion on innovative ideas was not achieved. Consequently the evidence that an Innopedia could be a source of innovative ideas was not established. No recommendation to the European Commission to follow up the Innopedia idea was made.

## **7. Assessment**

During the Create project it became clear that a proper assessment of creative ideas would be an essential element. In case of funding by the European Commission through calls for proposals these assessments would normally be named evaluations.

The Create project concluded that the regular evaluation criteria used by the Commission in the seventh framework program would not be suitable for very long term ideas on the future air transport system. These proposals will need to be judged on their original character and potential long term impact rather than the opportunities to implement them within a time period of a few years. The Create project designed a new set of evaluation criteria and the associated weighting factors. The project tested the criteria in a dummy evaluation using several proposals that came out of the workshop. A number of distinguished experts were selected based on their broad knowledge of aviation and their interest for novel solutions. The activity proved to be very successful and helped to improve the evaluation criteria. It also became apparent that an Idea portal activity is needed to make proposals sufficiently robust for an evaluation.

## **8. Incubation**

The idea behind an incubation phase for innovative ideas is to develop these ideas up to a point where they can compete for funding with proposal for more incremental short term research. The Create project concluded that a two year period would at least be required to develop initial ideas up to that stage. The feasibility study should confirm the benefits of the idea and if possible reduce the perceived risk. Complex novel concepts should be divided into a number of workable sun-units that may be contracted together or separately for incubation. The contractor should be confident that the key incubation aims can be achieved within the cost and time budget for the work. The critical areas for incubation should be arranged in a sequential order that permits those areas of criticality quickly to be addressed first. The incubation contract should provide for reviews. The purpose of the review will be to ascertain that the work is progressing towards achieving the aims of the project. Incubation should not be stopped prematurely unless a critical area of work has been brought to a definite and negative position. Insofar as it may apply (unusually) the proponents of a concept should have recorded their claim to background knowledge before the start of the incubation.

## **9 The Create process in Framework program 7**

The incubation process has not been successfully tested in the aeronautics programme despite a number of Level 1 calls in FP7. This failure was partly due to the funding regime that allowed only limited funding. Also the Commission asked for networks rather than studies on the selected subjects. Furthermore, the topics in the call were predetermined and, in part, these topics were so complex that it proved difficult to make a proposal. Lastly the evaluation criteria of FP 7 were focused on near term research having exploitation in the near future.

The CREATE team therefore recommended that a start should be made to place incubation contracts using an existing mechanism that is applied within Framework 7 (although this mechanism is not within the transport programme).

The mechanism that best suits the need to prove the incubation process is the ICT FET-Open scheme of FP7. Study contracts for incubation could be funded under this scheme at 100% in the transport programme.

Taking the idea of radical innovation concepts under the FET-Open scheme into the existing Work Programme in Aeronautics under FP7, a new category of level 1 projects could be defined but it would be clearer to provide a new name like “Incubation Projects” or “Level 0” projects.

A specific call in the Aeronautics Work programme could be inserted addressing specific topics as “level 0 - Incubation” projects. The topics for the call should be, in the view of the CREATE project, as open as possible to attract the widest level of interest and the greatest number of submissions. The CREATE team view is that these calls should be carefully crafted to emphasise the particular character of the innovations being encouraged whilst not limiting them by reference to the issues of today and to their perceived solutions. The language in the calls should therefore make reference to the longer term challenges that lie ahead for the air transport system, to the many important changes in context that will have important effects on travel, to the changing needs and aspirations of society, and to the changing factors that will determine global development.

The challenge that the call should lay down should be seen to open an exciting possibility for innovative individuals and companies to develop perhaps somewhat immature ideas that may, in due course, be part of a wider portfolio of potential solutions for the mid-century.

The purpose of the Level 0 Incubation projects should be set out as providing funding for the validation and exploration of specific parameters of risk whether these be in the technical, financial, operational or benefit areas. The evaluation criteria for these projects would also need to be specific giving greater prominence to innovative character and the other topics.

## **10 Development within Framework programme 8**

The actions recommended above within FP7 would be useful ways to start incubation contracts. But they do not embody the full aspirations for the CREATE process. It is certain that this must wait until FP8 for realisation.

A new mechanism will be needed that provides one of the essential ingredients of the process – a funding mechanism to permit incubation funding at the level of 95% for any research work that may be needed for the incubation. This funding level is selected as being high enough overcome the financial disincentive to which any long-term, high risk, multi-partner project will be exposed. It need not be at 100% as this would provide a source of risk-free funding for effort without any special incentive to make the idea work. So some balance has to be maintained at the incubation stage to meet both of these criteria and the CREATE team recommended a 95% level.

Under this stable Framework 8 process where confidence in the endeavour continuing is high and stakeholder interest has been developed the need will be for a high level of interest in submitting ideas, developing them for formal submission and taking the best of them forward through incubation. This also requires stimulation from the Work Programme of FP8 in the shape of successive calls for participation.

The calls should have the same nature as described above for the calls under Framework 7, although some additional and changing, focus may be appropriate to reflect changing views of global development in particular with dedicated assessment criteria fit to select innovative ideas.

## **11 Engaging the Aviation Community:**

On the assumption that funding can be negotiated and a process of launch established the next important challenge is creating a supportive climate within the aviation industry. A new Vision for 2050 was published in 2011 and it sets long term goals for air transport in the longer future. These goals will be challenges for which both near term

research and long term research will be needed. With a sufficient public funding stream for incubation it should be possible to raise attention among the stakeholders for long term research efforts.

The Vision document addresses the needs of the long-term. In order to implement these recommendations, and to energise a larger field of activity, an engagement on the part of the Commission will also be needed.

The European Commission is in the first position to publicise the implementation of this new incubation facility supported by the CREATE process. This should be augmented by national, industrial and Trade Association links to take advantage of the numerous conferences to bring this new facility to the attention of as many members of the wider aviation community as possible.

## **12 Next call of FP7**

Although the details of the next call in the aeronautics program of Framework program 7 are not known at the time of writing, the commission has already indicated that it is willing to start Level 0 projects for the remainder of Framework Seven. The Commission also has indicated its intention to change the criteria for evaluation much in line with the recommendations of the CREATE project.

However at the time of writing it is unknown if the Commission is willing to fund studies ( so called CSA-SA) or that the call would be based on normal research projects that allow only 50% funding by the Commission. It is also not yet clear if a 2 stage evaluation process would be followed to allow the Idea Portal mechanism to improve initial proposals between the first and the second stage of the evaluation. Finally it is still unclear if the Commission will enable the yearly Out of the Box workshops and the Idea Portal.

The level 0 projects should provide a good opportunity to combine creative people and ideas from Europe and Russia.

### **References:**

[1] create Team.2010. CREATE, creating innovative air transport technologies for Europe, final report Publication of the Seventh Framework program, European Commission.