

Position Paper of the PEGASUS network on future innovation in aerospace

Europe: keep the jet engine behind innovation in aerospace alive. Invest in long term research and education.

When it comes to the technological application of scientific discoveries, aerospace is by far the leading industry. Even today scientific research is a crucial key for enabling the sector to reach the goals it put forward in the ambitious ACARE Flight Path 2050.

Currently, however, the European funding opportunities focus disproportionately on higher TRL level research and ready-to-market technology. We as European aerospace universities – joined in PEGASUS – believe that a larger portion of the funding in SESAR and CLEAN SKY should be available for research on TRL levels 1 to 4 conducted at universities by MSc and PhD students as well as research assistants, postdocs and professors. Earmarking 5% of the SESAR and CLEAN SKY budgets for a Basic Research Programme will keep the invaluable innovation and human capital source for one of Europe's most strategic sectors vibrant.

Radical innovation and knowledge carriers in aerospace

Research in the TRLs 1 to 4 conducted by the full breadth of academic researchers – from MSc and PhD students to research assistants, postdocs and professors - is essential in the aerospace innovation ecosystem. Why?

It's the jet engine behind radical innovation

Research in the TRLs 1 to 4 is the jet engine behind radical innovation. Not bound by sales targets or restricted by 'local optima' conditions, lower TRL research at universities can initiate step-change innovation. The development of thermoplastic composites illustrates this well. First conceived in the labs at for example TU Delft, they are now a lifeline for the European aerospace industry. The 'open rotor' engine, a result of research started in the 1970s, is now a major project within CLEAN SKY. The European aerospace industry needs this research more than ever to keep a competitive edge and to come up with much needed solutions to society's challenges, such as low emission, low noise and low energy air transport. Noise reduction of aircraft is a major societal challenge. But without a better understanding of the interactions of sound with vorticity and heat only small, incremental improvements can be made.

It offers a perfect mix for creating and carrying new knowledge and true innovation

The mix of researchers in academic communities provide a perfect breeding ground for both creating new knowledge and innovation and feeding them into the innovation ecosystem. Working with professors in international peer groups, and focussing on long term research, MSc and PhD students are the ideal players in the innovation ecosystem to come up with high, risk gain breakthrough technology. In addition, the students – PhDs even more than MSc graduates – carry in-depth knowledge of their fields and of the way research works into industry once they start working there. Many of today's students are tomorrow's industrial leaders. Research assistants, postdocs and professors guarantee continuity and high levels of experience. In addition to that they will create spin-off companies with highly skilled jobs.

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The results benefit Europe

Universities, contrary to industry and knowledge institutes, also disseminate knowledge and innovation by means of patents and scientific publications, which are more and more available open source. This makes knowledge readily available for all. Universities also increasingly bring innovations to the market through spin-off companies.

Europe: funding opportunities for the entire innovation eco-system

Currently, (limited) funding opportunities are available for longer term research by means of the ERC grants, Collaborative Projects and the Future Sky programme led by the research institutes. We as PEGASUS universities believe this is not enough. The aerospace industry is one of Europe's most strategic sectors. To do justice to the complex interconnectedness between disciplines in aerospace, funding should also be available for lower level TRL research in SESAR and CLEANSKY and follow-up programs in future aerospace related EU Framework Programs.

We advise that:

- A Basic Research Programme is introduced that funds research on TRL levels 1 to 4 in CLEANSKY and SESAR and follow-up programs in future aerospace related EU Framework Programs.
- This Basic Research Programme should be governed by universities and fund top-down research conducted by MSc and PhD students, research assistants, postdocs and Professors at universities.
- Contrary to the Clean Sky Academy the Basic Research Programme focuses on peer-reviewed, university-determined topics. This will prevent researchers from just working on topics determined by the industry.
- The subjects should however regularly be reviewed with the industry to ensure they do contribute to relevant issues.
- This programme should be based on an agenda listing the most important long term scientific challenges in this field.
- 5% of the budget of SESAR and CLEANSKY and follow-up programs in future aerospace related EU Framework Programs are secured for lower TRL research in the innovation ecosystem.

Funding the entire eco-system

Currently we believe too much focus and funding is given to high TRL level research – building demonstrators – in CLEANSKY and SESAR. By earmarking 5% of the budget of future SESAR and CLEANSKY and follow-up programs in future aerospace related EU Framework Programs for a Basic Research Programme for academic, application inspired research, the aerospace innovation ecosystem will be covered better. Then funding will represent the entire ecosystem right from the source of innovation at universities through to the companies who bring the new innovations onto the market. It will enable Europe to secure long term perspectives and reach its own goals as set out in the ACARE Flight Path 2050.

The PEGASUS network would be willing to spearhead the preparation of a basic research programme, including a work plan, complementary to CLEANSKY / SESAR in emphasizing promising new technologies not yet close to the market but with strong potential benefit. The

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preparation of such a basic aeronautical research work programme would involve a broad aeronautical academic community beyond the PEGASUS network. This could be the basis for the management of a basic research programme with a modest budget (about 5% of aerospace related programs) but funding a large number of small projects.

The PEGASUS members are:

Czech Technical University (ČVUT) in Prague	Czech Republic
Ecole Nationale de l'Aviation Civile (ENAC)	France
Ecole Nationale Supérieure de Mécanique et d'Aérotechnique (ISAE-ENSMA)	France
Institut Supérieur de l'Aéronautique et de l'Espace (ISAE-SUPAERO)	France
Ecole de l'air	France
Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen	Germany
Technische Universität Berlin	Germany
Technische Universität Braunschweig	Germany
Technische Universität Dresden	Germany
Universität Stuttgart	Germany
Politecnico di Milano	Italy
Politecnico di Torino	Italy
Università degli Studi di Napoli "Federico II"	Italy
Università degli Studi di Pisa	Italy
"Sapienza" Università di Roma	Italy
Delft University of Technology (TU Delft)	The Netherlands
Instituto Superior Tecnico (Universidade Técnica de Lisboa)	Portugal
Politechnika Warszawska	Poland
Universidad Politecnica de Madrid / ETSIAE	Spain
Universidad de Sevilla / ETSI	Spain
Universitat Politècnica de València / ETSID	Spain
Kungl Tekniska Högskolan (KTH)	Sweden
Cranfield University	United Kingdom
University of Bristol	United Kingdom
University of Glasgow	United Kingdom

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