EREA ideas on “Smart and Clean Aviation Moonshot”

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Aviation is a strategic sector for Europe, essential for mobility, economic growth, social connectivity, technological leadership and industrial competitiveness. At the same time, the sector must address major challenges related to decarbonization, digital transformation, strategic autonomy and global competitiveness.

In the legislative proposal for Horizon Europe 2028–2034 (FP10), the idea of a “Moonshot for Smart and Clean Aviation” is mentioned only at a very high level. This creates the opportunity to further define how this new type of large-scale initiative could be designed and governed to effectively position Europe as a global leader in this key strategic technology area.

In this context, the development of a Smart and Clean Aviation Moonshot covering the next European Framework Programme for Research and Innovation and at least the new European Competitiveness Fund (ECF) offers a key opportunity to accelerate the transition towards sustainable, climate-neutral and digitally enabled aviation. This initiative should strengthen Europe’s aviation research and innovation ecosystem and support the full spectrum of activities from fundamental research to large-scale technology demonstrators up to market uptake of future products.

This paper serves to provide European policymakers ideas with concrete ideas and key recommendations to support the design and implementation of the future Smart and Clean Aviation Moonshot. It addresses in particular its Strategic Positioning & Mission, Governance & Funding Model, Project Structure & Innovation Pipeline, Stakeholder Engagement & Collaboration, Technology Focus & Research Priorities, Programmatic Recommendations, and Impact, Dissemination & Communication.

1. Strategic Positioning & Mission

- Ensure the Smart and Clean Aviation Moonshot initiative is designed to position Europe as a global leader in sustainable aviation, with a clear focus on decarbonization, digital transformation, and competitiveness, fostering Europe’s resilience and sovereignty
- Advocate for a balanced mix between top-down and bottom-up approaches that integrates fundamental research, applied research, and industrial deployment, supporting the full innovation chain from fundamental to market uptake.
- Focus on achieving breakthroughs on the key disruptive technologies that have the potential to address the challenges ahead, without losing sight of evolutionary technologies that might be introduced more quickly.
- Promote a balance between bottom-up (roadmap-driven) and top-down (industry-driven) project definitions.
- Ensure that transversal technologies (e.g., digitalization, AI, automation) benefit multiple aviation segments including the supply chain.

2. Governance

- Advocate for a partnership dedicated to aviation covering the entire Research and Innovation (R&I) chain, with a clear distinction between the aeronautics and air traffic management (ATM) domains.
- Recommend a balanced, neutral, and transparent governance structure, with adapted governance arrangements and associated budgets, structured around 3 distinct streams:
    - a **strong bottom-up collaborative research stream** focused on basic and applied research, research-driven and open to all stakeholders, involving the diverse stakeholder community and in particular smaller actors such as Research and Technology Organizations (RTOs), universities, and small and medium-sized enterprises (SMEs);
    - a **top-down high-TRL research stream**, similar to existing Joint Undertakings (JUs), focused on demonstration activities and led by industry;
    - and a **deployment stream**, supporting the uptake, and scaling of mature aviation technologies and solutions.
- Maintain clear governance safeguards to avoid potential conflicts of interest by ensuring beneficiaries do not directly decide on grant allocations.
- Strengthening the role of Member States in the Programme governance, in the Programme Committees for the lower TRL activities and in the State Representative Groups for the higher TRL activities.
- Maintain existing national aviation research programmes (e.g. FFG/TakeOff, PT-LF/LuFo, Luchtvaart in Transitie, CORAC, PRORA…) and ensure the strategic alignment of the Aviation Moonshot with these programmes in order to strengthen coherence, create synergies, and enhance the overall effectiveness of European research and innovation efforts in the aviation sector.

3. Funding Model

- Advocate for fair and balanced funding distribution among industry, RTOs, universities, and SMEs, supporting the entire research, development and innovation pipeline, from fundamental research to market deployment.
- Secure long-term, ring-fenced budgets to enable planning certainty and strategic autonomy for European aviation research.
- For a future “Moonshot Smart and Clean Aviation” partnership in FP10, In-Kind Contributions to Operational as well as to Additional Activities (IKOP and IKAA) should remain the central instrument for effectively leveraging public funds. This serves to increase thematical coherence, efficient investment of research budgets and the buildup of the whole aviation value chain. The private partners strictly reject cash payments into a joint funding pot, as this would mean financing competitors – such an option would be a knockout criterion for the participation of private partners.

4. Project Structure & Innovation Pipeline

- Establish a graduated innovation pipeline:
    - **Small collaborative research projects (TRL up to 4),** mainly RTO/university/SME-led, focused on disruptive and evolutionary technology development,
    - **Medium-sized collaborative projects for technology demonstration (medium TRL 4-6),** with balanced public-private funding, appropriate contributions from RTOs/universities, with theme/topic leadership by industry/SMEs and RTOs,
    - **Large integrated demonstrator projects (TRL>5)** for overall system-level validation and market readiness/development under industrial leadership,
    - **Deployment projects (TRL>6),** to facilitate market uptake
- The graduated innovation pipeline outlined above is reflected in the **projects' structure** presented in the figure below. The first 3 project categories correspond to the successive stages of the research and innovation pipeline - from early collaborative research, to technology demonstration, and finally to large integrated demonstrators enabling system validation and product development covered typically in the European Framework Programme for Research and Innovation, whereas the ECF would be suitable to fund the deployment projects

What should be covered by a future Smart and Clean Aviation Moonshot project

EC already announced that the future work programmes will be less prescriptive and more open leading to fewer number of call topics it can be assumed that there will not be any dedicated call topics for aviation outside of partnerships and/or moonshots. Therefore:

Scope of Smart and Clean Aviation Moonshot
(covering aeronautics and air transport/ATM)

Small Collaborative Research Projects (1.050 Mio. €*)	Medium sized Collaborative Research Projects (1.050 Mio. €*)	Large integrated demonstration Projects (3.900 Mio. €*)	Deployment projects (16.500 Mio. €*)
• For scientific resourcing and technology development (up to TRL4), considering disruptive & incremental technologies • 4-5 Mio.€ grant with usual cofunding for collaborative research • Some 10 partners • Mainly RTO/Univ lead • Call definition mainly bottom-up on the basis of • Agreed European Technology Roadmaps • (former ACARE SRIAs)	• For technology demonstration • 10-50 Mio.€ grant with additional private in-kind contributions to match • 50:50 funding between private and public • Up to 40 partners • Mainly industry lead • Call definition mainly top-down on the basis of industry needs and agreed European Technology Roadmaps	• For system demonstration • Up to 150 Mio.€ grants with additional private in-kind contribution of at least 1,5 times EC contribution • Up to 40 partners • Industry lead • Call definition top-down on the basis of industrial plans for new products	• For deployment covering the valley of death • Up xxx Mio.€ loans from ECF, exceptionally grants • For industrial leaders • Based on clear product development plans and commitments

* Budgets based on ARIS document

5. Stakeholder Engagement & Collaboration

- Foster the European Aviation research, technology and innovation eco-system by collaboration of all aviation stakeholders (industry, RTOs, universities, SMEs) adequately along the whole TRL chain.
- Support joint preparation and foster active participation of all aviation stakeholders (industry, RTOs, universities, SMEs, operators, service providers, member states) within the ACARE 3.0 framework in jointly defining European strategic research, innovation and industrialization agendas/technology roadmaps (like former ACARE SRIAs) and thus providing guidelines for the preparation of annual work programmes ensuring the alignment with European priorities and thus on programme priorities and calls for proposals.
    - Include also stakeholders from the "user perspective": e.g. airlines, MRO companies, suppliers, airports, but also certification authorities
- Identify the aviation sector within the "Clean Transition and Industrial Decarbonisation" policy window of the European Competitiveness Fund (ECF) and of Horizon Europe (HE) as strategic sector. The strong links between this policy window and the key challenges faced by the aviation sector fully justify such recognition and the proposed overarching moonshot concept. Therefore, explicitly anchoring the aviation sector in the regulations would ensure that its strategic, technological and industrial challenges are properly taken into account, benefiting all segments that structure the aviation ecosystem and its value chains.
  Furthermore, the governance of the ECF and of HE will rely on a multiplicity of committees and advisory structures, within which it is essential that the aviation sector is adequately represented. The expertise of stakeholders (including industry, RTOs, and universities) fully justifies their participation in the advisory structures and reflects their willingness to contribute proactively.
- Ensure that the voice of European research organizations and universities is considered in addition to the voice of the industry, for instance by encouraging participation in working groups and advisory committees.

6. Technology Focus & Research Priorities

- Focus on research on super-efficient, net zero and absolute zero aircraft technologies in terms of environmental compatibility, advanced propulsion (e.g. new architectures with open rotors, hybridization and other innovative core concepts), and novel efficient aircraft architectures (e.g. electrification) while considering innovative maintenance and repair procedures.
- Ensure research focused on operational aspects, on novel or advanced concepts of operation and related to the introduction of new technology, to be included alongside R&D activities targeting technology development and maturation. The Digital European Sky, a key goal of the European ATM Master Plan, aims to optimise gate-to-gate flights continuously up to 2045.
- Leave room for further optimization of existing technologies, systems, and components, e.g aerodynamics, propulsion systems, avionics and cockpit systems, cabin components and systems.
- Strengthen enabling scientific research and development, e.g. materials science, novel MRO technologies and procedures, as well as scientific research on environmental impacts (contrails / climate, noise, noise annoyance, ...).

- Drive digital transformation in aviation: AI, quantum technologies, digital twins, autonomous systems, interoperable data rooms, consistent data formats and interfaces throughout operation and maintenance, as well as cyber-security.
- Understand and mitigate the risks associated to the new technologies in order to anticipate certification
- Strengthen manufacturing capabilities, supply chain resilience, and life cycle analyses for Europe's technological sovereignty including the entire research and innovation chain.
- Support of the whole landscape of the aviation Technology Infrastructures for technological breakthroughs.

7. Programmatic Recommendations

- Make sure that lower TRLs (early-stage research) are adequately considered and funded in future Smart and Clean Aviation programme.
- Ensure that preparation of calls for Small Collaborative Research Projects (former Level 1 Projects / lower TRLs) include a stronger open and bottom-up component, with increased budget compared to recent Framework Programmes, to encourage new ideas, innovation, flexibility and mid and long-term research preparation, considering also high system-level goals.
- The preparation of higher TRL particularly big integrated demonstrator projects and deployment projects should be based on top-down approach on the basis of industrial plans and technology needs for new products and commitments.
- Maintain a clear separation of civil and military research programmes, but fostering the exploitation of universal technologies and capabilities for dual-use purposes where relevant.

8. Impact, Dissemination & Communication

- Broaden the definition of impact to include long term impact, education of work force and support to the entire supply chain.
- Ensure robust dissemination (journal and conference publications and patents) while preserving Europe's strategic autonomy and technological sovereignty, together with communication strategies, including participation in major forums (e.g. Paris Air Show, Aerodays, EASN conference, etc.) and showcasing demonstrators and research outcomes.
- Highlight the role and achievements of RTOs/universities in European aviation innovation.
- Foster education, training, and upskilling, ensuring workforce capability and skill readiness for the future European high-technology sector.

EREA at a glance

The Association of European Research Establishments in Aeronautics (EREA) brings together Europe's key aeronautics and aerospace applied research organisations. EREA promotes joint strategies, coordinates activities, and strengthens the collective voice of European RTOs in aeronautics. By fostering collaboration, EREA contributes to Europe's scientific excellence, industrial leadership, and technological sovereignty.

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