Clean Sky 2 will be a natural continuation and extension of the Clean Sky programme, delivering a range of innovative break-through technologies that can be ready for incorporation into the next generation of aircraft which will replace the current fleet from 2025. By underpinning joint European research and demonstrating new vehicle configurations on the ground and in flight, Clean Sky 2 will enable the aeronautics industry to introduce innovations in timescales that would otherwise be unachievable. In so doing, it will drive environmental improvements, increase transport efficiency, create jobs, develop and maintain vital top-level industrial skills and sustain economic prosperity.

Challenges under Horizon 2020

Adopted by EU member states on 3 December 2013, Horizon 2020 is Europe’s biggest-ever research and innovation programme with a budget of nearly €80 billion. It notes as one key societal challenge: **smart, green and integrated transport**. Horizon 2020 covers a critical period for Europe to quicken the pace of aeronautical innovation and reinforce its leading role in shaping the future of aviation.

A continued JTI public-private partnership through Clean Sky 2 can deliver key outcomes:

- **Creating resource-efficient transport that respects the environment.** Building on FP7 achievements (particularly within Clean Sky), aeronautical research and innovation in Horizon 2020 must complete its role towards achieving the ACARE 2020 targets. Three quarters will be achieved by the end of Clean Sky, with the JTI fully meeting its original goals. Beyond 2020, new efforts are needed to get within reach of the Flightpath 2050 targets of a 75% cut in CO2, 90% in NOx and a 65% noise reduction. Clean Sky 2 can facilitate the first steps on the way to these goals.
- **Ensuring safe and seamless mobility.** Aviation provides invaluable time-efficient mobility. New concepts can aid the air transport system (ATS) in meeting evolving mobility needs of citizens: more efficient use of local airports, faster connections, and less congestion.
- **Building industrial leadership in Europe.** Clean Sky 2 will help maintain highly skilled jobs in Europe. Besides traditional rivals, Europe now faces strong competitors in ‘BRIC’ countries. Clean Sky 2 will enable European industry to deliver the necessary innovations based on affordable and sustainable technologies. This will be supported by design tools and methods, programme and supply-chain management, and certification processes that will shorten time-to-market, decrease non-recurring costs, reduce risk, and create the global leadership essential for a sustainable industrial base.

These objectives will require both near-term solutions which can be implemented in the next generation of aircraft, and breakthrough innovations to address the longer term objectives – the air transport system from 2035 onward.

As technologies become more complex and interconnected, validation through demonstration is essential to enable industry to justify the substantial and increasing investment in new products.
Going beyond Clean Sky

Clean Sky 2 will provide the natural continuation of the progress achieved in the first Clean Sky Programme launched under the EU’s 7th Framework Programme for Research and Technological Development (FP7), and which ends in 2017. The projects included in this first ground-breaking aeronautical JTI programme are delivering strong results – the potential for significantly lower emissions, big noise reductions, and more efficient use of raw materials and finite resources. Close alignment in time and content between CS2 projects and those of its predecessor will allow for a seamless transfer of technical progress.

Advances in the first Clean Sky period largely relate to major components and large systems. CS2 will move the process forward to potential technological combinations and complete aircraft demonstrators comprising innovative configurations. In addition to the proven approach of integrated technology demonstrators (ITDs), Clean Sky 2 will introduce large scale demonstrations at the aircraft platform level. These bring together newly-developed systems and components, propulsion and aircraft configurations, allowing the technological progress to deploy its full impact. The innovations developed and refined by Clean Sky 2 will put the European Aeronautics industry in pole position to deliver advanced technologies for the next generation of aircraft when the market window opens to replace the aircraft currently in operation and under development.

Taking the 2014 situation as a benchmark, Clean Sky 2 aims to deliver up to a 30% reduction in fuel burn and related CO₂ emissions; similar or greater cuts in NOx emissions and up to a 75% reduction in noise footprint in communities near airports.

These pace-setting gains will enable the European aviation sector to satisfy society’s needs for sustainable, competitive mobility towards 2050. As such, Clean Sky 2 will be the key European instrument to overcome market failure and guarantee a sustainable advancement of aviation, while ensuring Europe’s continued technological leadership, the creation of highly-skilled jobs, and driving vital environmental improvements in the global air transport system.

Membership and participation

There are three levels of participants in CS2, each with clearly-defined roles and responsibilities.

- **The 16 Leaders** are committed to deliver the full Clean Sky 2 programme throughout its duration.
- **Core Partners** will be sought, who will make substantial long-term commitments to the programme, bringing key competences and technical contributions in line with its high-level objectives.
- **Partners** will be invited to participate in specific topics and projects in the context of a well-defined limited commitment.

Clean Sky 2 Leaders and Core Partners will become Members of the Joint Undertaking, and as such share the governance of the JU’s activities jointly with the European Commission and the running cost of the JU’s operations.

Core Partners in Clean Sky 2 will be the equivalent of Associates in the first Clean Sky phase. Up to 30% of the programme funding will go to successful applicants for Core-Partners roles.
Structure of the Clean Sky 2 programme

The Clean Sky 2 programme consists of four elements.

- **Three Innovative Aircraft Demonstrator Platforms (IADPs)**, for Large Passenger Aircraft, Regional Aircraft and Fast Rotorcraft, developing and testing flying demonstrators at the full aircraft / vehicle level;
- **Three Integrated Technology Demonstrators (ITDs)**, looking at airframe, engines and systems, using demonstrators at major integrated system level;
- **Two Transverse Activities** (Small Air Transport, Eco-Design), integrating the knowledge of different ITDs and IADPs for specific applications and enabling synergies to be exploited between different platforms through shared projects and results;
- **The Technology Evaluator (TE)**, monitoring and assessing the environmental and societal impact of the technologies developed in the IADPs and ITDs.

The overall budget for Clean Sky 2 is nearly €4 billion. Of this, a total of €1.755 billion will come from the European Commission. The private sector industry leaders will contribute approximately €2.2 billion. This includes significant additional activities which do not form part of the Clean Sky 2 programme as described here, but which contribute to and support its objectives – enablers for the demonstrators or parallel research work necessary to develop an operational product in due time.

A maximum of 40% of the available EU funding (roughly €700 million) will be allocated to Leaders. At least 60% of EU funding - representing over €1 billion in EU funding - will be open to competition:

1. Core-Partners compete via calls for Core-Partners, becoming Clean Sky members once selected. The Core-Partners will be eligible for 30% of EU funding, up to €540 million.
2. Partners compete through calls for proposals. The 30% of EU funding (€540 million) set aside for Partners will be awarded via participation in Calls for Proposals or, where relevant, via public Calls for Tender.

The structure of the programme is presented in graphic form below.
Brief overview of Clean Sky 2 programme components

Large Passenger Aircraft IADP (Leader: Airbus)

The main areas of the Large Passenger Aircraft will include: new propulsion systems and their integration in future aircraft; the future of the fuselage and aircraft systems concepts for possible next generation cabin architectures; and the ‘cockpit of the future’. These three platforms will include large scale demonstrators, test rigs and flight test demonstration for the first one.

Regional Aircraft IADP (Leader: Alenia Aermacchi)

The Regional Aircraft IADP will bring the integration of technologies developed in phase one within the Green Regional Aircraft ITD to a higher level of complexity and maturity via two flying test-beds and three large integrated ground demonstrators. The Regional Aircraft IADP will focus on demonstrating and validating key technologies that will enable a 90-seat class turboprop aircraft to deliver breakthrough economic and environmental performance and superior passenger experience.

Fast Rotorcraft IADP

This CS2 IADP consists of two separate demonstrators, the NextGenCTR tilt-rotor and the LifeRCraft compound helicopter. These two fast rotorcraft concepts aim to deliver superior vehicle productivity and performance.

Airframe ITD

This activity will demonstrate, as one of the key contributors to the different IADPs flight demonstrators, advanced and innovative airframe structures like a more efficient wing with natural laminar flow, optimised control surfaces, control systems and embedded systems highly integrated in metallic and advanced composites structures. It will also test novel engine integration strategies and investigate innovative fuselage structures.

Engines ITD

Clean Sky 2 will build on the work done in the Sustainable and Green Engines (SAGE) activity to validate more radical engine architectures.

Systems ITD

Systems and equipment are crucial for aircraft operation, flight optimisation and air transport safety. Moreover, the upcoming innovative aircraft architectures, such as more electrical aircraft and bleedless engines rely on new system technologies to improve global aircraft performance. The Systems ITD develops and builds highly integrated, high TRL demonstrators in major areas such as power management, cockpit, wing, landing gear, to address the needs of future generation aircraft in terms of maturation, demonstration and innovation.

Small Air Transport (SAT) Transverse Activity

The SAT initiative in CS2 represents the research and technology interests of manufacturers of small aircraft used for carrying up to 19 passengers or for freight transport. The aim is to develop, validate
and integrate key technologies on demonstrators up to TRL6 and to revitalise an important segment of the aeronautics sector that can bring key new mobility solutions.

**Eco-DESIGN Transverse Activity**

Eco-DESIGN will coordinate research geared towards high eco-compliance in air vehicles over their product life. It will heighten the stewardship in intelligent Re-use, Recycling and advanced services.

The activity is keyed to excellence in materials, processes and resources; supporting the manufacturing base and supply chain competitiveness and sustainability.

Eco-DESIGN follows two differentiating strategies: Eco-DESIGN Analysis (EDAS) and the Vehicle Ecological Economic Synergy (VEES).

**Technology Evaluator**

A technology and impact evaluation capability remains an essential element within the Clean Sky JTI. Impact assessments will evaluate the performance potential of CS2 technologies at both vehicle and aggregate levels (airports and air traffic systems).