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An Overview of the Scalability Investigation of hybrid Electric concepts for Next-generation Aircraft (SIENA) project

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This paper presents an overview of a project called “Scalability Investigation of hybrid Electric concepts for Next-generation Aircraft” (SIENA). This is a collaborative project being developed under the European Union Clean Sky 2 Program Thematic Topics.

The aviation industry has committed to a set of ambitious goals to reduce fuel burn, emissions and noise by 2050, including reducing global net aviation carbon emissions by 50% by the year. To help achieve these goals, new radical aircraft (A/C) system architectures, like new hybrid-electric propulsion systems, have to be designed in a way that are not only technically feasible but also operationally and economically viable. However, a number of technology challenges persist and combinations of Hybrid-Electric Propulsion (HEP) technologies with novel technologies, such as complex aero-propulsive couplings, novel thermal management technologies and non-drop-in fuels (such as hydrogen, or liquid natural gas) are being considered. The multitude of promising technologies, and the way they can be combined and integrated in A/C, results in a very large number of design options. Consequently, the research and industrial community is largely focusing on designing solutions for specific aircraft and operational concepts, resulting in multiple configurations developed in parallel.

SIENA introduces an innovative notion of scalable-by-design aircraft concepts by performing an automated and exhaustive design space exploration and systematic analysis of novel technologies, and their integration in new vehicle architectures. The project will focus on the development of a systematic methodology to review the feasibility of integrating different technologies in novel aircraft architectures in such a way that they can be scaled-up from smaller to larger passenger aircraft. These technologies will include key innovations such as HEP and the integration of non-drop-in fuels and will be considered for five different vehicle classes, from general aviation aircraft, through regional, commuter, to short and long range passenger aircraft. The performance of the different technologies will be assessed against classic aircraft performance requirements, as well as studying the economic, regulatory, and operational impact of such technologies and their viability in the aviation industry. The generated breakthroughs and findings from the project will guide upcoming projects under the Horizon Europe program.

The presentation will outline the technical development program, the challenges being addressed and the potential benefits that the approach presented can bring to the aerospace industry.