UDC 629.7.069.024

Oleksandr Zaporozhets, Prof., Dr.Sc.
(National Aviation University, Ukraine)

From ACARE environmental goals to Clean Aviation

A new Strategic Research and Innovation Agenda for a European Partnership on Clean Aviation was proposed under the umbrella of European Green Deal (COM/2019/640). The task facing the aviation sector in this and the next decades is to develop and introduce safe, reliable, and affordable low- to zero-emission air transport for citizens and to concurrently ensure Europe's industrial leadership is maintained and strengthened throughout the transition to a climate-neutral Europe.

Main results from EU PARE project

Transforming aviation towards climate neutrality will require an integrated approach - net zero CO_2 emissions from all flights within and departing from the European Union can be achieved by 2050 through joint, coordinated and decisive industry and government efforts. The European aviation industry is committed to reaching this target and contribute to the goals set in the European Green Deal [1] and the Paris Agreement [2].

Transforming from the current, entirely fossil-based kerosene fuel-powered system to such a future aviation system with multiple energy carriers and architectures constitutes a massive and systemic challenge. This new challenge is connected closely with ACARE *FlightPath* 2050 [3] goals for environment protection first of all. To achieve the *FlightPath* 2050 goals, step changes in aircraft configuration and operation (including alternative energy sources) will be required – currently envisaged evolutions will not be sufficient, there is a need a real basket of measures – Figure 1.

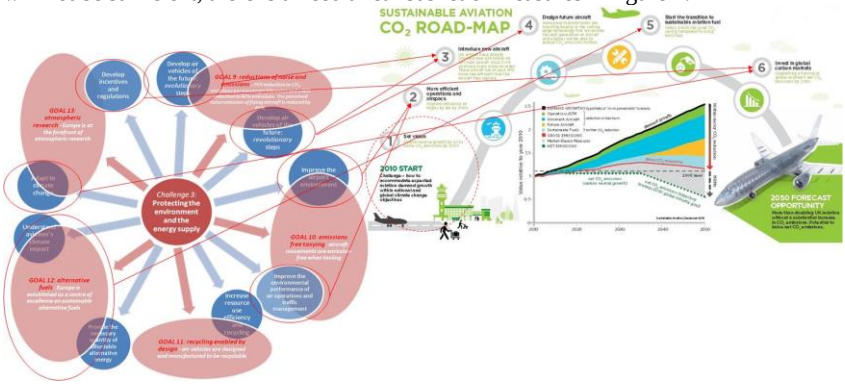

Fig. 1. The goals and action areas for *ACARE Challenge 3* in relation to fuel/energy consumption & GHG reduction along Sustainable Aviation Roadmap 2050

The main purpose of the project PARE (Perspectives for Aerospace Research in Europe) was to consider progress up to 2050 in comparison with the ACARE (Advisory Council for Aeronautical Research in Europe) goals, and identify gaps and correcting measures. This 3-year Coordination and Support Action (CSA) started on October 1, 2017 and finished on December 30, 2020. Its conclusion was extended by 3 months (to December 31, 2020) in part motivated by making the preliminary assessments of the COVID-19 as the biggest crisis in the history of world civil aviation.

Beyond travel demand, analysed tube and wing configurations in terms of reaching the Flightpath 2050 goals – there was found that with selected technologies in the study it was not likely to reach any of the goals. Technology alone would not be sufficient to achieve the necessary reductions in carbon emissions and they proposed that integrated solutions should be necessary. There was examined alternative energy bio-jet fuel with maintenance perspective and based on their evaluations they asserted that the use of biofuel would offer the benefit to aircraft maintenance. In addition, they argued that global aviation world needs to be underpinned by the awareness of the good effect of the usage of biofuel on engine process and procedure. Results show that biofuels have the most impact on system CO_2 emissions, responsible for an average 64% of the total savings by 2050 (with aircraft technologies and operational improvements responsible for 31% and 5%, respectively). However, this impact is associated with high uncertainty and very dependent on both biofuel type and availability. 40 different scenarios considered the feasibility of the aviation goals on CO_2 emission reductions designated for 2050 and it was found that these goals *are not feasible* because of the high demand growth. Moreover, with medium or low demand growth coupled with high technology introduction rates and faster retirement of old aircraft they found that the goals are feasible.

New European Green Deal initiatives

While climate change already had a high profile in Europe, the entry into force of the Paris Agreement undoubtedly contributed to pushing this to the top of the political agenda. Recognising this, the European Commission (2019) led by President Ursula von der Leyen has said that making Europe the first climate-neutral continent will be the *'greatest challenge and opportunity of our times'* and with it, her Commission's number one priority as laid out in the European Green Deal [1].

It is right to expect the aviation sector to meet its responsibilities in this regard. Aviation accounts for around 2-3% of CO_2 emissions globally, and 4% in Europe. While the fuel efficiency of aircraft operations has been improving by an average of over 2% per year between 2009 and 2019, one may acknowledge that further action is needed to bring down the absolute level, even if traffic levels increase. We must do this in an ambitious way in order to meet the EU's goal of net zero CO2 emissions by 2050. We believe that this is desirable and should be achievable – not only for European society and the economy as a whole, but also for the aviation industry and future generations of travellers.

The European aviation sector is convinced the trajectory towards climate-neutral operation is achievable despite the complexity of the system and interdependency as in the system so as in its impact on environment, this will be dependent on:

1. Aircraft and engine technology
2. Air traffic management and aircraft operations
3. Sustainable Aviation Fuels
4. Smart economic measures

No single country in Europe has the financial, technological and industrial capability to affect the transformation, nor the capability to promote and support the required changes to global rules and operative frameworks necessary to implement those solutions. The European additionality is evident. A new, institutionalised European Partnership for Clean Aviation focusing on the most impactful solutions constitutes the most effective approach that can adequately reduce the industrial risk for transformative research and innovation (R&I). This approach will secure the long-term industrial commitments needed for long innovation cycles.

An inclusive, ambitious and institutionalised European Partnership for Clean Aviation under Horizon Europe is the most effective and impactful means through which the aeronautics and air transport sectors can bring a decisive contribution towards a climate-neutral Europe. Only such a partnership can pull together the resources, develop, and enable the introduction of safe, reliable, efficient and affordable climate-neutral air transport. It will build Europe's leadership in innovation and technology, and deliver jobs and economic growth throughout the transition to a climate-neutral Europe by 2050. It can offer future generations the promise of continued, affordable and equal access to air travel, and its social and economic benefits, and contribute to the UN's Sustainable Development Goals.

Clean Aviation will contribute to the delivery of ЕΓ's climate neutrality by 2050 by pioneering new solutions in the aeronautics disciplines, addressing the relevant EU policy priorities (e.g. the Green Deal) and supporting the sector-wide European Sustainable Aviation Roadmap. It will trigger a technology revolution that will target climate-neutral aviation in Europe by 2050. Ambitious zero- and low-emission technologies will drive the transformation. These include hybrid-electric solutions for regional and short-range flights and ultra-efficient aircraft designs utilising thermal engines suited for the adoption of sustainable aviation fuels (SAF) covering the larger and more energy intense medium and long-range sectors.

References

1. The European Green Deal, COM(2019) 640. [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN]
2. Paris Agreement. United Nations 2015. [https://unfccc.int/sites/default/files/english_paris_agreement.pdf]
3. Flightpath 2050 Europe's Vision for Aviation Report of the High Level Group on Aviation Research. EC Directorate General for Mobility and Transport [https://ec.europa.eu/transport/sites/transport/files/modes/air/doc/flightpath2050.pdf]
.