



The Aviation & Space Journal

ISSN 2281-9134
The Aviation & Space Journal
[online]

Website: www.aviationspacejournal.com

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Sustainable Aviation: How the Sector can Cope with Major EU Environmental Goals

*Alessandra Laconi **

Introduction

The transport sector has been severely affected by the restrictive mobility measures that it has been necessary to adopt in order to contain the COVID-19 outbreak.

In terms of environmental sustainability, the pandemic has inevitably caused a significant decrease in air traffic¹ and aviation emissions. According to the latest Eurocontrol's data, CO₂ emissions from flights declined by a medium percentage of 57% in 2020.²

At any rate, this certainly cannot be considered as a (temporary) solution to the problem represented by the high quantity of greenhouse gases emitted by air transport. As evident, the upward growth in emissions will resume (and is likely to resume, albeit slowly) in conjunction with the recovery in air traffic demand, unless the aviation sector and governments take further measures to ensure the compatibility between the aviation sector's growth and setting climate objectives.

Several legislative processes were already underway at the EU level to support the aviation sector's decarbonization, and the recovery from the COVID-19 crisis (as known, characterized by demand shocks, supply chain disruptions, decrease in travel and tourism, reduced connectivity and difficulties for transport operators, to the point that no other industry has been so hugely affected by the COVID-19 pandemic as the air transport and tourism sector)³ can represent a further driving force towards a sustainable and smart transport system, following a coordinated EU approach to transport activity and connectivity, overcoming the crisis and strengthening the EU's strategic autonomy.

It is therefore clear that these premises must be brought back to the principles established in the European Green Deal Communication,⁴ which launched a new growth strategy for the EU that aims to transform the EU into a fair and prosperous society with a modern, resource-efficient and competitive economy, highlighting again the Commission's ambition to increase its climate targets and make Europe the first climate-neutral continent by 2050.⁵

From a regulatory point of view, the EU has been promoting the legislative initiative for years, in particular in the field of emission trading rules. Notably, the EU ETS is the cornerstone of the European climate policy⁶ as well as a prototype regime with respect to all other similar experiences; the current ETS legislation was revised in 2018 to deliver a 43% reduction in EU ETS emissions by 2030 compared to 2005, coherent with an EU economy-wide emissions reduction target of at least 40% by 2030 compared to 1990.

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By far the most controversial point of the EU ETS - which raised strong reactions by air carriers - was its application to all emissions from all flights taking off from or landing in the EU, even if the carrier was a non-EU airline and even though the majority of the emissions from that flight would all be emitted outside EU airspace.

Therefore, the ETS Directive has been widely criticized by non-EU airlines and governments and has been subject to a challenge by the Air Transport Association of America before the English High Court, which was referred to the Court of Justice of the European Union (ECJ). In December 2011 the ECJ ruled that the ETS Directive was not contrary neither to the Chicago Convention nor to general principles of international law, causing more and stronger reactions, especially by non-EU carriers.⁷⁸

In the light of the increased necessity and value of the European Green Deal due to the very severe effects of the COVID-19 pandemic, the European Commission recently announced proposals to update the aforesaid Directive and to implement the ICAO Carbon Offsetting and Reduction Scheme for International Civil Aviation (CORSIA), as it will be exposed below.

Moreover, based on the same approach, on the 9th December 2020, the European Commission presented its 'Sustainable and Smart Mobility Strategy - putting European transport on track for the future',⁹ together with an Action Plan composed by 82 initiatives. This strategy can be considered as the foundation of the green, digital and resilient transformation of the EU transport system following the pandemic, in order to reach a 90% cut in emissions by 2050, as a main result of a smart, competitive, safe, accessible and affordable transport system.¹⁰

The strategy contained in the Communication can be defined as a transversal and multilevel study, aimed at guiding and coordinating European legislative policies in order to pursue and achieve the objectives set in terms of environmental sustainability of transport.

In a nutshell, the Communication sets out the actions required to ensure that each mode of transport can contribute to the achievement of the objectives set by the European Green Deal, i.e. reducing greenhouse gas emissions by 55% by 2030 and making Europe the first climate-neutral region in the world by 2050.

The aim of the Communication, in essence, sets an evident change of perspective, from incremental change to fundamental transformation, providing for a list of cornerstones in the form of ambitious progressive goals, in particular:

- *By 2030:*
 - *at least 30 million zero-emission vehicles will be in operation on European roads*
 - *100 European cities will be climate neutral*
 - *high-speed rail traffic will double*
 - *scheduled collective travel of under 500 km should be carbon neutral within the EU*
 - *automated mobility will be deployed at large scale*
 - *zero-emission vessels will become ready for market*
- *By 2035:*
 - *zero-emission large aircraft will become ready for market*
- *By 2050:*
 - *nearly all cars, vans, buses as well as new heavy-duty vehicles will be zero-emission*
 - *rail freight traffic will double*



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- *high-speed rail traffic will triple*
- *the multimodal Trans-European Transport Network (TEN-T) equipped for sustainable and smart transport with high-speed connectivity will be operational for the comprehensive network.*

In brief, it is necessary to make all transport modes more sustainable, making sustainable alternatives widely available in a multimodal transport system, and putting in place the right incentives to drive the transition.

In light of the above, and with particular regard to the aviation sector, it is therefore evident that key stakeholders representing EU and national policymakers, airlines, airports, technology manufacturers, air traffic control, and civil society are called to operate in an interconnected way and each to the extent of their competence, in order for the EU to become a climate-neutral economy by 2050, while also working towards a zero-pollution ambition.

Legislative policies

With regard to the measures that can be adopted at the legislative level, and focusing on the aviation field, EU policies can be grouped in three main categories:

1) Measures to significantly reduce the current dependence on fossil fuels (notably, by opting for low and zero emission vehicles and enhancing the use of renewable and low-carbon fuels).

Despite its growth, the proportion of low and zero emission vehicles is still too weak. Air transport has greater decarbonization challenges in the next future, due to current lack of available zero-emission technologies, long development and life cycles of aircraft, the required significant investments in refueling equipment and infrastructure, and international competition in this sector.¹¹

Furthermore, a decisive action is urgently needed following the current crisis, and air transport must have rapid access to additional renewable and low-carbon liquid and gaseous fuels, like hydrogen, hydrogen-based synthetic fuels and advanced bio-fuels.¹²

In this respect, the Commission expressed its intention to establish a Renewable and Low-Carbon Fuels Value Chain Alliance, in order to strengthen the cooperation among public authorities, industry and civil society aimed at the development and use of the most promising fuels (implementing action under the European Clean Hydrogen Alliance and European Battery Alliance).

The reduction of emissions of aircraft, together with energy efficiency and high standard design and operation must be promoted, also through a closer cooperation between the EU and the International Civil Aviation Organisation (ICAO), establishing global emission decrease goals to be read in conjunction with and in respect of the Paris Agreement (the next ICAO General Assembly will take place in 2022). Nevertheless, it is also important to invest on zero-emission aircraft technologies, provided that, with regard to civil aviation, the Communication sets the ambitious goal of making zero-emission aircraft available to the European market by 2035.

The decarbonization of aviation transport requires a favorable environment, promoting adequate carbon pricing policies, research and innovation (namely through the Horizon Europe net).

Moreover, the Single European Sky can represent the framework for a more efficient traffic management, contributing to reduce the climate impacts associated with emissions of gases other than CO₂ in the air transport sector.

With regard to infrastructure, the best practices followed by the most sustainable

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airports should be widespread and become the new standards to look at and encourage further sustainable connections.¹³ The Commission will propose measures to make EU airports clean, promoting renewable and low-carbon fuels, as well as the feeding of stationed aircraft with renewable power, the project and use of new, clean and silent aircraft, the revision of airport charges,¹⁴ the revision of ground operations at airports and a spread use of smart traffic management.¹⁵

Investment in renewable energy production, in fleet renewals and in sustainable multimodal access must increase, both from public and private sources.

As for aviation, improving the efficiency of air traffic management (ATM) has a great potential for modernization and sustainability, helping to reduce excess fuel burn and CO₂ emissions caused by flight inefficiencies and airspace fragmentation. It is therefore quite clear that the Single European Sky (SES) has to be fully implemented without delay, in order to have a modern regulatory framework and adequate digital ATM infrastructure.

The EU must therefore offer all the adequate legislative measures for the validation of new technologies and services, like unmanned aircraft for commercial applications, hydrogen aircraft, electric personal air vehicles etc. On the other hand, technology developers and start-ups would find a fruitful regulatory context for the deployment of solution in EU market.

In relation to the deployment of unmanned aircraft (drones), the Commission clearly stated its full support, in particular through the development of new rules ('Drone Strategy 2.0').

2) Action towards more sustainable transport modes (provided that all transport modes are indispensable for EU transport system).

Sustainable mobility alternatives must be promoted, creating an advanced EU multimodal transport system, reaching a better level of efficiency for the benefit of people and goods.

EU people are ready to opt for more sustainable, efficient, safe and affordable transport alternatives, and this can be considered a consequence of the COVID-19 pandemic and the digital solutions that have spread widely in this historical period.

On the other hand, the pandemic crisis has strongly showed that uninterrupted air, land and waterborne services are fundamental not only for the transport of goods, but also for manufacturing industries and - in general - for the proper functioning of the EU's single market.¹⁶

In light of the above, the completion of the Single European Transport Area must be accomplished, ensuring multimodality and interoperability between different transport modes.

From the perspective of modernization and smart connectivity at affordable and transparent prices, the Commission will propose a revision of the Air Services Regulation,¹⁷ as well as of EU rules governing airport charges, slots and computer reservation systems.

3) Internalization of external costs (in particular, by implementing the 'polluter pays' and 'user pays' principles, through carbon pricing and infrastructure charging mechanisms).

It is necessary to reinforce incentives for transport users in order to obtain more sustainable choices. The main economic incentives are carbon pricing, taxation, and infrastructure charging, but there is no doubt that an enhanced and clear information to users is a fundamental complementary action.¹⁸

In particular, both the 'polluter pays' and 'user pays' principles¹⁹ need to be implemented in relation to all transport ways, considering the high amount of external costs.²⁰ The internalization of these costs (to be borne by actual users) can represent

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an important measure to pursue fair and efficient pricing for all transport modes. In the aviation sector, as exposed above, the main legislative carbon pricing instrument granting the internalization of CO₂ emissions related costs is the EU ETS.²¹ The Commission announced several proposals to update the EU ETS Directive (in particular, to reduce the ETS allowances allocated for free to airlines) and to implement the ICAO Carbon Offsetting and Reduction Scheme for International Civil Aviation (CORSIA).²²

In fact, following the aforesaid announcement, on 14th July 2021, the Commission proposed the “Fit for 55” legislative package, providing for measures to reduce emissions by at least 55 percent by 2030, compared to 1990 levels.

This legislative package, as announced in the 2030 Climate Target Plan, is the most comprehensive building block in the efforts to implement the ambitious new 2030 climate target, and all economic sectors and policies will need to make their contribution.

The main amendments in the field of aviation can be summarized as follows:

- consolidation of the overall measure of allowances at current quantities and application of the linear reduction factor, as set out in Article 9 of the ETS Directive;
- increase of the auctioning of aviation allowances (the number of free allowances allocated to aircraft operators will be reduced progressively, with the aim of stopping free allocation to aviation by the end of 2026);
- continuation of intra-EU application of the EU ETS and application of CORSIA to extra-EU flights (flights within the European Economic Area - EEA, as well as flights to Switzerland and the UK, will continue to be covered by the EU ETS);
- equal treatment of airlines on the same routes.

A further separate proposal was made to implement Member States’ notification to EU-based airlines of the offsetting for the year 2021 under ICAO’s CORSIA, in order to reduce the administrative burden on national authorities and airline operators and provide legal certainty with regard to CORSIA offsetting by EU-based airlines. The EU ETS Directive will apply CORSIA to EU-based airlines’ emissions from flights to and from countries outside the EEA. When emissions from flights outside the EEA reach levels above 2019 they will have to be offset with corresponding carbon credits.

With regard to fossil-fuel subsidies, the Commission expressed its aim to align the taxation of energy products and electricity with EU energy and climate policies. Therefore, current tax exemptions (including for aviation fuels) have to be duly considered as part of an organic proposal.

In light of the overall global analysis offered by the Commission, following the pandemic crisis the transport sector and the mobility system must be both decarbonized and modernized, limiting their negative impact on the environment and improving the safety and health of EU citizens.

It is worth to note that the implementation of an actual variation of perspective, from incremental change to fundamental transformation, will necessarily require the full contribution from all transport actors and stakeholders, as well as a significant increase of investments from public and private sectors.

Indeed, the organic set of policies provided for in the examined Communication represents an action plan to achieve the objectives of the European Green Deal, thus - beyond the ones to be adopted at legislative level by EU institutions, Member States and their national authorities - all the concerned subjects and operators are required to participate proactively to the overall action plan established by the EU Commission.

*AVIATION***The actions required to the main stakeholders**

In the aviation field, the five associations representing aircraft manufacturers, airlines, airports and air navigation service providers in Europe²³ have planned a shared route to achieve the EU's goal of net zero CO₂ emissions by 2050, through the initiative appropriately called 'Destination 2050' to reflect the common end goal.²⁴

The purpose of the initiative is to identify new measures and/or review existing programs under innovative and better perspectives, through which the members of the involved associations can achieve the decarbonization goal collectively.

On these premises, the involved associations asked the Netherlands Aerospace Centre (NLR) and SEO Amsterdam Economics to support them in providing the necessary scientific basis for the project. In the public full report of February 2021,²⁵ they have thus identified actions across four pillars, seamlessly from the contents of the above-examined Smart Mobility Strategy:

- aircraft and engine technology: improvements in aircraft/engine technology and fleet replacement are considered as the largest promise for decarbonizing European aviation. An adequate fleet replacement includes the introduction of a hydrogen-powered single-aisle aircraft on intra-European routes in 2035. Aircraft availability by 2035 requires technology readiness by 2027 to 2030 (for example, new technologies should be incorporated in commercial products, helped by efficient new certification for disruptive technologies);
- air traffic management and aircraft operations: these improvements are estimated to be a crucial opportunity in reducing CO₂ emissions in the short to medium term, so as to move towards a network-centric and digital ATM system implementing the SESAR solutions, and providing for a renewed set of key performance indicators with clearly defined accountabilities and a seamless upper airspace. Regulations and incentives should enable and encourage the rapid decarbonization of ground operations;
- sustainable aviation fuels: SAFs represent a strong contribution to achieving net zero carbon emissions in 2050, and actions must be taken to scale up and commercialize SAF deployment, providing for clear sustainability criteria and granting a diversified and sustainable feedstock base. In order to make SAF cheaper, financial incentives and the implementation of a EU wide blending obligation are required. In order to reduce cost and emissions, a monitoring and accounting framework should be implemented, so that airlines can claim the use of SAF in the most efficient way;
- smart economic measures: in the short term, smart economic measures are central in the reduction of carbon emissions from aviation. The EU ETS and the CORSIA scheme are key mechanisms to reducing carbon emissions, especially in the short term when breakthrough technologies and SAFs are not yet widely available. In 2050, any remaining emissions can be balanced by carbon removal projects.

On these assumptions, Destination 2050 shows a possible pathway that combines new technologies, improved operations, sustainable aviation fuels and economic measures.

It is noteworthy to highlight that the Destination 2050 report provides for clear recommendations to industry and governments, emphasizing on the urgent need to realize the appropriate measures leading to net zero CO₂ emissions from European aviation through collective policies and actions on their part, in order to avoid differentiated policies, carbon leakage and transfer of activity.

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After the exam of the Sustainable and Smart Mobility Strategy drafted by the Commission, it is interesting to point out here the recommendations to industry consistently provided in the Destination 2050 report, which can be summarized as follows:

- continue to substantially invest in decarbonization;
- develop more fuel-efficient aircraft and bring these into operation through continued fleet renewal;
- develop hydrogen-powered and hybrid/electric aircraft and associated airport infrastructure, and bring them available to the market;
- scale up drop-in sustainable aviation fuel (SAF) production and uptake;
- implement the latest innovations in ATM and flight planning;
- compensate remaining CO₂ emissions by removing carbon dioxide from the atmosphere.

Therefore, given the common goal, it is clear that the major stakeholders of aviation transport are called to act proactively, each to the extent of their competence.

Conclusions

In conclusion, it is important to stress again that legislative policies and actions from all sector subjects are equally and strongly required to make the potential identified a reality. All the described improvements with respect to aircraft and engine technology, ATM and aircraft operations and sustainable aviation fuels represent substantial goals to be realized through policies and actions both from institutions and industry.

It is not pleonastic to consider that aviation is a global industry which requires global solutions.

At an international level, the ICAO work on defining global long-term goals represents an important chance for the aviation sector, which could benefit from a clear closeness of purposes between global and European objectives.

At EU level, a common long-term vision needs both a coherent policy framework and a strong collaboration between stakeholders. With regard to civil aviation, the first ambitious goal is making zero-emission aircraft available to the European market by 2035. In order to achieve this objective, the aviation sector is called to put in place as from now all the necessary efforts in terms of policies and activities, as exposed above.

One of the most effective ways to tackle the increasing emissions from European aviation is by revising the EU ETS. In the light of the illustrated Communication concerning the Sustainable and Smart Mobility Strategy, it seems that the proposed revision of the EU ETS Directive is consistent with the main objectives set by the European Green Deal and, more generally, by the Paris Agreement. All the concerned sectors will have to contribute to achieve these goals, including aviation. Such efforts must begin immediately and increase steadily. As a global leader on climate change, the EU must avoid policies that could limit its ambition, at the same time taking into account international law provisions.

Indeed, the whole question should be evaluated at a global level, within the ICAO framework, by further and jointly elaborating common sustainability objectives, in order to avoid possible inconsistencies.

Even if appropriate corrective measures and a continuous monitoring of the EU ETS functioning need to be adopted, it can be affirmed that - in the short term - smart economic measures remain fundamental: the EU ETS and the CORSIA scheme repre-

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sent key mechanisms for the reduction of carbon emissions from aviation, looking forward to a wide availability of SAFs and breakthrough technologies.

In the future, alignment with EU legislation on renewable energy and energy efficiency is desirable, in order to avoid overlapping between different policies and pursue greater system efficiency.

From an operational point of view, it is essential for investors to clearly know in advance the targets to be met and the related timing, starting from a long-term and consistent policy framework in sustainable aircraft, engine and fuels, from research and development (bringing together start-ups and spin-offs with aviation professionals) to market deployment.

Nevertheless, providing consumers with adequate information on travel sustainability can lead to more sustainable choices, spreading awareness at all levels. In this respect, awareness should be shared not only at management and executive levels, but also with operational employees, starting from pilots and air traffic control officers, to - for example - maintenance workers, ground handling agents and airport personnel in general.

The views expressed are purely those of the author, and thus may not in any circumstances be regarded as an official position.

¹ See the project by the students of the lab. systems design of the master's degree course in design of the University of the Republic of San Marino, with the editorial supervision of Il Sole 24 Ore (Prof. M. Moretti), available at <https://lab24.ilsole24ore.com/traffico-aereo-coronavirus/>.

² Emissions calculated using the Eurocontrol Small Emitters Tool (see <https://www.eurocontrol.int/shared/sustainability/map-emissions.html>, where the CO2 emission percentage of each Eurocontrol Member State for 2020 is shown).

³ According to Eurocontrol's data, in May 2021 air traffic decreased by 65% compared to the same 2019 period (see Eurocontrol, Comprehensive Air Traffic Assessment - Covid-19 impact on European air traffic, 5 May 2021). See also IATA, press release No. 95/2020, Deep Losses Continue Into 2021, 24 November 2020, where it is confirmed that the deep losses in the air transport sector recorded in 2020 will continue in 2021. The negative trend for the current year is confirmed by Il Sole 24 Ore (see 'Aerei, ripresa lenta. A maggio traffico passeggeri in calo del 62,7% rispetto a prima del Covid', available at <https://www.ilsole24ore.com/art/aerei-ripresa-lenta-maggio-traffico-passeggeri-calo-627percento-rispetto-prima-covid-AE7WPRV>).

⁴ COM(2019)640 final.

⁵ The current College of European Commissioners (2019-2024) led by Commission 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'.

⁶ Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, as amended by Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018, and Decision (EU) 2015/1814.

⁷ See P. Manzini, A. Masutti, The application of the EU ETS System to the Aviation Sector: From legal disputes to international retaliation?, *Air & Space Law*, 2012, 37, pp. 307 - 324.

⁸ The EU temporarily reduced the scope of the EU ETS to only include flights between EEA airports for the 2012 compliance year under the 'Stop the Clock' decision. It was subsequently agreed that the 'intra-EEA scope' should be extended for 2013 until 2016.

⁹ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'Sustainable and Smart Mobility Strategy - putting European transport on track for the future', {SWD(2020) 331 final}, COM(2020) 789 final.

¹⁰ In the Communication, the term 'vehicle' refers to all types of vehicles, including, among others, cars, lorries, buses, coaches, light vehicles, trains, aircraft, ships, boats, ferries, etc.

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- ¹¹ See R. Leal Arcas, Trade Redemption: How Trade Agreements Can Help Decarbonize the Economy, in A. De Luca, V. Lubello, N. Lucifero (edited by), *The European Union renewable energy transition, with the scientific contribution of University of Florence and Baffi Center Research Unit of Law and Economic Studies*; RULES, Bocconi University of Milan, Milano, Wolters Kluwer, 2019, p. 113.
- ¹² See D.W. Zingg, O.L. Gulder, Technology developments and Renewable Fuels for Sustainable Aviation, in A. De Mestral, P.P. Fitzgerald, M. Tanveer Ahmad (edited by), *Sustainable development, international aviation, and treaty implementation*, Cambridge, Cambridge University press, 2018, pp. 17-31.
- ¹³ See M. Mousavi Sameh, J. Scavuzzi Dos Santos, Environmental Sustainability Measures for Airports, in A. De Mestral, P.P. Fitzgerald, M. Tanveer Ahmad (edited by), *Sustainable development, international aviation, and treaty implementation*, Cambridge, Cambridge University press, 2018, pp. 62-80.
- ¹⁴ See ACI Europe. (2020b). Information on the use of modulations of airport charges for environmental reasons. Available at <https://www.acieurope.org/downloads/resources/ACI%20EUROPE%20Paper%20on%20Environmental%20Modulations%20of%20Charges.pdf>.
- ¹⁵ See COM(2020) 747 final, “Updated analysis of the non-CO2 climate impacts of aviation and potential policy measures pursuant to EU Emissions Trading System Directive Article 30(4)”.
- ¹⁶ In relation to the integrity of the EU’s single market, the Commission affirmed the necessity to rigorously pursue the enforcement of EU rules in the fields of competition, state aid, free movement of goods and services.
- ¹⁷ Regulation No 1008/2008 of the European Parliament and of the Council of 24 September 2008 on common rules for the operation of air services in the Community.
- ¹⁸ See S. Sankari, Product information on freight emissions for consumers - changing the market towards sustainability, in E. Eftestøl-Wilhelmsson, S. Sankari, A. Bask (edited by), *Sustainable and efficient transport: incentives for promoting a green transport market*, Cheltenham, Northampton, Elgar, 2019, pp. 212-229; see also S.A. Cohen, J.E.S. Higham, P. Peeters, S. Gossling (edited by), *Understanding and governing sustainable tourism mobility: psychological and behavioural approaches*, London, Routledge, 2014.
- ¹⁹ See Organisation for Economic Co-operation and Development, *The Polluter Pays Principle*, Paris, OECD Publishing, 2008.
- ²⁰ See the study ‘Sustainable Transport Infrastructure Charging and Internalisation of Transport Externalities’ (June 2019), according to which overall charges and taxes collected from direct CO2 and air pollutant emissions, indirect CO2 and air pollutant emissions from energy production, air pollution and excessive noise and habitat damage amount to at least EUR 340 billion.
- ²¹ See V. Schade, *The inclusion of aviation in the European emission trading scheme: analyzing the scope of impact on the aviation industry*, Hamburg, Germany, Anchor Academic Publishing, 2014.
- ²² See M.V. Gehring, C. Robb, *Sustainable Development and Emission Trading: the EU Perspective*, in A. De Mestral, P.P. Fitzgerald, M. Tanveer Ahmad (edited by), *Sustainable development, international aviation, and treaty implementation*, Cambridge, Cambridge University press, 2018, pp. 83-107.
- ²³ A4E - Airlines for Europe, ACI Europe - Airports Council International, ASD - AeroSpace and Defence Industries - Association of Europe, ERA - European Regions Airline Association, and CANSO - Civil Air Navigation Services Organization.
- ²⁴ The study is limited to commercial flights departing from airports within the European Union (EU), the United Kingdom (UK), and the European Free Trade Association (EFTA), consisting of Iceland, Liechtenstein, Norway and Switzerland.
- ²⁵ Destination 2050 - A Route To Net Zero European Aviation, NLR-CR-2020-510, February 2021, available at https://www.destination2050.eu/wp-content/uploads/2021/03/Destination2050_Report.pdf.

Europe and Human Spaceflight: New Context, New Strategy?¹

*Sara Dalledonne **

1) Toward a change of paradigm for human spaceflight?

Although European astronauts have travelled to space more than 60 times onboard Russian and American rockets, Europe has never fully developed its own capability to launch astronauts into space. Options to develop human-rated space transportation systems have been considered several times in Europe over the last decades but the lack of political consensus among Member States on the strategic relevance of such endeavours, as well as disagreements regarding funding have driven these plans to an impasse. The ill-fated Hermes spaceplane, an optional ESA Programme led by CNES that was cancelled in 1992 due to continuing delays and major costs overruns, has been a traumatism that contributed to discouraging subsequent attempts to develop human spaceflight systems in Europe.

Notwithstanding, 60 years after Yuri Gagarin's first flight, the lack of autonomous European capabilities in the field of human spaceflight is a matter that periodically returns to the forefront of space policy debates. With the future of Europe's strategy for access to space under the spotlight, several top-level executives have again raised the question of Europe's capabilities to launch astronauts. Indeed, some recent developments may point to a possible change of paradigm for human spaceflight or, at least, to a change of landscape that would justify a fresh debate on this important topic in Europe:

- Space has become an environment for long-lasting human presence

Unlike the ISS that had a limited lifetime in orbit, programmes currently under development offer long-term perspectives and will require decades of efforts before objectives are fulfilled. Therefore, we can reasonably assess that human spaceflight is now being set on a permanent footing and should no longer be considered a temporary need to achieve a specific objective. All major space powers are envisioning such capability as a permanent feature of their space transportation strategy. The renouncement of Europe at this point in time might thus be definitive and irreversible and would certainly be determinant in its capacity of leadership in space.

- Cislunar space is a clear destination for space exploration

So far, Low Earth Orbit seemed the ultimate destination for human spaceflight, with the sole objective to service the ISS. Investing in a Europe-made crewed transportation system was therefore difficult to justify given the existing capacities available worldwide to reach this orbit, with the Shuttle on the U.S. side for the deployment phase and later on, the Russian Soyuz vehicle for routine exploitation.

However, with the advent of new space exploration projects towards the Moon, and towards Mars at a later stage, cislunar space is now set to become the privileged

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destination for most crewed and robotic flights. Furthermore, these developments raise the bar to an unprecedented level and the needs in terms for both freight and crewed space transportation will require an international effort to which Europe needs to decide whether it wants - or not - to contribute.

- New commercial and industrial dynamics have implications for launch service markets

The commercial and industrial dynamics of human spaceflight are profoundly changing, with serious implications for the space launch sector at large. As a result of the service-oriented procurement approach implemented by NASA, the development of private human spaceflight capabilities, including space tourism, has become a key driver for launcher developments in the U.S., stimulating considerable private investment and blurring the lines between commercial and institutional markets.

Attracting private investment in Europe to contribute to the development of such capacity could be considered in the framework of innovative Public-Private Partnerships supporting both long-term public perspectives and commercial objectives. Taking advantage of the current window of opportunity could leverage the public investment in this domain.

2) A demanding endeavour and a crucial decision to integrate human spaceflight into the European space transportation strategy

Throughout the past decades, Europe has based the economic viability of its space transportation strategy on capturing large shares of accessible global demand and European industry has been especially successful in addressing GEO markets. However, the emergence of new aggressive competitors, as well as the advent of new generations of space telecommunications systems have deep implications on the global demand for launch services and will inevitably question the resilience of this model. In this context, the key issue of the competitiveness of the European offer will need to be addressed in the short to medium term.

Additionally, major trends in space transportation industrial and business strategies, as well as in international programmes and commercial launch markets, are changing the dynamics of human spaceflight with potentially far-reaching implications for the broader domain of access to space. Yet, much is at stake for Europe as stakeholders are actively considering the future of their strategies and programmes in this domain. Ultimately, human spaceflight is poised to become an increasingly important factor for Europe's competitiveness on commercial launch markets and for Europe's role in international programmes. This prospect seems to be considered seriously by European actors and several top-level officials have already called on Europe to reevaluate its approach to space transportation.

Enlarging the scope of missions to include human spaceflight capabilities would affect all the key factors impacting the competitiveness of European launch service providers:

- **Reusable technology:** Major international competitors leveraged new public strategies including demand for human spaceflight to develop reusable launchers able to launch both satellites and crew/cargo capsules.
- **Industrial organization:** Human spaceflight is a catalyst for new approach based on long-term commitments for service-oriented procurement that could trigger a more efficient industrial setup.
- **Sustainable demand:** An enlarged customer base could contribute to the improve-

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ment of the competitiveness of the sector.

As demonstrated by the success of the U.S. Commercial Orbital Transportation Services (COTS) programme, such investment must be first justified by new public ambitions in space exploration and international programmes and then facilitated by clear synergies between institutional goals, commercial interests, and industrial strategies. In this regard, the current space ecosystem offers new options to foster these synergies, share costs between public and private stakeholders, and distribute development costs over time, as part of an adapted service-oriented procurement. On top of that, now that private actors, such as Blue Origin, have demonstrated that development costs for such capabilities have progressively decreased, new industrial management frameworks should make it affordable for Europe. The engagement on the development of autonomous human spaceflight capabilities must also be part of a strategic vision considering the risk posed by Europe's full dependence on foreign commercial service providers.

For the time being, the most difficult decision is probably convincing European States to agree to open this file once more in light of the recent developments of space transportation worldwide and to consider with a fresh look the stakes ahead regarding access to Space.

¹ Source: ESPI Brief 53 "Europe and Human Spaceflight: new context, new strategy?", Published: October 2021. All rights reserved. The article is an updated version of the ESPI Brief 53 (October 2021). For more information regarding the ESPI Brief, please visit the ESP website (<https://espi.or.at/publications/espi-executive-briefs>)