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FOURTEENTH AIR NAVIGATION CONFERENCE

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- Agenda Item 2: Timely and safe use of new technologies**
2.1: Evolving aircraft technologies contributing to LTAG

UPDATE ON WAKE ENERGY RETRIEVAL

(Presented by The International Coordinating Council of Aerospace Industries Associations (ICCAIA))

EXECUTIVE SUMMARY

Wake Energy Retrieval (WER) operations in cruise, applied to aeroplanes engaged in international commercial operations, can enable significant fuel burn savings and associated CO₂ emission reduction without additional ground infrastructure or aeroplane sensors. The principle relies on an aeroplane harvesting a part of the energy from the wake vortex generated by a leading aeroplane, by taking advantage of the lift afforded by the updraft energy inherent in the wake.

The concept was presented to ICAO during the 41st Session of the ICAO Assembly (A41-WP/127). This Information Paper notes the progress being made, recalls the ambitions and details the main steps of the way-forward, including some recommendations on how the necessary provisions to enable WER operations could be developed, in support to the CO₂ emission reduction goals for aviation, as expressed by ICAO's Long-term Aspirational Goals (LTAG).

1. INTRODUCTION

1.1 Wake Energy Retrieval (WER) operations in cruise, applied to aeroplanes engaged in international commercial operations, can enable significant fuel burn savings and associated CO₂ emission reduction without additional ground infrastructure or aeroplane sensors. WER operations could be one of the important elements to achieve ICAO's LTAG targets for the decarbonization of the aviation sector by 2050.

1.2 During the 41st Session of the ICAO Assembly, the working paper A41-WP/127 provided elements on progress and achievements since the 40th Session of the ICAO Assembly and proposed a strategy to address the required provisions for WER operations. Several panels of the ANC (e.g. Separation and Airspace Safety Panel (SASP), Flight Operations Panel (FLTOSP), Air Traffic Management Operations Panel (ATMOPSP)), the North Atlantic Procedures and Operations Group (NAT POG) and the North Atlantic Systems Planning Group (NAT SPG) have also been presented with

the WER concept and trials through working and information papers (NAT SPG/58-WP/12, NAT IMG/60-WP/11, SASP-WG/36-IP/14).

2. **DISCUSSION**

2.1 The WER concept was proposed for further consideration during the 41st Session of the ICAO Assembly in November 2022. The decarbonization of the aviation sector requires the development of innovative solutions that can be implemented quickly. This is the objective of WER, a flight technique used by migrating geese when flying across long distances, which, when applied to commercial aviation, leads to reducing fuel consumption and thus the carbon footprint in operations. This paper aims to reiterate the context and challenges of WER, and describe the progress in developing the WER project since the 41st Session of the ICAO Assembly in 2022. It also aims to describe the major points of a plan which could lead to the development and application of adequate recommendations and standards in support of the deployment of WER operations.

2.2 WER operations are being investigated by aircraft and equipment manufacturers jointly with other industry partners such as airlines and air navigation services providers (ANSPs). The activities can be split into three main categories:

2.3 ***Technical Feasibility***

2.3.1 In November 2021, an operational flight trial in General Air Traffic, across the North Atlantic airspace, from Toulouse (LFBO) to Montreal (CYUL), was performed with French, UK, and Canadian ATC support. Rendezvous and split manoeuvres were performed in both French and Canadian domestic airspaces. These two first transatlantic flights demonstrated the efficiency of the technology and the way it can be operated. At least two tons of fuel (around six tons of CO₂) were saved during each flight. A 5 per cent fuel saving per follower flight has been confirmed. A total of 11h20 (round-trip) of automatic relative positioning was realised.

2.4 ***Operational Feasibility***

2.4.1 Based on the success of the first flights, a European project in the frame of the Single European Sky ATM Research Joint Undertaking (SESAR JU) was launched to harmonise WER operations in North Atlantic and European airspaces. The project will last three years (until the summer of 2026). The participants to this project are aircraft manufacturers (Boeing and Airbus), airlines (Delta Airlines, Air France, French Bee and Virgin Atlantic), ANSPs (NATS, DSN, BULATSA, IAA, ON), Eurocontrol, ATM technology providers (Indra, Frequentis) and research entities (University of Barcelona, UAB, in Spain, Italian CIRA, German DLR and French ENAC). Trials using commercial flights are planned from winter 2025. These trials will demonstrate and confirm the integration of the pairing process up to the rendez-vous. The project covers the technical and operational feasibility of the integration of WER in the

European ATM environment including subjects such as effects of WER on airspace, operational efficiency, benefit sharing, and other environmental and safety topics.

2.5 ***Certification and rule-making***

2.5.1 Airbus and EASA signed a Pre-Application Contract in order to investigate the safety aspects and the regulation adjustments to be made in the three domains (ATM, Operations and Initial airworthiness), in order to be able to deploy the Wake energy retrieval operation.

2.5.2 All potential failure aspects and subsequent crew response will need to be addressed, some of them requiring additional demonstrations to be performed, and will be part of the discussions with airworthiness authorities on the way to certification of the operations.

2.6 ICCAIA established an Ad Hoc Group in April 2024 to further explore the necessary standardisation and regulatory impacts, enabling industry to efficiently support progress of any work on the subject in ICAO panels by the means of existing or newly created job cards.

2.7 The 41st Session of the ICAO Assembly agreed with A41-WP/127 presented by The International Coordinating Council of Aerospace Industries Associations (ICCAIA), which invited ICAO to develop a roadmap with the objective to establish the adequate standards and recommendations to enable the entry into service of WER operations by 2030.

2.8 ICCAIA believes that the next steps would be:

- a) to consolidate an ICAO concept of operations (CONOPS), based on the progress of existing initiatives (e.g. work on SESAR JU's project, Airbus past flight trials);
- b) to review and analyse the impact to the current ICAO provisions;
- c) to develop a WER Manual and the amendments to the ICAO provisions (e.g. Annex 2 — *Rules of the Air*, Annex 6 — *Operation of Aircraft*, Annex 10 — *Aeronautical Telecommunications*, Annex 11 — *Air Traffic Services, Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444), *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168)) when necessary/relevant;
- d) to perform impact analysis studies for ANSPs (ATM system changes, Safety Net changes, controller working position (CWP) changes, training), reduced vertical separation minimum (RVSM) height monitoring aspects, for airspace users (certification of new systems, flight crew training, flight planning for the selected pair);
- e) to support involved early adopter regulators in the development of their safety cases and amendments to their national regulations; and
- f) to support all involved stakeholders so that normal operations could commence before the end of the decade in the first region(s).

2.9 The WER concept has been the subject of promising demonstrations and international aviation should now support its generalisation through the development of appropriate regulations and standards. Building on the work already carried out (e.g. various flights carried out in the recent past, SESAR project launched, etc.), it is now important to mobilise to develop, approve and support the proposed plan and execute the different stages.

2.10 Given rapidly evolving technologies and processes, ICCAIA encourages mechanisms to ensure that ICAO provisions are developed in a timely manner as technologies mature. This is one such example with a clear timeline for implementation.

3 CONCLUSION

3.1 The purpose of this information paper is to raise awareness on WER by sharing status, progress and plan for the future activities:

- a) the WER solution has been demonstrated as an interesting option to reduce CO2 emissions through enhanced operations;
- b) the industry acknowledges the need to work with ICAO and regulators in order to define adequate regulations and standards and their deployment at regional level; the industry's objective is to be ready by 2030 in order to enable initial WER operations; and
- c) a plan including the detail of the different steps is outlined herein. Industry will continue to stay engaged and will work with ICAO to further develop and execute a plan for development of SARPs and guidance materials needed to support introduction of WER operations.

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