International Civil Aviation Organization

A41-WP/127[1]
TE/39
27/7/22

WORKING PAPER

ASSEMBLY — 41ST SESSION

TECHNICAL COMMISSION

Agenda Item 31: Aviation Safety and Air Navigation Standardization

WAKE ENERGY RETRIEVAL (AUTOMATED FORMATION FLIGHT)

(Presented by the International Coordinating Council of Aerospace Industries Associations)

EXECUTIVE SUMMARY

Wake Energy Retrieval operations in cruise, applied to aeroplanes engaged in international commercial operations, allow 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 actually surfing it. The technical solution ensures that the aeroplanes remain safely positioned throughout the "paired" flight.
This paper notes the progress being made in the North Atlantic (NAT) Region and urges support for the development of ICAO provisions (including an ICAO manual) that are necessary to enable Wake Energy Retrieval operations, which support CO2 emission reduction goals for aviation.

Action: The Assembly is invited to:
a) note the progress made on Wake Energy Retrieval Operations in the NAT region; and
b) direct ICAO to define a strategy aimed at developing the necessary provisions to enable Wake Energy Retrieval Operations within a five-year timeframe.

Strategic Objectives:	This working paper relates to Strategic Objectives: Environmental Protection, Safety, Air Navigation Capacity and Efficiency.
Financial implications:	N/A
References:	A40-WP/317 EX/129, *Automated formation flight*

[1] English, Arabic, Chinese, French, Russian and Spanish versions provided by ICCAIA.

1. INTRODUCTION

1.1 Reduction of fuel consumption and consequently of "Greenhouse Gas emissions" (GHG - mainly CO2) and more globally the environmental footprint of the aviation sector is a key challenge for commercial aviation for the next decades. Significant technical progress has already been made for fuel efficiency during the last decades.

1.2 Wake Energy operations in cruise applied to aeroplanes engaged in international commercial operations is one of the most promising complementary ways to reduce fuel burn. This paper provides elements on progress and achievements since the last ICAO 40th Assembly and proposes a strategy to address the required provisions for Wake Energy Retrieval operations.

2. DISCUSSION

2.1 During 2020, and 2021, early test campaigns validated the concepts of Wake Energy Retrieval. In July 2020, a first flight test campaign validated all elements of the concept (vortex position estimator, automated capture and tracking functions through a dedicated aeroplane system). In March 2021, a second flight test campaign confirmed fuel and emissions reductions in line with models. In addition, airborne functions for automated vortex capture and tracking were tested at different altitudes and separations.

2.2 In September 2021, paired aeroplanes flew in General Air Traffic conditions, under French (Brest) and UK (Prestwick) Air Traffic Control. Safety studies were performed to manage Wake Energy Retrieval operations in General Air Traffic conditions with legacy tools.

2.3 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 Brest and Canadian domestic airspaces.

2.4 These two first transatlantic flights of a pair of aeroplanes, one surfing the vortex of the other, were considered a success. At least 2 tons of fuel (around 6 tons of CO^2) were saved during each flight. A 5% fuel saving per follower flight has been confirmed. A total of 11h20 (round-trip) of automatic positioning was realised.

2.5 Operational feedback on operations, phraseology and datalink were obtained from the trials and will enrich future activities on this topic. Further detailed information about these trials and the development of a concept of operations is provided in Information Paper WP xx.

2.6 In order to enable the concept to be used globally, standards will need to be established to define, inter alia, pair and split procedures, terminology to be used, the separation required between aircraft, the transfer of responsibility between ATC and the paired aeroplanes and frequency allocation for the coordination. The implementation of Wake Energy Retrieval operations could be envisaged in a phased approach so that they can be first implemented, with a limited number of changes to ICAO provisions, in the High Seas airspace of the NAT Region in a five year timeframe. As a second step, the outcomes of this implementation phase will be used to propose additional updates to ICAO SARPs and related guidance material so that Wake Energy Retrieval operations can be extended into domestic and/or interface area airspaces.

3. CONCLUSION

3.1 The transatlantic trials are a concrete demonstration of collaborative work for designing and qualifying optimised solutions aiming to reduce fuel consumption, to optimise operations and consequently to significantly reduce CO2 emissions during the flight.

3.2 Acknowledging that the review and update of the global ICAO provisions (Standards and Recommended Practices (SARPs), PANS, and Manuals) is the primary responsibility of the various ICAO panels and working groups, the NAT SPG/58 did not support the proposal to establish an industry led NAT project team. NAT SPG recognised that the timelines for updates to ICAO global provisions were not compatible with the current plans for deployment of this operational improvement, so that operations can commence from 2025 onwards, in the NAT airspace (in line with the ICAO NAT 2030 Vision),

3.3 Following NAT SPG/58 recommendation, ICCAIA is therefore requesting the support of the Assembly to direct ICAO to develop the provisions that are necessary to enable Wake Energy Retrieval operations which contributes to short term aviation emission reduction targets.

— END —