Fuel Tankering:
Economic benefits and environmental impact

Authors: Laurent Tabernier, Esther Calvo, Andreas Tautz, Robin Deransy, Peter Martin

PURPOSE OF THE STUDY

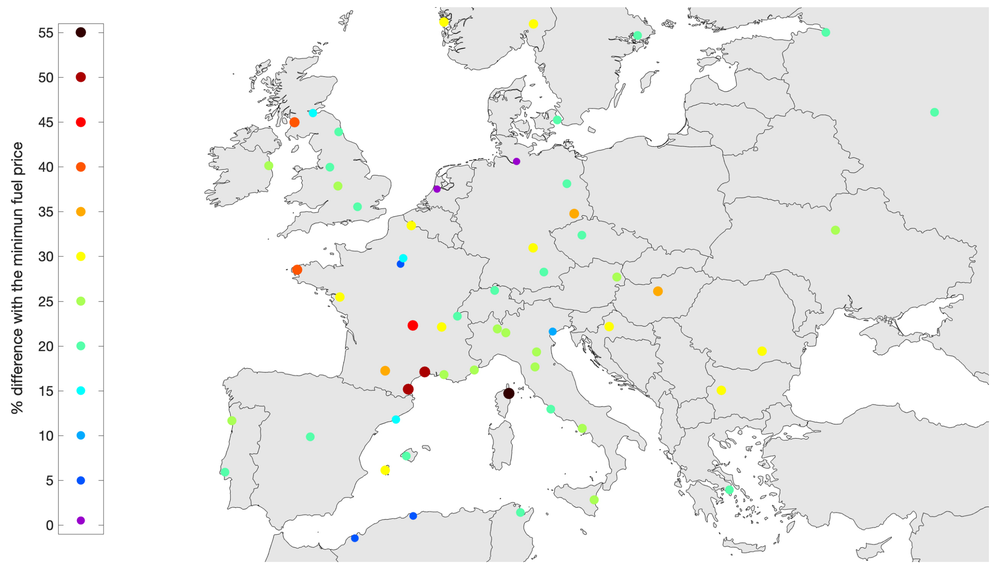
Fuel tankering is a practice whereby an aircraft carries more fuel than required for its flight in order to reduce or avoid refuelling at the destination airport. However, carrying more fuel than necessary increases the fuel consumption and thus the amount of CO_2 emitted. So far, studies on fuel tankering [1]-[6] focused mainly on its economic benefits for a single flight. As demand to accelerate the decarbonisation of transport becomes more and more pressing, the purpose of this study is to provide information on the extent of the impact on the environmental of fuel tankering at ECAC level.

STUDY PARAMETERS

Simulations were performed with June 2018 ECAC traffic data taking into account the distribution of ECAC flights per distances flown, aircraft performance, maximum take-off weight, landing weight, fuel tank capacity, legal fuelling minima, and information about negotiated fuel prices from some airlines (as illustrated below), a payload factor of 80.3%, and 124 kg/passenger [7].

Fuel tankering can be partial or full. Full fuel tankering means that 100% of the fuel necessary for the return flight is carried. For partial tankering, only 10% to 90% of this quantity is carried. For full fuel tankering, flight legs of more than 1,500 NM were not considered. For partial tankering, flight legs of more than 2,500 NM were not considered. The use of fuel tankering for reasons other than fuel price differences at airports was not considered.

Example of differences in jet fuel price at airports (illustrative)



IS FUEL TANKERED IN EUROPE?

Interviews with pilots from various airlines, business aviation dispatchers and handling agents, confirmed that in practice full tankering is performed on 15% of flights, and partial tankering performed on a further 15% of flights. They also mentioned that fuel tankering is done in 90% of cases for fuel price reasons, and only in 10% of cases for social disruption, technical failures at the refuelling facility, fuel shortages, risks of delays, or contaminated fuel at destination airports. To calculate the optimum tankering, most airlines use operations centre software (e.g. Lido and Sabre) taking into account the cost of fuel at the airports served. A patent has recently been published by Honeywell for a tool to further enhance fuel tankering and fully exploit its economic benefits [8].

REFERENCES

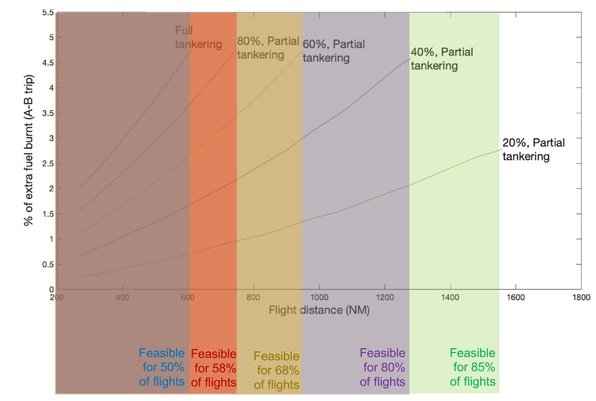
[1] Filippone, A. "**Case Study Fuel Tankering: Is it Worth it?**" The University of Manchester, February 2015.
[2] Lindgren. M, Brynhagen., M. "**Fuel Tankering**" Bachelor thesis, Lund University School of engineering at Campus Helsingborg, 2012.
[3] J. Lesinski III, W. "**Tankering Fuel: A Cost Saving Initiative**" Graduate Research Paper, Department Of The Air Force at Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio, May 2011.
[4] Tavares Guerreiro, J. A., Muller, C. and Fibeiro Correira, A. "**A fuel tankering model applied to a domestic airline network**", Journal of Advanced Transportation, Vol. 47, 2013, p. 386-398.
[5] "**Focus on Fuel Part three: Global Fuel Pricing and Availability**" Retrieved March 2019, https://www.jetex.com/global-fuel-pricing-and-availability/.
[6] Thurber, M. "**Tankering Benefits Tangible and Achievable** "October 2015, Retrieved March 2019, https://www.ainonline.com/aviation-news/business-aviation/ 2015-10-12/tankering-be-nefits-tangible-and-achievable.
[7] EASA, EEA, EUROCONTROL "**European Aviation Environmental Report 2019**", doi: 10.2822/309946, ISBN: 978-92-9210-214-2.
[8] "**Methods and apparatus for providing fuel tankering data onboard and aircraft**", Pub. No. US 2018/0189704 A1, July 2018.
[9] ATA, "**World Air Transport Statistics**" N. Kumar, P. Frolik, G. Joshi, H. Ramadugu, 2017.

For more information: EUROCONTROL Think Paper #1

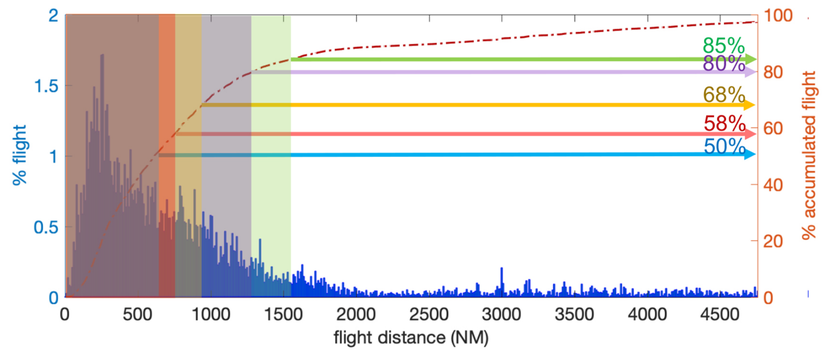
FUEL TANKERED: THE RESULTS

The study demonstrated that over the 10 milion annual flights in ECAC, 2.1 million were able to perform fuel tankering, distributed as follows: 1.6 million flights are able to perform full tankering (16.5%) and 0.45 million flights are able to perform partial tankering (4.5%).

% of extra fuel burnt vs.% of flights performing tankering



% flights vs. % of flights performing tankering



As a result, in ECAC, fuel tankering would represent 136kg of additional fuel burnt per flight concerned (costing 75€), generating 428kg of additional CO_2 (i.e. 9€ in purchased CO_2 allowances).

Despite this additional cost, fuel tankering would still result in a net saving of 126€ per flight on average. It should be noted that the values above are averaged and could vary significantly between airlines due to negotiated fuel price, type of aircraft used, and distances flown.

ECONOMIC BENEFIT VS ENVIRONMENTAL IMPACT

As aviation is a very competitive market, airlines must do everything possible to minimise their operating costs, in particular regarding fuel cost, which represents 17% to 25% of their operating expenses [9]. Consequently, tools have been developed for identifying the value of performing fuel tankering, a practice whereby an aircraft carries more fuel than required for its flight in order to save costs. However, fuel tankering is not without environmental consequences, as the more fuel an aircraft carries, the more fuel it burns and the more CO_2 it emits.

This study estimated that fuel tankering could result in a net saving of 265M € per year for the airlines, but would generate 286,000 additional tonnes of fuel burnt and 901,000 tonnes of CO_2 emissions in the ECAC area per year. This is equivalent to about 2,800 round-trips between Paris and New York or the annual emissions of a European city of 100,000 inhabitants. This is a substantial economic benefit but also a significant environmental impact.

Therefore, fuel tankering could offset the benefit of initiatives to save fuel and reduce aviation CO_2 emissions. At a time when aviation is challenged for its contribution to climate change, a practice, such as fuel tankering, that generates significant additional CO_2 emissions is questionable. And the COVID19 crisis has created such economic pressure that airlines might have been tempted to intensify the practice of fuel tankering since then.