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INTERDEPENDENCY ANALYSIS OF CURRENT AND FUTURE CRITERIA AND THEIR LIMITS FOR AIRCRAFT NOISE CONTROL IN URBAN AREAS

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Abstract. Aviation in the 21st century contributes to climate change, noise and air pollution. Together with various social and economic problems, environmental issues have the potential to constrain the operation and growth of airports. Constraints on airport capacity affect the capacity of the air navigation system as a whole. Many international airports are operating at their maximum, and some have already reached their operating limits including those resulting from environmental impact. This situation is expected to become more widespread as air traffic continues to increase.

A growth of an airport can be controlled by setting up flight safety, operational, economic and environmental limits (Fig. 1) [1]. In addition to the increasing traffic demand, new constraints on the traffic flows have been imposed and limited the capacity and efficiency of air transportation [2, 3]. Apart from airport and airspace capacity issues, that need to be resolved to accommodate further growth, the air transport industry is also facing increasing constraints (short-term and long-term) with respect to environmental pollution, both locally – around the airports, and globally – during the flights on the routes worldwide.

EU FP-7 project TEAM_Play (TP) brings sophisticated and well established economic and environmental modelling tools for different sectors (points and areas of concern) and has shown that there are significant interactions and potentially large economic synergies between LAQ control and fuel burn (FB) and greenhouse gas (GHG) mitigation. This means that by adopting policies and management strategies that tackle airport noise, local and global air pollution, other factors significant benefits will also be gained in other areas such as climate change mitigation, but also human and environmental health.

Modelling Interactions and Synergies Tool (ModIST) quantifies the environmental, technical and economic interactions between mitigation measures for the considered LAQ factors and fuel burn/GHG. It assesses the simultaneous multi-factor impacts reductions on local environment (complex tool ALFA – Airport Local Factors Assessment, including LAQ, Noise and Third Party Risk, all designed in NAU) as well as for selected metrics of greenhouse gases (e.g., the global warming potentials) with further economical evaluations.

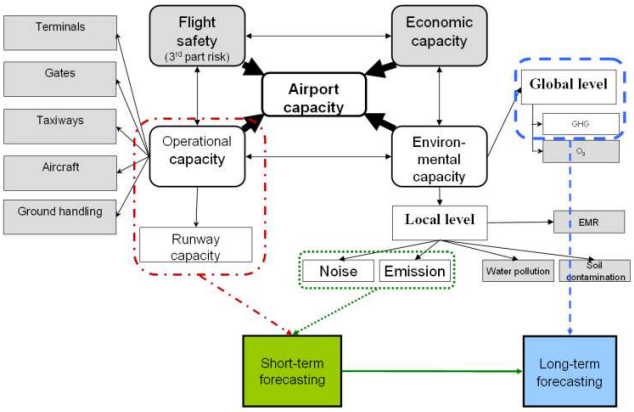

Fig. 1. Source from K. Kazhan PhD thesis

In addition, ModIST includes an optimization approach that allows the search for least-cost combination of mitigation measures for LAQ factors and FB/GHG that meet user-specified constraints (policy targets) for each possible of the

environmental endpoints. The optimisation capability of ModIST is applied in MaxEnt and enables the development of multi-factor and multi-effect impact control strategies. MaxEnt tool is currently under development in NAU for LAQ factors and it was validated for operational scenarios at the busiest Ukraine's airports with and shown increase of noise airport capacity up to 10% and 15% for day and night time accordingly; and the implementation of noise abatement procedures (NAPs) – 20–25%. Thereby, ModIST can identify mitigation strategies that achieve LAQ and FB/GHG related targets simultaneously at least cost.

In particular, the optimisation can be used to search for cost-minimal balances of controls of all the factors under consideration over the various scenarios in aviation sector in all European countries that simultaneously achieve user-specified targets for human health impacts (for example, expressed in terms of reduced life expectancy in accordance with WHO guidelines for these factors), ecosystems protection, and maximum allowed violations of WHO guideline values, etc. (Fig. 2).

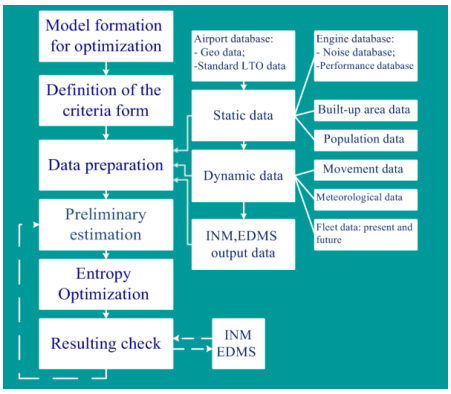

Fig. 2. Principal scheme of the algorithm of the Entropy model (from K. Kazhan PhD thesis)

Thus in addressing the problem of decision making process in possible local airport scenarios ModIST allows: to assess ability of effective using operational procedures; to determine optimal correlation among NAPs, air quality operations and environmental standards, first of all in urban areas around the airport; to forecast schedule and aircraft fleet for predefined capacity; and to rank environmental problems inside the urban areas in airport vicinity.

Keywords: airport scenarios, noise, local air quality, airport capacity,

References

[1] Zaporozhets, O.; Tokarev, V.; Attenborough, K. 2011. *Aircraft noise propagation, exposure & reduction: assessment , prediciton and control*. London, New York, Spon Press: 414.

[2] Kazhan, K.; Tokarev, V.; Konovalova, O.; Zagurska, L. 2011. Environmental capacity and sustainable development of airports in Ukraine *Proceedings of National Aviation University*. 3: 142-148.

[3] Kazhan, K.; Tokarev, V. 2009. The optimal noise modelling in the airport vicinity. *The 9th International Conference on Theoretical and Computational Acoustics, Proceedings*. Dresden: 41-50.