Mitigating Environmental Constraints at Airports Through Long Term Planning: A Decision Support Approach

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European airports are increasingly subject to environmental constraints, the effects of which can be mitigated through long term planning. This paper describes the theory, indicators and nature of a proof of concept decision support tool, designed to help maximise the environmental capacity of airports. The tool – PANDA – uses operational and environmental indicators referenced to sustainability thresholds. It geographically locates noise exposure zones on a probabilistic basis, and provides a simplified representation of gaseous emissions in the airport area. A particularly novel artificial neural network in PANDA derives the relationship between user-entered data on air transport movements (ATMs) and noise exposure. An open programming structure permits further development of the model in terms of the number of environmental parameters included, the sophistication of their modelling and the number of airports modelled simultaneously.

Flight Movement Inventory: SAGE-AERO2K

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A global air traffic emissions database is an essential tool for both policy makers and climate change scientists. Since the last comprehensive aircraft emissions inventories were developed in 1996 and 1998 for the year 1992, an update is necessary. This need is being addressed in the USA through a project entitled SAGE and in Europe through a project entitled AERO2K. Both Europe and the USA have agreed to collaborate on these similar projects. The agreement resulted in the exchange of flight movement data in order to realise an air traffic movement inventory, the essential starting point for estimating global aviation emissions. The objective of the inventory in both projects is to provide 4-D flight trajectories (latitude, longitude, altitude and time) using as much measured data as possible. The movement inventory is the essential input to the core module used for computing fuel burn and emissions. This paper details the aircraft movement’s data in AERO2K and SAGE.
Emissions Reductions Enabled by Improved Airport Surface Operations

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Capacity constraints in the United States national airspace system (NAS) have coupled with the growth in air traffic to increase congestion in airways, terminal areas and on the airport surface. In this paper, we discuss the growth in aviation emissions from ground operations in the United States from 1995 to 2000 and investigate the potential for emissions reductions under 3 scenarios: improved operations, single-engine taxiing, and use of tow trucks to move aircraft to and from runways. Emissions estimates, unlike with previous models, are based on actual mission times and aircraft types from the Airline Service Quality Performance (ASQP) data, compiled by the US Department of Transportation (DOT) from information provided by the ten largest US carriers. Results indicate that surface emissions have been growing faster than airborne operations or total mission time in domestic US aviation, and may therefore become a constraint on airport expansion. The potential for emissions reductions through improved ground operations and single-engine taxiing is significant. The net environmental benefits from using tow trucks are unclear and should be investigated further.

Weather Specific Noise Abatement Procedures: A Case Study of Departure Procedures for Runway 4R at Boston Logan Airport

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Although weather is a significant factor in the noise impact of aircraft operations, noise abatement procedures have traditionally been designed for "an average day." In this paper, we present the details of NOISIM (a model that is used to predict the effects of weather on aircraft noise) and show through a validation study that the model accurately predicts measured noise levels (the model predicted peak noise levels were within 3 dBA in 95% of the cases and differences in sound exposure levels were less than 1 dBA in 95% of the cases). We then use the model to determine the effect of weather on aircraft noise impact and illustrate how knowledge of these relationships might enable changes in flight procedures. First, a parametric study is used to illustrate the significant effect that weather has on aircraft performance and noise propagation, and to provide motivation for more explicit consideration of weather in both the design and selection (in daily operation) of noise abatement procedures. Second, a case study of the departure procedure for runway 4R at Logan International Airport in Boston is used to illustrate how the number of people impacted by a sound exposure level greater than 70 dBA can be reduced by almost 56% from approximately 285,000 (for the existing procedure) to approximately 120,000 (for a weather-specific departure procedure).