

Cancun 2002 - WP 91

Environmental issues in ATM

Introduction

At the 40th IFATCA conference 2001 in Geneva, SC1 accepted the work item concerning environmental issues in ATM. This item was put on the agenda as with the growth of air traffic, environment and ATM seem to get more often in conflict.

There are several environmental issues associated with aviation: aircraft noise, aircraft emissions and other emissions from aviation (i.e.: Emissions caused by construction and expansion of airports or associated infrastructure; management of wastes at airports, including disposal of environmentally harmful materials used in aircraft servicing and maintenance). Environmental concern about climate change, gaseous emissions and noise is becoming, also for aviation, an increasingly important political, economic and social issue. This paper will address the environmental impact on safety and capacity.

Discussion

The aviation industry has grown rapidly and has become an integral and vital part of modern society. Future projections suggest that the demand for air travel will continue to rise, in line with the growth in the world economy. This has created concern that aviation's rapid expansion will outstrip improvements in industry environmental performance.

Although the highest number of aircraft movement take place in and over the USA, it seems that the main environmental issues influence the air traffic the most in Europe and certain parts of Australia. This can be drawn from the fact that the usage of continuous descent approaches, preferential runway systems, as a means to avoid environmental problems, is widely spread around European airports. The amount of noise complaints placed by people living around Schiphol Amsterdam is and has been as high as the total amount of complaints received from all airports around the world combined.

The main concerns with the rapid growth are the increase in aircraft emissions and aircraft noise. Industry is working on ways to decrease this impact on the environment.

Concerning aircraft (engine) emissions, ICAO is involved through its council Committee on Aviation Environmental Protection (CAEP) in the work on three possible solutions for this problem:

1. Technology: improved engine or airframe design could control emissions. There have been considerable improvements through the years in constraining growth of emissions and fuel efficiency and these can be expected to continue.
2. Operational measures: the early implementation by States of the new communications, navigation, surveillance and air traffic management (CNS/ATM) are effective means of reducing fuel burn and avoiding unnecessary emissions.
3. Market-based options: the increased use of market-based options as environmental levies (charges or taxes) and emission trading.

At present these three possible solutions do not have a great impact on capacity or safety. In the future they might have as airlines and providers will have environmental targets to meet.

No other effect of air transport operations is being experienced as directly and individually as aircraft noise. There is a clear distinction between "sound" and "noise". Sound is a physical event that generates different reactions from individuals. If a sound is perceived to be disturbing or annoying it will usually be described as noise. The number of people annoyed by aircraft noise is determined by the number of aircraft movements, the types of aircraft used and by the population patterns around the airport.

The three methods currently used and available to contain the sound are:

1. Land use planning: control of land use near airports is vital if the noise reductions already achieved are not to be offset by people moving closer to airports and to the noise.
2. Reduction of noise by the use of quieter aircraft. An aircraft entering the fleet today is typically 20 dB quieter than a comparable aircraft of 30 years ago. A further 10 dB reduction is expected within the next decade. A reduction of 10 dB is perceived by the human ear as a halving of the noise experienced.
3. Noise abatement operating measures such as preferential runways, and -routes and noise abatement procedures for take off, approach and landing.

Especially the third method has its impact on ATM. Preferential runway-systems and -routes are widely used on airports around the world. The preferential routes mostly route the aircraft around populated areas and do not always influence capacity, although in almost all cases they influence

efficiency in a great way. The (feeling of) safety on the ground is increased by the "absence" of sound and the decreased chance of an aircraft crashing in populated areas.

These "Public Safety Zones" or "Public Safety Routes" have, up to the present, been determined more in a somewhat rule-of-thumb manner than scientifically. New standards are and have to be defined.

With the design of a preferential runway system, above all priority is given to safety. As a result of that, capacity and efficiency is or can be reduced in favour of environmental restrictions. A crosswind maximum of 15 Kts including gusts is recommended by ICAO as a criterion for the selection of a noise preferential runway. On certain airports however (for example Amsterdam Airport Schiphol) the amount of noise around runways is computed with the use of pre-set parameters. When the maximum amount of noise set for one runway is or is about to be reached, less preferential runways have to be used. This might mean using a runway with more cross- or tailwind than the standards set by ICAO. In 1997 there was a landing-accident at Schiphol. One of the main causes of this accident was the runway-allocation at that time, which prescribed the use of the most noise preferential runway up to a maximum of 25 Kts crosswind during night hours. At that time, several runways had been closed as the total computed amount of noise was reached. This resulted in the use of a less preferential runway. In 2001 an aircraft crashed at Zurich airport while executing a non-precision approach. A precision approach on another runway could not be made as a result of environmental restrictions. These two examples indicate that safety is affected.

The use of noise abatement procedures in take off and landing are also widely used around the world. Standard Instrument Departure (SID) is the most common tool used to avoid excessive noise while over flying populated areas. At Schiphol the Continuous Descent Approach (CDA) procedure has been introduced. In this procedure the vertical- and speed-profile flown by an approaching aircraft are free from a certain point and along a dedicated approach-route. The freedom to fly own speed- and descent-profile results in a approach flown with nearly idle power and therefore minimises the noise exposure on the ground significantly. The main problem with this kind of approach is that due to uncertainties in approach time predictions the landing interval between aircraft had to be increased from 1.8 to 4 minutes. This measure reduces the airport capacity dramatically and is therefore only carried out during the quieter night hours.

Since December 1998, within the scope of European Commission DG VII, an international project on the determination and evaluation of noise abatement flight procedures was initiated. This project, Study of Optimisation procedures for Decreasing the Impact of Noise around airports (SOURDINE) is co-ordinated by ISR/Thomson-CSF, in co-ordination with the Dutch National Aerospace Laboratory (NLR) The project aims at defining new procedures leading to the reduction of noise in the airport vicinity.

At different airports around Europe and in Australia stringent and sometimes difficult procedures are to be followed as a result of environmental restrictions. Sometimes confusing and complex runway changes (London Heathrow/Amsterdam Schiphol/Sydney); the usage of non-precision approaches

where there are precision approaches available (Zurich); and approaches with a high glide path angle of 5.5 degrees or more (London City).

The Flight Safety Foundation (FSF) had a study done by its Approach and Landing Accident Reduction (ALAR) working group into the use of non-precision approaches. This study has established that the use of non-precision approaches raises the risk of serious accidents by a multiple of between five and seven compared with statistics for precision approaches. Since this study the FSF has been campaigning for phasing out of non-precision approaches.

Work is done on several new departure techniques using different power and flap-settings. NLR is working on Precision Navigation Instrument Departures, which are flown as an RNAV procedure along a predefined 2-D horizontal route. The departure route geometry can be adapted in the local situation in a way that populated areas are avoided as much as possible. Existing noise abatement departure routes become more effective because of the very accurate way the prescribed routes can and must be followed.

On the approach-end three measures have been evaluated: reduced flaps approach, slightly increased ILS glide slope and increased final approach altitude. These three measures can be implemented on a rather short time scale and no serious problems are to be expected with respect to ATC and airport capacity.

A more complex procedure, Advanced Continuous Descent Approach (ACDA) has the following technologies integrated:

- Curved approach, continuous lateral and vertical guidance with a constant 3° glide path;
- Decelerated approach via an energy management algorithm in the FMS, and
- 4-D RNAV, a prediction of the aircraft track in position and time is made before the aircraft initiates an ACDA procedure.

It is expected that the three above-mentioned issues, together with the additional planning and monitoring tools for the air traffic controller, will reduce the uncertainties in the time of arrival over the threshold to the accepted level of the current practice. Consequently the capacity of an airport using ACDA approaches will be restored to the level for conventional approaches.

Eurocontrol has environmental objectives and targets fully integrated in the adopted EUROCONTROL ATM 2000+ Strategy. The ATM 2000+ Strategy considers that environmental implications are an essential part of the ATM decision-making process, and that, where possible, the most environmentally friendly solutions should be adopted. The Eurocontrol Agency's general environmental objective will be to work closely with ICAO, the European Union and other relevant international and national bodies to obtain those improvements in ATM which, while providing significant operational, technical and economic benefits, mitigate the environmental impact.

Conclusions

There are several environmental issues in ATM. Aircraft noise and aircraft emissions are the issues that have the greatest impact on efficiency and safety.

The normal order of priority in air traffic control is: safety, efficiency and "finally" environmental issues. More often this order is changed in favour of the environment, although the highest priority is still given to safety. Especially at certain airports or at certain times, the environment part in ATM is favourable above efficiency. This is mainly reached by the use of special departure- and approach-procedures.

In all studies, work programmes or new procedures concerning environmental issues, safety is left beyond dispute. However there are and have been cases in which safety was breached in favour of the environment. Work programmes should therefore have to study the safety aspect of future developments more carefully. This to ensure that these developments are as safe as those that would be used if these environmental issues would have been effected.

Aircraft noise has become a significant threat to the growth of air transport.

By the increase in number of movements and the anticipated future growth in aircraft movements the amount of noise could increase again. As aircraft (engines) are getting quieter this development should be balanced.

New standards are developed and set, by CAEP, on aircraft engine emissions and noise.

Several organisations and projects (NLR, Sourdine) are working on the development of new departure- and arrival-procedures to minimise aircraft-noise on the ground. These developments must be followed closely and addressed from a controller point of view.

The EUROCONTROL Agency is co-operating with several international and national organisations, in controlling and reducing the environmental impact of aviation activity.

Recommendations

It is recommended that :

“In the operation, maintenance and development of the ATM system:

- when balancing the requirements of safety, efficiency and the environment, maintenance of the appropriate level of safety shall always have primacy.

- The measurement of performance shall reflect the impact of environmental constraints.

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