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Input data for aircraft noise measurements and modeling

The issues of implementation of radar track data for noise assessment purposes are under consideration in the paper.

Aircraft noise is the most significant cause of adverse community reaction related to the operation and expansion of airports. Limiting or reducing the number of people affected by significant aircraft noise is therefore one of ICAO's main priorities and one of the key environmental goals [1].

Noise measurements and aircraft noise monitoring are targeted on the aircraft noise control and for the reduction of noise levels within the habitation areas.

For correct noise assessment and increasing accuracy of modeling results the following data should be taken into account: latitude - longitude positions, origins and destinations, flight numbers, aircraft types, altitudes, headings and speeds.

The emission for aircraft noise can be found in two different types, analytical flight path can be defined with headings, turn to instructions like the air traffic controller would give to the pilots or these path can be generated in the form of backbones from recorded flights. The second type is the simulation of single or multiple recorded tracks. The "radar tracks" can be from the primary radar for the x/y part of the track and from the secondary radar response of an aircraft's transponder or the data can be recorded directly from the ADSB broadcast that ADSB equipped aircraft are sending. As the origin of the recorded data is different, so is the format used to record the data. Flight tracks are usually generated in close cooperation with the airport and air traffic control, in a generalized form, they needs to represent the existing traffic or the proposed or studied traffic conditions [1].

Alternative possible data sources for aircraft noise measurement and modeling [2]:

1. ADS-B: ADS-B (Automatic Dependent Surveillance-Broadcast) contains flight information on all flights being received by all AirNav RadarBox units being used all over the world, where users have opted to share their received data.

2. ASDI: ASDI (Aircraft Situation Display to Industry) data comes from the FAA radar systems.

3. Oceanic: Data from major trans-oceanic routes / position reports. Atlantic and Pacific Oceans included.

4. MLAT: Data from Multilateration calculations. Multilateration or MLAT is a navigation technique based on the measurement of the difference in distance to three stations at known locations by broadcast signals at known times.

5. CPDLC: Position reports coming from CPDLC - Controller–Pilot Data Link Communications -, a method by which air traffic controllers can communicate with pilots over a datalink system. The signals are relayed by satellites.

6. HFDL: Position reports coming from HFDL – High Frequency Data Link –, a method by which air traffic controllers can communicate with pilots over a datalink

system. Aircraft and ground stations make use of high-frequency radio waves in order to communicate.

7. ESTI: Accurate Estimated flight position based on several criteria for when coverage for a specific aircraft is lost. The criteria is extremely strict and based on flight parameters and historical flight data.

8. Merged: Contains data from all our available feeds organized and prioritized by relevance and accuracy.

The access to the listed sources nowadays is performing by flight tracking company like Flightradar.com, RadarBox24.com etc.

However there is an alternative approach to obtaining the listed radar track data. The limitations of the data from the Flight Tracking Companies and Airports are the following limited access to database depending on tariff plan, additional data are performed by special requests etc.

The ADS-B receiver for the purposes of short-term aircraft noise measurements was developed by the scientific group of engineers and scientists of NAU. The hardware and software complex, which is under development, will allow real-time recording of aircraft tracks and creating a historical database for revision in the future.

ADS-B signal reception and processing equipment consists of a radio receiver and an antenna with a narrow bandwidth at the ADS-B transmission frequency, software that interact with the receiver and decode and record data from the aircraft transmitters in given area (maximum reception radius is about 400 km).

The first testing of ADS-B receiver and aircraft noise measurement for noise assessment purposes was conducted for UKKK airport (International Airport Kiev) in August-September 2018.

Information that was obtained through flight tracking includes: the flight number; the name of the airline; the actual departure time; the actual arrival time; information on the type of aircraft; flight altitude; ground speed and latitude - longitude positions.

These data were supplemented by results of noise measurement for real operational conditions and by meteorological data.

The complex allows receiving complete data on 90% of flights arriving and departing from the UKKK (Kyiv Airport). The remaining 10% are old types, such as MD-82/83, light-engine and some business jets, as well as old Soviet aircraft which decommissitha oning is only a matter of time.

The preparation of the second stage of testing is taking place now at UKLL (Lviv Danylo Halytskyi International Airport) during the campaign on Environmental Assessment of the Impact of Aircraft Noise (both, measurements and modeling).

One of the highlights of flight tracking is the map display (fig. 1).

Experience has shown that flight path maps are the basic aircraft noise information tool. Providing people with an indication of where aircraft fly effectively underpins all other aircraft noise information. On the basis of flight path maps the Flight path movement's charts should be developed in consultation with the public to overcome some of the perceived weaknesses of flight path maps (Fig.2). They can show a 'macro' picture of aircraft noise distribution around an airport [4].

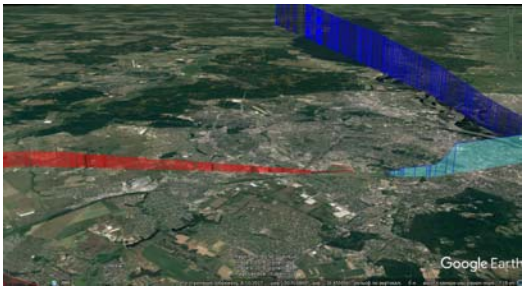

Fig.1. Visualisation of flight traking results at UKKK (Kyiv Airport), 22 August 2018: aircraft landing (red) and departure (blue)

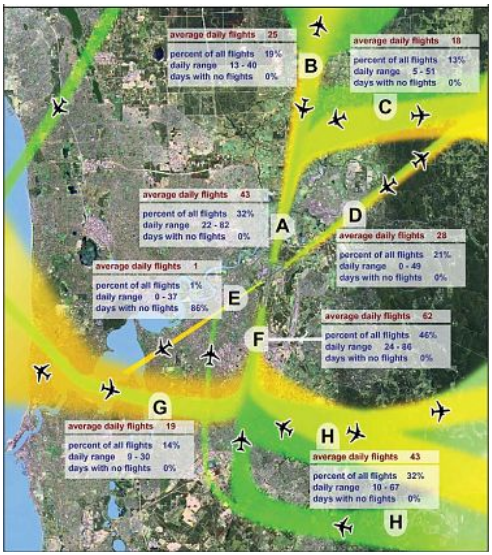

Fig. 2. Example of Flight path movement's charts for Australian airport [4]

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