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DETAILED CALCULATION METHOD FOR AIRCRAFT NOISE MAPPING BASED ON VERIFIED INPUT DATA FROM MEASUREMENTS

Mikhail Kartyshev[1], Yuriy Zakharov[2], Oleg Kartyshev[3]

State University of Civil Aviation, Russia

E-mail:[1]mkartyshev@yandex.ru, [2]v3v@yandex.ru, [3]oa_kartyshev@mail.ru

Abstract. Disadvantages of existing programs for aircraft noise calculation like INM and SOUNDPLAN are the following: lack in databases of valid noise and flight performance data for aircraft manufactured in CIS countries; usage by domestic pilots piloting principles, which are set out in national airworthiness codes and quite different from those used in the algorithms of the INM, SoundPlan and in ICAO recommendations for appropriate calculation methods.

In the modelling context due to the Recommended method ICAO Doc 9911 [1], a flight path (or trajectory) is a full description of the motion of the aeroplane in space and time. Together with the propulsive thrust (or other noise related power parameter) this is the information need to calculate the noise generated. The ground track is the vertical projection of the flight path on level ground. This is combined with the vertical flight profile to construct the 3D flight path. Segmentation modelling requires that the flight path of every different aeroplane movement is described by a series of contiguous straight segments. The manner in which the segmentation is performed is dictated by a need to balance accuracy and efficiency – it is necessary to approximate the real curved flight path sufficiently closely while minimising the computational burden and data requirements. Each segment has to be defined by the geometrical coordinates of its end points and the associated speed and engine power parameters of the aeroplane (on which sound emission depends). Flight paths and engine power may be determined in various ways, the main ones involving synthesis from a series of procedural steps and analysis of measured flight profile data.

Synthesis of the flight path requires knowledge of (or assumptions for) ground tracks and their lateral dispersions, aeroplane mass, speed, flap and thrust-management procedures, airport elevation, atmospheric pressure, wind and air temperature. Analysis of measured data, e.g. from flight data recorders, radar or other aeroplane tracking equipment, involves 'reverse engineering', effectively a reversal of the synthesis process. Instead of estimating the aeroplane and power plant states at the ends of the flight segments by integrating the effects of the thrust and aerodynamic forces acting on the airframe, the forces are estimated by differentiating the changes of height and speed of the airframe.

"The method of calculating aircraft noise contours" and appropriate program AcousticLAB-avia using real aircraft noise characteristics at particular airport may achieve a given accuracy of a contour evaluation and satisfying the precision of navigation equipment for aircraft (±50 m) and can be used in designing sanitary protection zones around the airports (aerodromes).

Keywords: aircraft noise, calculating method, measurements' verification.

References

[1] ICAO DOC 9911 Recommended Method for Computing Noise Contours Around Airports Ed 1. 999 University Street, Montréal, Quebec, Canada H3C 5H7, 2008. ISBN 978-92-9231-316-6.