PROCEEDINGS

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airport according to a monthly or a yearly scheme. The method offers sufficient flexibility in so far as special applications of the method can easily be designed for the purpose. In our opinion the underlying rating of the noise caused by movements by individual types of aircraft serves further as a useful tool to distinguish properly between aircraft types in respect of noise.

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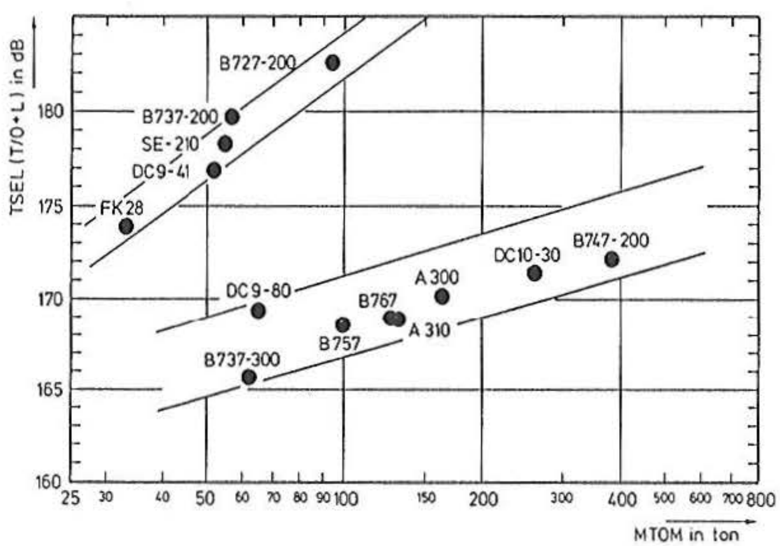

TSEL-values for a combined take-off and landing for some jet aeroplanes noise certificated according to ICAO Annex 16, Chapter 2 (upper belt) and Chapter 3 (lower belt).

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COMPARISON BETWEEN THEORETICAL MODEL RESULTS AND FIELD DATA FOR AIRCRAFT NOISE

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INTRODUCTION

From a general point of view, the acoustical impact of an airport on its surroundings should be evaluated with respect to two main factors, namely landing and take off operations and aircraft engine run-up tests on the ground.

These problems are to be investigated according to two different theoretical approaches, since in the former case the sources considered are movable and higher than the receiver and in the latter one they are steady on the ground. As for landings and take offs, many computer models have been developed in order to define contour levels in terms of such quantities as the Day-Night Level or the Noise Exposure Forecast. The main problem is to choose the more suitable model and to calibrate it so as to obtain a good approximation of the actual situation.

For the engine run-up tests on the ground, the number of experimental data is smaller so that a computer program was developed on the basis of noise levels we measured.

EVALUATION OF NOISE LEVELS DUE TO AIRCRAFT TRAFFIC

Among all the available computer models we have chosen the Integrated Noise Model, developed in 1978 by the Federal Aviation Administration on the basis of noise data collected by Bolt, Beranek and Newmann [1,2] and we have applied it to the Naples airport of Capodichino. We have also carried out noise measurements at 26 locations, most of them at 1.5 m above ground some other at 15 m, during a period of several weeks. For each aircraft considered the INM was then calibrated according to field data. The experimental values fitted fairly well the theoretical ones for threshold points (corresponding to locations number 1, 7, 21, 24, 25, 26 in table 1), not for locations lateral to the runways (points 8, 9, 10, 11 in table 1, corresponding to measuring positions at about 15 m above ground). In order to improve the approximation one should either compute the excess attenuation as a function of the "source-receiver system" geometry or, which is an easier way, modify the value of some parameters. Fig. 1 and 2 respectively show the L_{DN} contour levels due to 5 landings of a Boeing 737 and 5 landings of a McDonnel Douglas DC 9, with a reverse thrust of 7500 lbs/eng and with a reverse thrust of 15000 lbs/eng.

From Table 2 one can see the degree of approximation which has been achieved at critical locations by repeating the procedure described above for all the relevant parameters and for all types of aircraft considered[3].

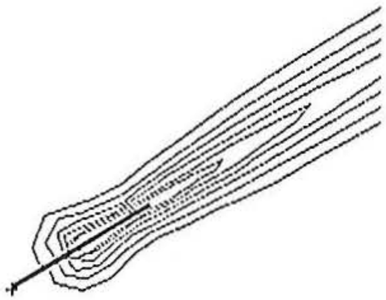

FIG. 1 Contour levels for 5 landings of a B737 and for 5 landings of a DC9 with reverse thrust = 7500 lbs/eng

POSITION	1	5	7	8	9	10	11	21	24	25	26
L_{DN} measured	55.9	56.2	53.5	56.3	49.1	45.7	41.2	66.3	62.1	55.9	55.9
L_{DN} theoretical	60.0	50.0	50.0	39.0	37.0	33.0	29.0	65.0	62.0	60.0	55.0

Table 1

POSITION	8	9	10	11
L_{DN} measured	56.3	49.1	45.7	41.2
L_{DN} theoretical	55.0	49.0	45.0	43.0

Table 2

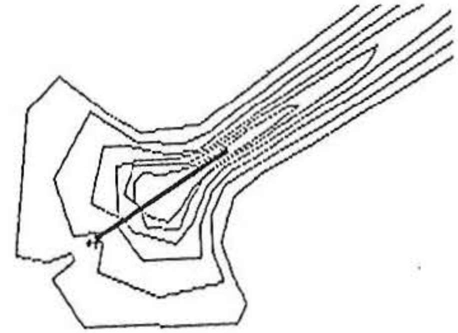

FIG. 2 Contour levels for 5 landings of a B737 and of a DC9, reverse thrust = 15000 lbs/eng

EVALUATION OF NOISE LEVELS DUE TO ENGINE RUN-UP TESTS ON GROUND

Noise measurements have been made at different distances and along different axes, during engine tests of two types of military aircraft, a jet and a propeller, on a summer day (wind velocity less than 2 ms^{-1}). The microphones were located at 1.5 m above ground, along four axes (0°, 45°, 90°, 135° with respect to the the front of the aircraft), from 25 up to 300 m from the center of the aircraft. An example of the excess attenuation values measured is shown in fig. 3.

The research program we are working on is concerned with the development of a theoretical model to predict the propagation of sound waves during engine tests. The present study aims to define the set of parameters necessary to specify the noise characteristics of the source and to select the most suitable set of equations to describe the sound propagation over a finite impedance terrain. As for the first object of the research, the field data allow to describe the noise source as a set of elementary sources, each one defined by its geometrical position, its sound power level and directivity. The sound power level and the directivity are computed on the basis of the levels measured 50 - 800 m from the aircraft, being difficult to carry out measurements in the "near field" and, as other authors have outlined[4], levels measured at shorter distances also affected by the soil surface.

Secondly, our research program is concerned with computing the excess attenuation of sound waves as a function of both the resistivity of the terrain and the "source receiver system" geometry.[5,6]

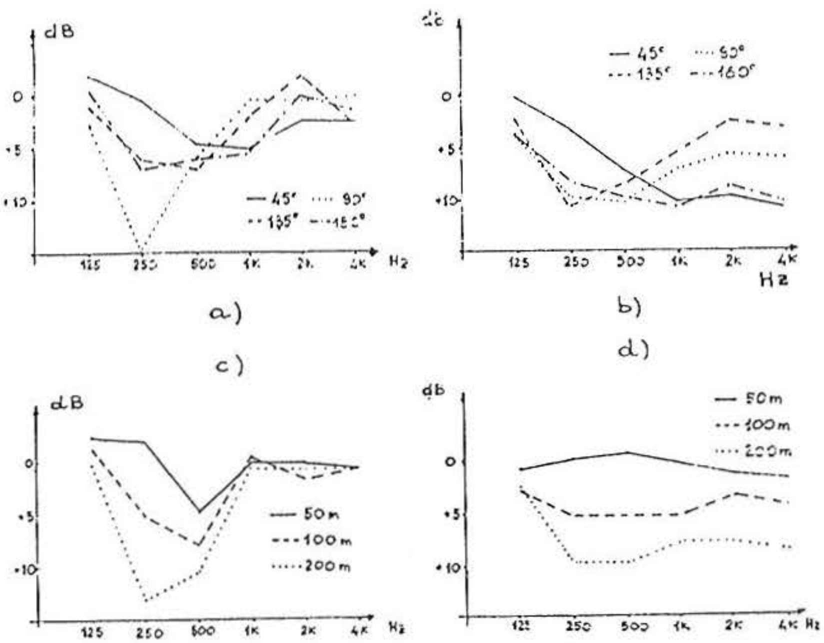

FIG. 3 (a) Jet type - engine speed 100%: attenuation along different axes.

(b) Propeller type - engine speed take-off: attenuation along different axes.

(c) Jet type - engine speed 100% - direction 90°.

(d) Propeller type engine speed take-off - direction 90°.

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BRITISH DEVELOPMENT OF QUIET HEAVY GOODS VEHICLES

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INTRODUCTION

As early as 1963 the Committee on the problem of Noise (1) found that the noise from vehicles would have to be reduced to about 80 dB(A) for the noise to be judged to be on the border between acceptable and noisy. A survey conducted in 1980 found that 12 percent of the adult population of Great Britain were bothered at home by the noise of lorri[es] using the road outside (2). The same survey showed that vehicle noise heard indoors was at least as important a cause of nuisance as noise heard out of doors.

In 1980 the Armitage Inquiry into lorries, people and the environment (3) found that, after safety and general intrusion, noise was the most important aspect of nuisance from lorries. It was suggested that lorry noise had increased by 6 to 8 dB(A) over 20 years and that the noisiest lorries then in service (built before 1970) had noise levels of up to 96 dB(A).

THE TRRL QUIET HEAVY VEHICLE (QHV)

In 1971 the TRRL launched its quiet heavy vehicle (QHV) project (4). The principal objective of the project was to produce 2 demonstration 8[-] articulated vehicle tractors. The implied noise limits for the major components (all at 7.5 m) were engine (including gearbox) 77 dB(A), cooling system 69 dB(A), air intake 69 dB(A), exhaust 69 dB(A). An additional low frequency limit of 90 dB(C) was also set for the exhaust. Research prototypes of these 2 vehicles were built by Leyland Vehicles and Foden/Rolls Royce respectively, and achieved drive-by noise levels of 79.5 dB(A) and 83.5 dB(A). A demonstration tractor then was built by Foden/Rolls Royce (5). This was powered by an RR Eagle 320 Engine rated at 238 kW and was built to production standards. It achieved a drive-by noise level of 81.7 dB(A). Subjectively, the QHV sounds smooth and non-aggressive.

The noise from the engine was reduced by turbocharging and reducing the rated speed from 2100 rev/min to 1950 rev/min, and the engine cooling system and gearbox were surrounded by a tunnel enclosure (Figure 1). A large exhaust silencer was fitted. The effect of various degrees of enclosure, and of the cooling fan, on the drive-by noise is shown in Table 1.