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### **Aircraft noise levels as measured at DME/NRC site at Uplands Airport** Krishnappa, G.; Hammell, T. H.

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NATIONAL RESEARCH COUNCIL OF CANADA

DIVISION OF MECHANICAL ENGINEERING

OTTAWA, CANADA

LABORATORY MEMORANDUM

SECTION Engine Laboratory

NO. NRC-ENG-77

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COPY NO.

DATE March 1973

SECURITY CLASSIFICATION

SUBJECT Aircraft Noise Levels as Measured at DME/NRC Site  
at Uplands Airport

PREPARED BY G. Krishnappa and T.H. Hammell

ISSUED TO

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Introduction

The D.M.E. property East of Uplands Airport is being considered as an alternative site for locating the proposed Engineering Acoustic Research Laboratory. Fig. (1) shows the area near Uplands Airport with an arbitrary location of a spot for the proposed laboratory. As this area is close to Runway No. 25/07, is continually exposed to the noise of aircraft during take-off from Runway 07. The relative distances of the location from the runway and the proposed site for the "Roller Rig" are shown in Fig. (1). Noise will be among the other important considerations for siting the proposed laboratory, from the point of view of keeping the noise from aircraft interfering with the experiments within the laboratory.

This memorandum describes the noise survey conducted during take-off of some aircraft with some detailed analysis of DC8 noise signatures which showed highest noise levels among the aircraft surveyed.

Noise Monitoring Position

Noise was monitored at the intersection of Alert Road and Access Road to D.M.E. Railway Laboratory. This location is about 600 ft. South West of Site A and 1700 ft. North of Runway 25/07. The recorded noise levels are considered to be substantially identical to those at the Site 'A' area. During peak noise levels aircraft were expected to be about 800-1000 ft. from the end of runway at altitudes varying from 500-800 ft.

Instrumentation

Take-off noise levels from aircraft were monitored on a B&K precision sound level meter with 1 inch diameter condenser microphone and recorded on a Tandberg 11 portable battery operated tape recorder at a tape speed of 7 1/2 in. per sec. The signal to the input on the tape recorder was fed through the output terminal on the sound level meter. The input attenuator on the tape recorder was adjusted so that full scale deflection voltage on the sound level meter could be recorded on the tape without overdriving the tape recorder. This is done by feeding a 1000 Hz signal directly to the microphone from a speaker. The output control on the tape recorder was adjusted to get a reasonable output voltage

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level for any meter deflection on the sound level meter. An oscilloscope was used for monitoring signal levels during the above calibration procedure.

A Bruel and Kjaer piston phone signal was recorded on the tape to produce a reference signal.

Test Procedure and Method of Analysis

Table I gives the peak sound pressure levels monitored from several aircraft taking off from Runway 07. Since the DC8 showed the maximum peak noise levels among the several aircraft surveyed, the noise signature was recorded on the tape recorder for further detailed analysis. One-third octave analysis of the recordings were done by using a Bruel and Kjaer one-third octave band analyser. Fig. (2) and Table II give the one-third octave band noise levels; it should be noted that they are not instantaneous levels but represent the peak noise levels in the band over the duration of the recording. At the high frequency end of the spectrum, the peak level in the band centering at 3150 Hz could well be the blade passing frequency tone from the front of the engine. A substantial amount of energy is contained in the low frequency bands from 100-250 Hz, with obvious implications for structures in that area.

The total perceived noise levels were calculated by using the following formula.

$$N = \hat{n} + 0.15 \left[ \sum_{i=1}^{24} \eta(i) - \bar{n} \right]$$

N = the total Noys value

$\hat{n}$  = the number of noys in the noisest one-third octave band

$\eta(i)$  = number of noys in the  $i^{\text{th}}$  one-third octave band

and perceived noise PNL =  $40 + 33.3 \log N$  PNdb.

The noys value for each one-third octave band are tabulated in Table II. 3150 Hz band shows the highest noy value among all the bands and hence contributes significantly to the PNdb level. The calculated fly over perceived noise level at the spot comes to about 113 PNdb from a DC8 aircraft.

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Conclusions

Among the aircraft surveyed, a DC8 showed the highest peak noise level of 98 db which corresponded to 113 PNdb at the test site. Other aircraft were relatively quiet, with peak sound pressure levels varying from 82-96 db.

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TABLE I  
E.A.R. LABORATORY SITE NOISE SURVEY  
AT INTERSECTION OF ALERT ROAD AND ACCESS ROAD TO U90

<u>Date</u>	<u>Time</u>	<u>Type of Aircraft</u>	<u>Runway 25/7 T.O. Direction</u>	<u>Peak Noise Level</u>
20-2-1973	2.30	DC9	7	92
27-2-1973	2.00	DC8	7	98
28-2-1973	11.00	Boeing 737	7	96
		Viscount	7	86
		L1011	7	82

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TABLE II  
PEAK ONE-THIRD OCTAVE BAND FLY OVER DC8 NOISE LEVELS

<u>Centre Frequency</u>	<u>Peak Band Sound Pressure Levels</u>	<u>Noys</u>	
100	89.5	20.4	
125	88.5	20.4	
160	91.0	24.3	Calculated Perceived Noise Level 113.04 db
200	90.5	27.0	
250	88.5	25.1	
315	89.5	28.7	
400	73.5	10.2	
500	85.5	23.4	
630	85.5	23.4	
800	83.5	20.4	
1000	78.5	14.4	
1250	78.5	16.6	
1600	75.5	17.5	
2000	72.5	16.3	
2500	74.5	21.5	
3150	84.5	46.0	
4000	75.5	23.1	
5000	72.5	17.4	
6300	74.5	20.1	
8000	63.5	7.6	
10000	52.5	3.0	
		TOTAL NOY	426.8

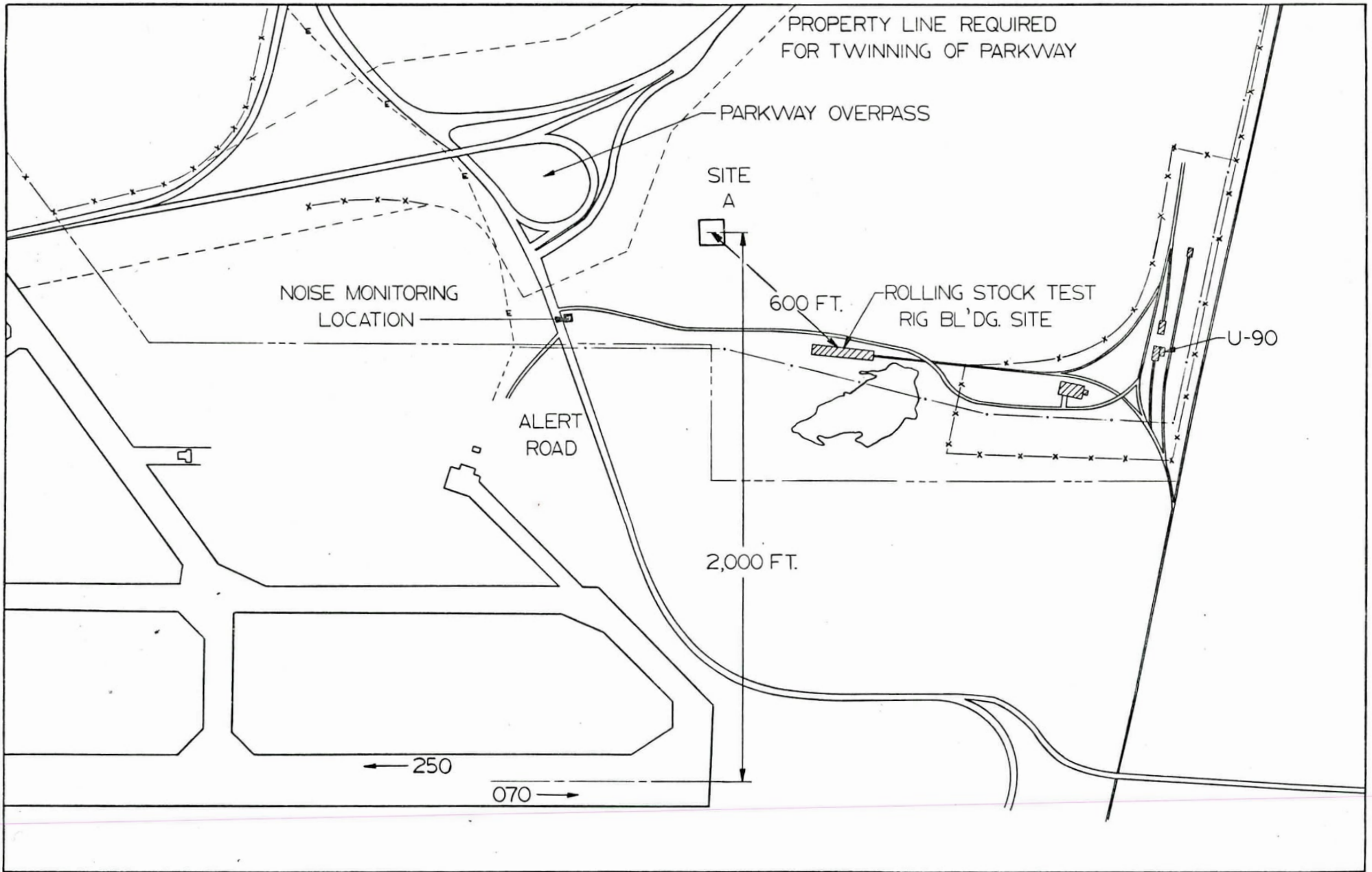
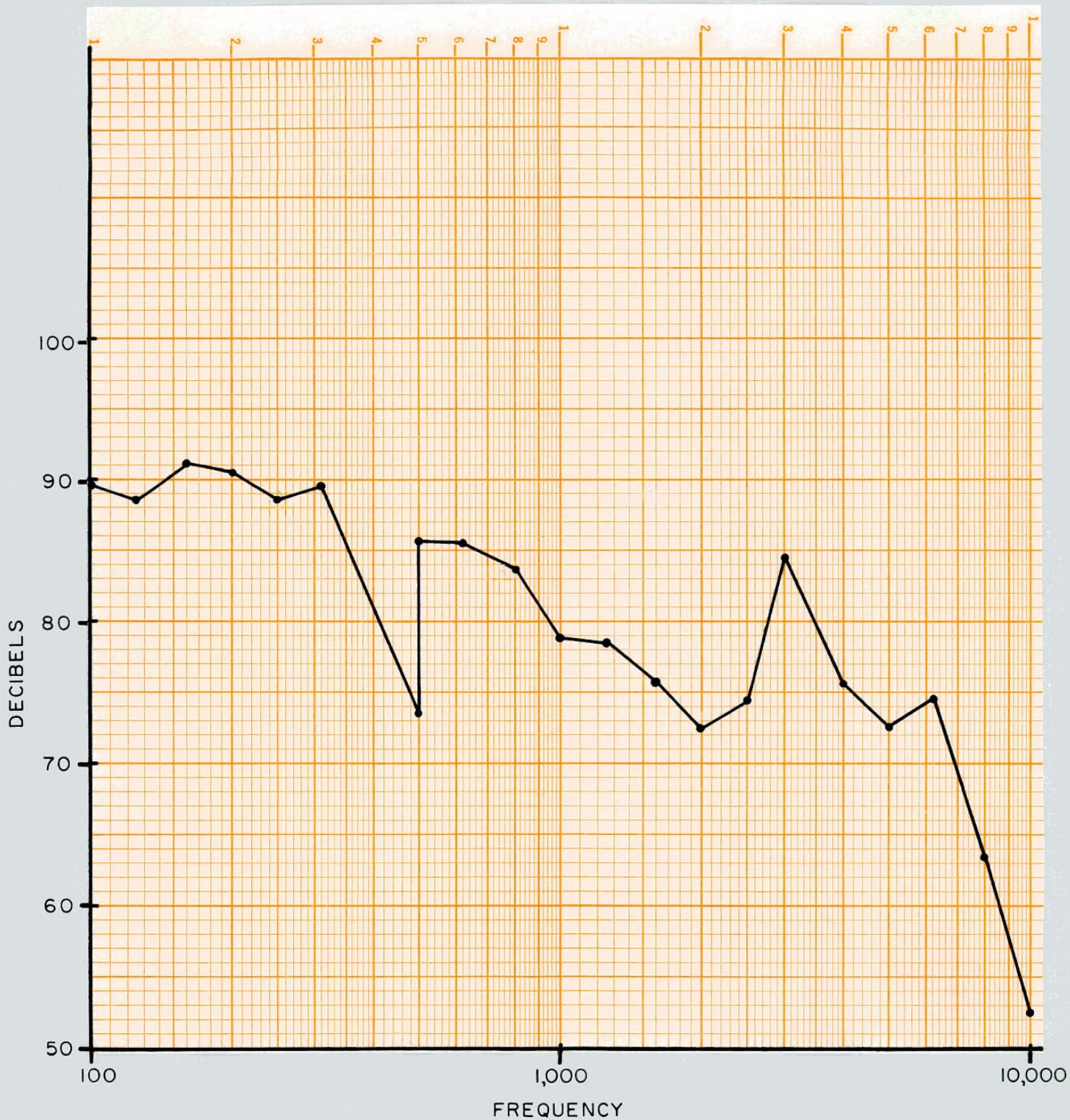


FIG. I UPLANDS - ME. PROPERTY



PEAK  $\frac{1}{3}$  OCTAVE BAND NOISE LEVELS FROM A DC-8, DURING TAKE-OFF FROM RUNWAY 07.

FIG.-2