

MEASUREMENTS OF AIRCRAFT EXTERIOR NOISE IN THE FIELD

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Revised

1. PURPOSE - The purpose of this recommended practice is to define measurement techniques and equipment for acquisition and reduction of basic data on aircraft exterior noise. It is not its purpose to propose use of these techniques or this equipment for research or monitoring-type tests.
2. MEASUREMENT EQUIPMENT - The following equipment should be used to acquire basic data in the field on aircraft exterior noise:
 - 2.1 Microphone system
 - 2.2 Microphone windscreen - optional
 - 2.3 Tripod or similar microphone mounting provisions
 - 2.4 Gain control (or attenuator)
 - 2.5 Tape recorder with N.A.B. equalization for 7-1/2 or 15 ips or a tape recorder having uniform frequency characteristics over the range from 20 to 12,000 cps.
 - 2.6 Acoustic calibrator system using sine wave or broad band noise of known sound pressure level.*
 - 2.7 Insert voltage device - optional.
3. CALIBRATION
 - 3.1 Microphone Calibration - The microphone should be calibrated according to ASA Standard Z24.11 - 1954, or the latest approved revision thereof.
 - 3.2 Recording System Calibration - The complete electrical recording system should receive a frequency and amplitude calibration by use of sine wave voltage of known amplitude and at frequencies covering the range from 20 to 12,000 cps. A broad band signal of known amplitude can also be used.*
 - 3.3 Sensitivity Checks in the Field
 - 3.3.1 Prior to and after each test an acoustic calibration of the system should be made in the field as a sensitivity check. This acoustic calibration should be used to establish a reference level during subsequent analysis of the stored data. The acoustic calibrator should produce a sine wave or broad band noise of known sound pressure level at the face of the microphone button.*

*If broad band noise is used, the signal should be described in terms of its rms value and maximum peak/rms factor for a "no clipping" level.

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- 3.3.2 An insert voltage device is recommended to record a known signal on the tape recorder just prior to and after recording aircraft noise data. It is recommended that this check be made under field-operating conditions to ensure against drift or error and to supplement the calibrations described in paragraphs 3.1, 3.2, and 7.1.

4. ACCURACY

- 4.1 Combined System Accuracy - The combined recording and reduction system when calibrated as recommended should be capable of measuring a plane progressive wide band sound wave arriving in the direction of the axis of calibration of the microphone with an accuracy of ± 1 db.
- 4.2 Frequency Response - The response of the combined system to a plane, progressive sinusoidal sound wave should be constant within ± 3 db over the frequency range from 37.5 cps to 12,000 cps excluding the directional frequency characteristics of the microphone.
- 4.3 Directional Frequency Characteristics - The sensitivity of the microphone to plane sound waves arriving from any direction within 45 deg of the axis of calibration should not differ by more than 1 db below 1000 cps, 2 db between 1000 and 4000 cps, 5 db between 4000 and 8000 cps and 6 db between 8000 and 12,000 cps.

5. FIELD MEASUREMENT TECHNIQUES

- 5.1 Acoustical Environment - Basic data on aircraft noise should be acquired under conditions of wind velocity less than 10 kn. It is also recommended that data be taken when the relative humidity is above 30%. The test should be run in an area free of obstructions, such as hills or buildings, which could reflect, obstruct or diffract the measured sound wave.
- 5.2 Microphone Positioning and Orientation - For measurements made of aircraft flying directly overhead, the microphones should be oriented with their longitudinal axes parallel to the ground and perpendicular to the vertical projection of the flight path. For other than overhead flights, the microphone diaphragm should be oriented to receive as close to grazing incidence of the sound as the test conditions permit.
- The height of the microphone above ground level should be 5 ft.
- 5.3 Recording of the Ambient Noise - The ambient noise of the measurement system and the test area (that is, the composite response of the system to the background noise and the electrical noise of the equipment) must be determined so that the validity of the measured aircraft noise level can be established.
- 5.3.1 The octave band pressure level of the aircraft noise signal should exceed the corresponding octave band pressure level of the ambient noise by at least 10 db