Annoyance from audible infrasound

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Research Laboratory (USA-CERL) has studied community response to these sources. The results show that large-amplitude impulsive noise is better assessed using C-weighting rather than A-weighting, and that building vibration and rattles are the primary adverse factors. Based on these results, USA-CERL, with FAA support, studied the role noise-induced vibrations and rattles play in human response to helicopter noise. A "laboratory" test was performed in the field, using almost 200 subjects. The test used paired comparisons in two real dwelling units. The source as a UH-1H (Huey) helicopter and the control was 500-Hz octave band of white noise with an amplitude (envelope) temporal pattern shaped to approximate a helicopter fly by. The general results show that with no rattles or vibration generated, the helicopter is correctly assessed using A-weighting. With only "a little" rattle, about 10 dB must be added to A-weighted levels for correct assessment, and with "a lot" of rattle, the offset exceeds 20 dB. Overall, these studies demonstrate the very important role noise-induced rattles and vibrations play in noise annoyance.

9:30

O4. Annoyance from audible infrasound. Henrik Møller (Institute of Electronic Systems, Aalborg University, Strandvejen 19, DK-9000 Aalborg, Denmark)

For several years it has been known that noise at low and infrasonic frequencies can cause considerable nuisances. The annoyance cannot be predicted by A-weighted sound levels since the A-curve nearly removes the infrasonic frequencies completely and it also seems to attenuate the low audio frequencies too much. Recent work on equal loudness and equal annoyance contours indicates that the annoyance from infrasound is closely related to the loudness sensation. The use of a weighting curve based on the loudness and annoyance curves is suggested. The ISO/DIS 7196 G1 curve might be a proper choice. The applicability of this curve is demonstrated. The experiments involve pure infrasonic tones as well as one-third octave bands. The consequence of simultaneously occurring audio frequency noise is also demonstrated.

Contributed Papers

9:55

O5. Broadband rotor noise in atmospheric turbulence. S. A. L. Glegg (Department of Ocean Engineering, Florida Atlantic University, Boca Raton, FL 33431)

This paper describes the development of a prediction method for broadband noise from wind turbines. In this method, two of the more important source mechanisms (unsteady lift and unsteady thickness noise [D. Hawkings, J. Acoust. Soc. Am. Suppl. 1 63, S21 (1978)] can only be predicted if the inflow turbulence intensity and length scale are known. By using a suitable model of the atmospheric boundary layer, these parameters can be estimated, as a function of height above the ground, using the measured wind speed and a ground surface roughness parameter. The sound propagating to the geometric nearfield of the rotor is then calculated by evaluating the source level at 20 azimuthal positions and five radial positions in the rotor disk plane. Other source mechanisms, such as trailing edge noise and the noise from separated flow, are also included. The results are compared with measurements on 5-, 20-, and 80-m-diam wind turbines.

10:10

O6. Comparison of advanced turboprop and conventional jet and propeller aircraft flyover noise annoyance. David A. McCurdy (NASA Langley Research Center, Mail Stop 463, Hampton, VA 23665)

A laboratory experiment was conducted to compare the annoyance to advanced turboprop aircraft flyover noise with the annoyance to conventional turboprop and jet aircraft flyover noise. The effects of fundamental frequency and tone-to-broadband noise ratio on advanced turboprop annoyance were also examined. A computer synthesis system was used to generate 18 realistic, time varying simulations of propeller aircraft takeoff noise in which the harmonic content was systematically varied to represent the factorial combinations of six fundamental frequencies ranging from 67.5–292.5 Hz and three tone-to-broadband noise ratios of 0, 15, and 30 dB. These advanced turboprop simulations along with recordings of five conventional turboprop takeoffs and five conventional jet takeoffs were presented at D-weighted sound pressure levels of 70, 80, and 90 dB to 32 subjects in an anechoic chamber. Analyses of the subjects' annoyance judgments compare the three categories of aircraft and examine the effects of the differences in harmonic content among the advanced turboprop noises. The annoyance prediction ability of various noise measurement procedures and corrections is also examined.

10:25

O7. Reduction of tank main gun noise with a muffler. Rodney M. Atack, Joel D. Bales, John G. Wrobel, and Nelson D. Lewis (Bio-Acoustics Division, U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD 21010-5422)

With the continuing encroachment of residential communities on military installations and the noise complaints received from these residents, it is necessary to reduce the noise levels propagating from these facilities. At stationary 105-mm tank gun firing locations, such as those used for weapon testing, the noise from the firing can be significantly reduced by firing through a large muffler. The muffler used at one installation to reduce the noise impact is approximately 2.3 m in diameter, 6.3 m long, and weighs approximately 20 metric tons. During a test of this muffler, the noise level in the adjacent community was reduced by approximately 7 dBA from levels that caused a moderate risk of complaints to levels which are barely audible. The significant noise reduction produced through utilizing a noise muffler presents an avenue through which research can be directed towards reducing noise impact from certain types of weapons testing.

10:40

O8. A noise monitoring and warning system for intermittent large-amplitude impulsive sounds (blasts and sonic booms). Paul D. Schomer, Aaron Averbuch, and Lester Lendrum (U.S. Army Construction Engineering Research Laboratory, P.O. Box 4005, Champaign, IL 61820)

The noise generated by large weapons (artillery, tanks, demolition) is a source of considerable problems for many Army installations. As a part of the Army's program to mitigate noise problems, the U.S. Army Construction Engineering Research Laboratory (USA-CERL) has designed and installed a blast noise monitoring and warning system at several installations. Each system consists of a base station and several remote, smart sensors. Each smart sensor actually contains two microprocessors and a large memory. When sounds that are "too loud" are detected, the sensor uses a "smart" modem to call the base station computer and warn operations personnel of the high levels. Alternatively, the sensor can buffer (monitor) these data in its memory and read out these data on command (by telephone) to a distant base station. Each sensor, designed for unattended long-term operation, includes such features as self calibration, an uninterruptable power supply, and a −40° to +85 °C operating temperature range. Early indications are that the desired reliability and user friendly ease of operation have been attained.