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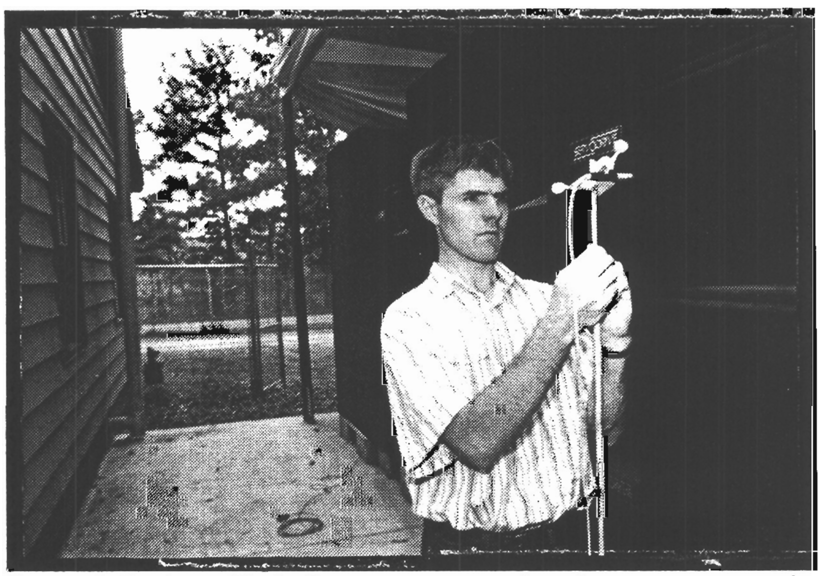
GIANT STEREO "BOOM BOX" WILL HELP SCIENTISTS UNDERSTAND SONIC BOOM EFFECTS ON HUMAN BEINGS AND BUILDINGS



Research Engineer Clarke Stevens sets up a microphone to measure noise emitted from the large speaker system during sonic boom experiments. (Color Slides/B&W Prints Available)

A tiny beige house with four rooms and green trim sits quietly by a gravel road, nestled among delicate dogwood trees -- and flanked on one side by an 8-by-20-by-15-foot black stereo speaker system.

The scene description sounds like the setting of a rock'n'roll dream or a surrealist short story. But it's actually the site of an upcoming Georgia Tech Research Institute (GTRI) study that will measure the effects of sonic booms on humans and buildings. The speaker system involved in the project, which is sponsored by NASA-Langley Research Center, is the first of its kind.

The 12-month study addresses an issue that must be considered if the United States is to develop supersonic high speed civil transport vehicles (HSCT), said Dr. Krishan Ahuja, head of GTRI's acoustics branch and professor in the School of Aerospace Engineering.

"Currently no accepted way exists to assess human responses to sonic booms people experience while indoors," Ahuja said. "Human reaction to outdoor sonic booms is more predictable. There is some indication that people find sonic booms relatively more objectionable when they are indoors, because of the associated vibrations of objects and buildings."

Sonic booms are powerful, unexpected sounds resembling the noise of an explosion. They occur when an airplane's speed exceeds the

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speed of sound. Air particles in front and in back of the plane are compressed into shock waves, causing sudden air pressure changes--and thus, the booms we hear. Much sonic boom research was done in the late 1960s and early 1970s, about the time the supersonic Concorde airliner was under development.

But the GTRI sonic boom research differs from past studies. Previously, researchers studying low-frequency sonic booms positioned boom-emitting speakers in a room or building with subjects, despite the fact that most sonic booms do not occur within a closed space. In the present study, the effects of sonic booms of various shapes emitted outside a house will be determined on human subjects seated both outside and inside the structure.

The black wooden speaker for the GTRI experiment sits on a concrete pad covered by a metal roof and shrouded in plastic when not in use, to protect it from the weather. The speaker took two years for an outside company to produce and is undergoing final refinements at Georgia Tech. Researchers plan to use noise in the three to 4,000 Hertz frequency range.

"You wouldn't hear much at the very low frequencies, but you would feel it," Ahuja said. In addition, secondary noise from vibrations and rattle effects of the sonic boom will produce some form of extra annoyance to subjects seated inside the house.

During the research trials, a computer will broadcast truck, helicopter, aircraft and sonic boom noises through the speaker in random order while subjects inside and outside the house pass time reading or engaging in other activities. After each experiment, the subjects will answer questions that will show which types of noise they found most unsettling. The responses will be statistically analyzed to see how bothered people were by the variety of sounds.

None of the noise levels in the experiment will exceed U.S. Occupational Safety and Health Administration standards, said Ahuja, who has involved a psycho-acoustician in the project. About 150 people of all ages with perfect hearing will be chosen for the study, and will participate for two to three one-hour trials. Their hearing will be tested before and after each session.

Researchers will measure the vibrations the house is subjected to using an accelerometer. Because sonic booms are the result of sudden air pressure changes, they will also monitor these fluctuations inside and outside the house as sonic booms are broadcast.

Ahuja foresees additional research applications for the giant speaker. It might be used to broadcast sound into the sea or the sky so scientists could study how sound travels under water, as well as how turbulence in the sky affects sound propagation.

The speaker might have other applications in sound detection and ranging, temperature profiles of the atmosphere, radio-acoustics sensing, sonic fatigue studies of aircraft and additional psycho-acoustic studies.

Ahuja also plans to use these speakers to study how low-frequency sound travels from outside an aircraft cabin to its interior, along with innovative methods of controlling cabin noise.

The sonic boom effects research has received GTRI funding, in addition to its NASA sponsorship. Ahuja is being assisted by Research Engineer Clarke Stevens and undergraduate students Alex Fleming and Brad Nye.

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