PHYSICS

# Search for 'Perfect' Sound

**Two Michigan researchers went in search of the perfect sound for civil defense, trying to find the best alerting characteristics of sounds people really "hear."**

➤ CIVIL DEFENSE officials are searching for the "perfect" sound, one that will penetrate your brain, grab your attention and warn you of impending disaster.

Unlike advertising agencies who, through radio and television, have tried new and different sounds to attract attention, officials of the Office of Civil Defense (OCD) are looking for one that might someday save lives.

Current warning signals too often are confused by the public with other sirens, horns and whistles, it is believed.

People are alerted by sounds many times each day, by a siren's wail, a horn's honk, a doorbell's ring and, sometimes, a woman's scream. There are many other distinctive sounds that do not necessarily alert, a jet taking off, a garbage disposal grinding, chalk screeching on a blackboard and a cherry bomb exploding.

The OCD commissioned Michigan State University department of speech and hearing, East Lansing, to find the best sound for a warning signal possible, using human reactions to sounds as a psychological yardstick.

Dr. Herbert J. Oyer and Edward J. Hardick of MSU studied the responses of 1,250 men, women and children to laboratory and everyday sounds, trying to learn what characteristics attract people's attention.

They included more than 400 sounds, from a tugboat's toot to an elephant's trumpet. Sleeping college students, children in a school cafeteria, workers in the factory and housewives running a vacuum cleaner were among those tested.

The most effective sound in the majority of tests was the missile alarm used at Cape Kennedy. This distinctive sound is a jump-tone signal, one that alternates between two complex tones.

Other sounds placing high in field studies included the "yelper" siren, British air raid siren, the Navy diving alarm and certain car horns.

The researchers determined certain characteristics, which they felt would make the best warning signal. A complex signal having a pitch between 700 cycles per second (cps) and 4,000 cps would be heard best by the human ear, while the person is indoors. High-pitched frequencies do not carry very far outdoors.

Loudness is an important factor. How loud noise is at the human ear is measured in terms of decibels (db). A sound pressure level of 80 db to 100 db, achieved at the ear with a signal as just described, would have the best alerting potential, they concluded.

In comparison, a rustle of leaves has a noise level of approximately 20 db, a quiet office, 40 db, an automobile, 70 db, a riveter, 105 db, a 75-piece orchestra, 140 db and a turbojet engine, 175 db.

In order to provoke the maximum effect, the signal must be readily distinguishable from all other sounds. The researchers found that an alerting sound could be made more distinctive by raising the pitch or modulating the signal, combining horn-type sounds or using a jump-tone.

Finally, the signal must have meaning to the population. Whereas alerting is defined as attracting attention, warning is defined as alerting people to a threat.

"To be warned is to be alerted," they said, "but the reverse is not always true. Once a signal has been selected it should be tested as rarely as possible," they said.

"If we succeed in finding a new 'perfect' sound," an OCD official told SCIENCE SERVICE, "perhaps it would be possible to confine its use to civil defense alerting use only."

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COMMUNICATIONS

## Light-Beam Transmitter Powered by Human Voice

➤ A NEW SYSTEM of voice communications on a beam of light requires no power source at the transmitting station other than the human voice.

The only artificial power needed is a battery for the light source and another for the receiving amplifier, said Numa E. Thomas, researcher for the National Aeronautics and Space Administration's Langley Research Center, Hampton, Va.

The system, called the Retrometer, is named for the transmitter, which consists of three flat mirrors, each perpendicular to the other two, like two walls and the ceiling at the corner of a room.

Two of the mirrors are rigid, while the third is flexible, mounted in front of a perforated backing.

The "receiver" shines a beam of light at the mirrors, which reflects it back to its source. When a person speaks through the perforations in the "transmitter," the sound of his voice vibrates the flexible mirror, distorting, or modulating, the beam of light.

A photoelectric cell at the light source converts the modulated beam back into an electrical signal, which is amplified and then converted into sound by a conventional loudspeaker or headphone.

The Retrometer has many potential uses, including air-to-sea rescue work, since the simple reflector could easily be packed in survival kits or life rafts. The system would prove especially useful in blasting operations, combat situations and other cases where radio transmissions are hazardous.

For other kinds of specialized work, the Retrometer could be adapted to infrared or ultraviolet light. For long-range communications, a laser might provide the light source.

Retrometers placed along highways might give toll and traffic information to motorists, with the car headlights providing the beam of light.

Installed in planes, they would provide emergency communication with the control tower, in the event of radio or power failure.

The only other existing light-beam communication system employing a voice-powered transmitter uses the sun as a light source, and is consequently limited.

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U.S. Navy

*STORM VORTEX?—This picture of an apparent perfect storm vortex was taken at 65,000 feet by Capt. Lachlan MacLeary, Air Force pilot, over the Santa Barbara Channel off the Pacific Coast during a study of infrared radiance properties of clouds, a project supported by the Advanced Research Projects Agency through the Office of Naval Research. No severe weather occurred along with the disturbance.*

PHYSICS

## Laser Light Pencil Better TV Pictures

➤ LASER LIGHT is providing clearer, brighter television pictures in a laboratory experiment.

The laser light beam is directed at a scene or picture to be televised, and the reflected light picked up by a photomultiplier. The picture is redisplayed on an oscilloscope.

Developed by scientists at the General Precision Laboratory in Pleasantville, N .Y., the laser TV could have many deep space applications such as photographing the dark sides of the moon and planets and detecting objects in the dark.

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