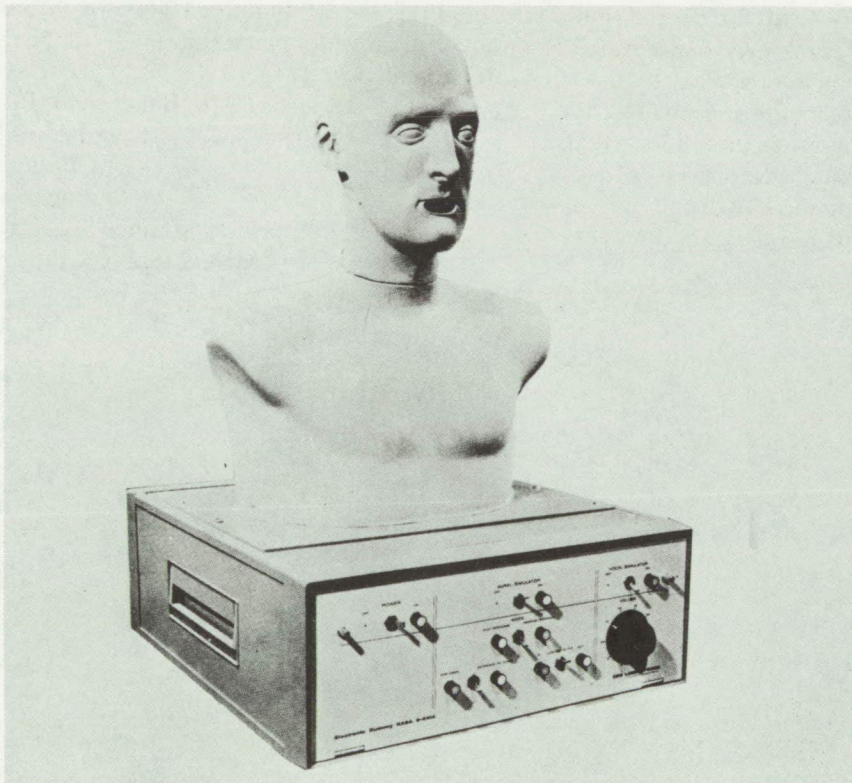


# NASA TECH BRIEF



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## Electronic Dummy for Acoustical Testing



In order to conduct acoustical tests in a laboratory fashion, that is with variations and repeatability not dependent on human subjects, it was decided to design and fabricate an electronic dummy (ED). The ED was proposed as a manikin to represent the average male torso from the Xiphoid process upward and to include an exact acoustic replica of the human head.

As designed and fabricated, the head simulates natural flesh impedances, features an artificial voice that produces levels up to 100 db (referenced to 0.0002

dyne/cm<sup>2</sup>) at 6 inches, and highly advanced artificial ears that measure sound pressures at the eardrum or the entrance to the ear canal. A unique hearing-mode amplifier optionally provides automatic and continuously variable loudness contour equalization.

Because the head must withstand repeated application and removal of tight-fitting helmets plus internally supporting a vocal simulator and two aural simulators, a rigid skull form was fabricated from 1/8-inch thick fiberglass. This skull form was fitted into the

(continued overleaf)

simulated flesh form. The simulated flesh form was fabricated from a flesh-colored composite of plastisol, having a durometer of approximately 15 to 20, a value that offered the best compromise between accurate flesh simulation and high tear strength.

The artificial voice (vocal simulator) was fabricated from a modified commercially available loudspeaker and an aluminum coupler to link the speaker to the oval-shaped mouth opening. The required response equalization was achieved electrically when an acoustic screen damper raised harmonic distortion to an intolerable level.

The aural simulators are made with ear canals consisting of metal tubes terminating in microphones (the eardrums) and duplicating the impedance and response, as functions of frequency, of human ears. Placement of the simulators into the head form of the ED introduces ear pinna and head diffraction into their response, allowing the simulators to accurately duplicate the response "seen" by human ears.

In the hearing response mode, the outputs of the ear canals are fed to hearing-mode amplifiers that simulate the average male hearing response as a function of sound pressure level at the ear drums, in accordance with the Fletcher-Munson equal loudness contours.

#### **Notes:**

1. The ED should prove a valuable tool in acoustical testing through a wide range of applications.
2. Further information concerning this invention is presented in CBS Laboratories Final Report, N66-25565, "Development of an Electronic Dummy for Acoustical Testing," available from the Clearinghouse for Federal Scientific and Technical Information (CFSTI), Springfield, Virginia 22151, price \$3.00 (hardcopy), \$0.65 (microfiche).

Inquiries may also be directed to:

Technology Utilization Officer  
Manned Spacecraft Center  
Houston, Texas 77058  
Reference: B67-10298

#### **Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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