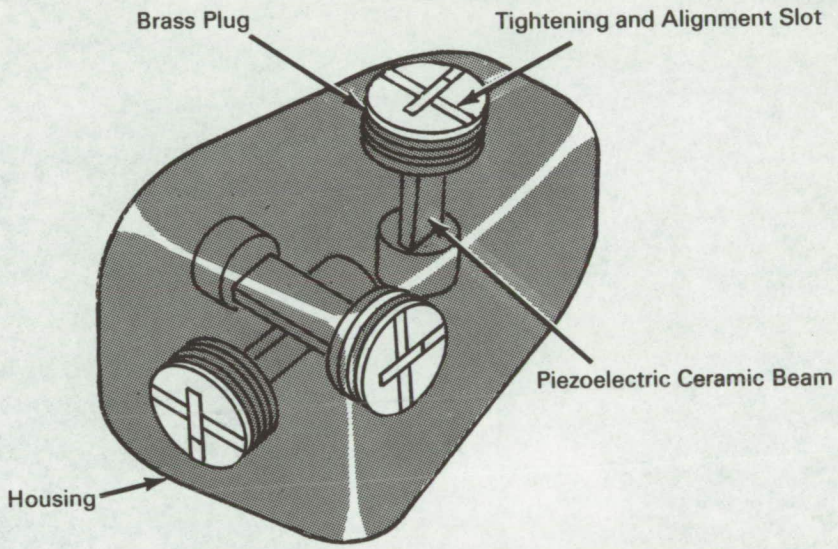
November 1966

Brief 66-10534

# NASA TECH BRIEF



## Miniature Piezoelectric Triaxial Accelerometer Measures Cranial Accelerations




**The problem:**

To design and build a triaxial accelerometer to measure human cranial accelerations when a subject is exposed to a centrifuge or other simulators of g environments. The size and shape must be suitable for attachment to the teeth without discomfort.

**The solution:**

A tiny triaxial accelerometer whose sensing elements are piezoelectric ceramic beams. The accelerometer physical shape is compatible to a human mouth and may be attached to the teeth by an appropriate bridge and located behind the upper teeth in the roof of the mouth. The sensitivity is about 20 millivolts (rms) per g and the frequency response is essentially flat over the range tested (5 to 500 cps).

**How it's done:**

The accelerometer consists of three orthogonal cantilever beams of piezoelectric ceramic material mounted in an aluminum case having external dimensions approximating those of a human molar. The beams are 0.2-inch in length and each has a gold weight bonded to the free end. The beams are located in a slot cut in a brass threaded plug and bonded in place with a nonconductive epoxy cement.

All three elements are made identical as far as possible. A slot on the brass plug face provides an alignment reference. Insulated soft copper wires are soldered to the top and bottom electrodes of each beam and passed through the open slot of the plug along the beam side. The elements are then inserted

(continued overleaf)

into the housing and potted in place with epoxy cement.

**Notes:**

1. In testing, the linearity for all components proved to be excellent. Sensitivity was of the order of 20 millivolts (rms)/g. The repeatability was excellent and the response was essentially flat over the entire range tested (5 to 500 cps). The cross axis sensitivity did not exceed 5.5 percent.
2. A related innovation is described in NASA Tech Brief B64-10004, "Ultrasensitive Transducer Advances Micromeasurement Range," May 1964. A method of testing piezoelectric transducers is described in NASA Tech Brief B66-10533, "Method Permits Mechanical and Electrical Checkout of Piezoelectric Transducers While Installed in a System," November 1966.
3. This device could be considered for application in dental, medical, and automotive safety research.
4. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B66-10534

**Patent status:**

No patent action is contemplated by NASA.

Source: V. L. Rogallo and G. J. Deboo
(ARC-71)