September 1975 B75-10201

NASA TECH BRIEF

Lyndon B. Johnson Space Center

Ultrasonic Detection of Flaws in Large Structural Areas

The problem:

Ultrasonic equipment designed to detect flaws in small structural areas is well known. However, few systems are available for monitoring large areas.

The solution:

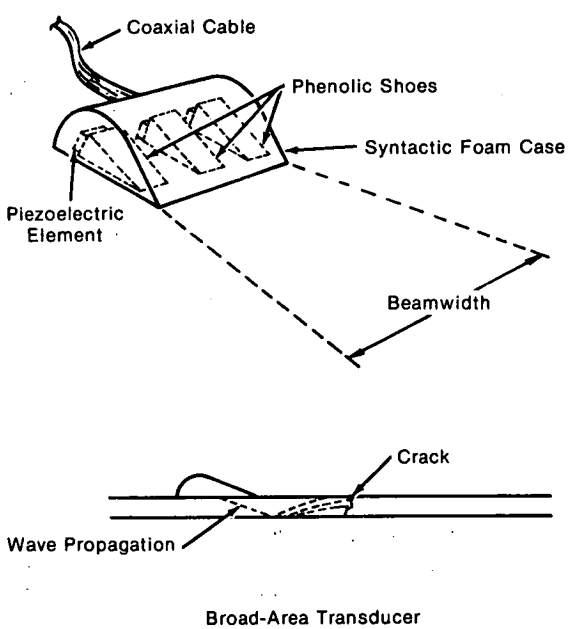
A newly-proposed ultrasonic system will monitor large structural areas from a fixed point.

How it's done:

The key feature of the system is the new transducer design. As shown in the illustration, the transducer system consists of three piezoelectric elements that produce a relatively-wide ultrasonic beam. This beam covers a significantly larger area than the one produced by a single-element transducer.

Each piezoelectric element is bonded to a separate phenolic shoe. The direction and width of the ultrasonic beam are adjusted by using various shoe angles and different separations between the shoes, respectively. The shoes are covered by a syntactic foam case, and a coaxial cable is used to connect the transducers, in parallel, to the processing electronics. In use, the system is bonded to the structure, making sure that there are no flaws in the bond-line interface. This process is very critical; even a pinhole in the bond-line interface can cause significant response problems. Typically a number of these transducers are bonded to different locations of the structure to monitor several areas.

The basic processing electronics necessary for operating the transducers include a multiplexer which receives information from the transducers. The multiplexer output is fed to a recorder or an oscilloscope. An audio alarm may also be connected to the multiplexer output to indicate the presence of a flaw. More sophisticated systems may include a computer and several recorders.



Broad-Area Transducer

Notes:

1. Further information is contained in the following publication:
   Materials Evaluation No. 8, vol. 32, August 1974, pp. 157-162, "On-Board Ultrasonic Structural Surveillance," by F. E. Sugg and C. C. Kammerer
2. Specific technical questions may be directed to:
   Technology Utilization Officer
   Johnson Space Center
   Code AT3
   Houston, Texas 77058
   Reference: B75-10201

(continued overleaf)

Patent status:
NASA has decided not to apply for a patent.

Source: F. E. Sugg and C. C. Kammerer of
Rockwell International Corp.
(MSC-19499)

Categories: 06 (Mechanics)
01 (Electronics - Components and Circuitry)
02 (Electronics Systems)
03 (Physical Sciences)