March 1971 Brief 71-10045



AEC-NASA TECH BRIEF



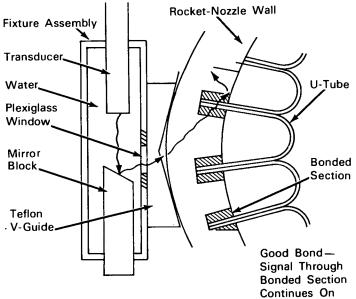
Space Nuclear Systems Office

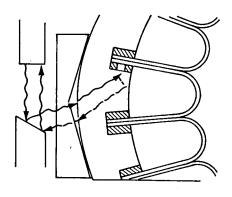
AEC-NASA Tech Briefs announce new technology derived from the research and development program of the U.S. AEC or from AEC-NASA interagency efforts. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

Ultrasonics Used for High-Precision Nondestructive Inspection of Brazed Joints

Brazed joints can now be inspected nondestructively with a high degree of precision using a new method involving ultrasonics. Earlier ultrasonic equipment was too cumbersome to allow accurate, easy aiming of the sound beam. With the new technique, however,

If the beam is considerably defocused when the mirror position is changed, it can be refocused by adjusting the position of the transducer, a lithium sulfate long-focus transducer operating at 2.25 MHz.





Bad Bond (On One Side Of Joint) — Signal Shear Wave At Unbonded Braze Echoes Back To Transducer

voids of ≥ 0.1016 cm (≥ 0.04 in.) in depth have been detected in braze depths of 0.254 cm (0.10 in.), and detecting voids of smaller dimensions is possible.

An ultrasonic mirror "fixture" is used to aim the beam without having to move the entire beam structure. The fixture consists of an ultrasonic transducer and a polished aluminum mirror block-mounted in a sealed chamber. The mirror can be rotated and moved longitudinally, and the beam can be easily aimed within $0.875 \times 10^{-2} \text{rad}$ (0.5 deg) after the fixture is in approximate position.

Coupling water is pumped through the fixture. Careful internal design ensures control of the beam's water path length to within 0.635 cm (0.25 in.). This length is critical to the accuracy of the system.

Notes:

 For a Hastelloy X rocket nozzle 1.5 m (5 ft) in diameter, 1.8 m (6 ft) long and 1.016 cm (0.40 in.) thick, the method described plotted 250,000 data points in the inspection of 685.8 m (2250 ft) of braze joint. Every unsatisfactory bond was detected.

(continued overleaf)

This document was prepared under the sponsorship of the Atomic Energy Commission and/or the National Aeronautics and Space Administration. Neither the United States Government nor any person acting on behalf of the United States Government assumes any liability resulting from the use of the information contained in this document, or warrants that the use of any information, apparatus, method, or process disclosed in this document may not infringe privately owned rights.

 Requests for further information may be directed to: Technology Utilization Officer AEC-NASA Space Nuclear Systems Office U.S. Atomic Energy Commission Washington, D.C. 20545 Reference: B71-10045

Patent status:

No patent action is contemplated by the AEC or NASA.

Source: R. M. Peterson of Aerojet-General Corp. under contract to AEC-NASA Space Nuclear Systems Office (NUC-10352)