

# NASA TECH BRIEF

## *Marshall Space Flight Center*



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### **Nondestructive-Test Standards for Evaluation of Fiber-Reinforced Composites**

Advanced composite materials can incorporate many variations during fabrication that are not found in homogeneous metallic materials. Variables such as the number and orientation of plies, duration of cure, heating rates, and accidental inclusion of foreign matter during layup can undermine the integrity of a finished structure. Advanced composite standards that represent as nearly as possible the potential variations (defects) which can occur when these materials are processed into finished structures, were designed, fabricated, and tested.

Test-standard panels used were fabricated of fiber-reinforced materials (boron and graphite in plastic matrices).

The test panels were designed to contain typical defects due to processing and fabrication errors, so that they would represent the most probable conditions to be found in production hardware. Design emphasis was placed on introducing known defects in the panels which were not necessarily detectable through state-of-the-art nondestructive-testing techniques.

Since a single nondestructive-test method does not reveal all possible defects in a composite structure, two or more complementary methods must be used to characterize them adequately. Radiography and ultrasonic C-scan techniques generally will reveal most defects, but infrared and microwave techniques may also be required in some instances. However, further development of nondestructive-testing methods is required to ensure identification of some defective conditions.

One problem is caused by the inherent variability in heterogeneous composite structure, which becomes superimposed on the recorded signal and may mask the presence of a defect. Although this problem remains to be solved, various signal enhancement approaches can help to clarify such nondestructive-test information. In light of these considerations, three nondestructive-test methods, (ultrasonic C-scan, radiography, and infrared) were chosen to evaluate the fiber-reinforced standards designed and fabricated during this program.

#### **Note:**

Requests for further information may be directed to:  
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#### **Patent status:**

No patent action is contemplated by NASA.

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