CARES/*Life* Ceramics Durability Evaluation Software Used for Mars Microprobe Aeroshell

Mars Microprobe Aeroshell made of heat-resistant silicon carbide material. (Copyright Jet Propulsion Laboratory; used with permission.)

The CARES/*Life* computer program, which was developed at the NASA Lewis Research Center, predicts the probability of a monolithic ceramic component's failure as a function of time in service. The program has many features and options for materials evaluation and component design. It couples commercial finite element programs-which resolve a component's temperature and stress distribution-to reliability evaluation and fracture mechanics routines for modeling strength-limiting defects. These routines are based on calculations of the probabilistic nature of the brittle material's strength. The capability, flexibility, and uniqueness of CARES/*Life* has attracted many users representing a broad range of interests and has resulted in numerous awards for technological achievements and technology transfer.

One noteworthy highlight was the use of CARES/*Life* to assess the survivability of the Mars Microprobe Aeroshell from launch-induced stresses. When the two Mars Microprobes piggyback aboard the Mars Surveyor '98 Lander (scheduled for launch in January 1999), they will be encased in basketball-sized, protective aeroshells made of silicon carbide. These aeroshells will free fall through the Martian atmosphere and crash into the polar surface. Shattering upon impact, the shells will release a miniature science probe designed to determine the presence of water ice. Although the shells are designed to shatter on Mars, they must, nonetheless, survive the high stresses associated with the launch. Analysis with CARES/*Life* indicated a high likelihood that the shells will remain intact after launch.

A key to maintaining interest in CARES/*Life* has been to actively maintain and promote the program as well as to enhance the program's ease of use. Toward this end, ANSCARES 2.0 was created. This computer program couples CARES/*Life* to the ANSYS finite element analysis program. Most noteworthy is that ANSCARES 2.0 contains an automatic surface recognition feature that frees CARES/*Life* users from manually modeling component surfaces. The majority of CARES/*Life* customers are also

ANSYS users, so upgrading the links between the two codes was an imperative goal.

Bibliography

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