

NASA asks Lehigh engineering students to analyze debris from failed Columbia shuttle

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Materials science class will use light microscopy to examine 50 pieces recovered on ground

Every year, seniors in Lehigh University's Failure Analysis course peer through microscopes to learn the variety of ways in which different materials deform and crack.

They apply their new skills to specimens from machines, factories and buildings that have been damaged in real-life situations.

This spring, Lehigh's failure-analysis students have a sobering responsibility. They have been chosen by NASA and the Kennedy Space Center to analyze debris from the Columbia space shuttle, which exploded over the southern U.S. on Feb. 1, 2003, killing all seven astronauts aboard.

More than 83,000 pieces of the shuttle, weighing 85,000 pounds, were recovered by thousands of U.S. Forest Service employees and volunteers walking shoulder to shoulder through the woods of East Texas and Louisiana. The pieces were catalogued and sealed in plastic bags by NASA workers.

In mid-January, 50 of the pieces, still preserved in their plastic bags, arrived in a large crate at Lehigh's Whitaker Laboratory, where they were promptly locked in a small room inside one of the building's labs.

Lehigh is the first university NASA has asked to analyze debris from the

Columbia, says Arnold Marder, professor of materials science and engineering and instructor of the Failure Analysis course.

NASA has determined that the explosion that destroyed the Columbia was caused when a piece of insulating foam spalled, or broke away from the fuel tank during launch and struck the shuttle's wing panel. The impact damaged the panel's thermal protection system, exposing the panel to deadly heat when the shuttle re-entered the Earth's atmosphere.

Marder says investigators can learn much more by analyzing the Columbia debris.

"How do materials behave under conditions of hypersonic reentry?," says Marder. "We don't know all the answers."

The spalling of the insulating foam, which is applied in layers to a shuttle's fuel tank, also concerns Marder.

"This spalling has occurred in 80 percent of all 113 shuttle flights," says Marder. "And yet only one shuttle has failed. Why is that?"

Marder, who spent a sabbatical with the Kennedy Space Center last spring, proposed to NASA officials that students in his Failure Analysis class be given the chance to analyze debris from the Columbia.

Lehigh's materials science and engineering department is an ideal site for such a post-mortem, says Marder. The department is one of few in the nation that offers a class in failure analysis. And its microscopy facilities are unrivaled - the department has hosted the world's most comprehensive microscopy short courses for more than 30 years.

Several Lehigh graduate students flew to Florida during Marder's sabbatical to consult with NASA officials over the Columbia

investigation, as did Arlan Benscoter, a world-renowned metallographer and research scientist in Lehigh's materials science and engineering department.

The 14 materials science seniors in this spring's Failure Analysis class, after honing their microscopy techniques, will begin analyzing the Columbia debris in early or mid-February, says Marder.

The professor gave his students their formal charge in one of their first classes.

"You are detectives," he said. "Your job will be to examine the failure surface, back-track and determine what were the conditions under which it failed and why it failed."

Source: Lehigh University

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