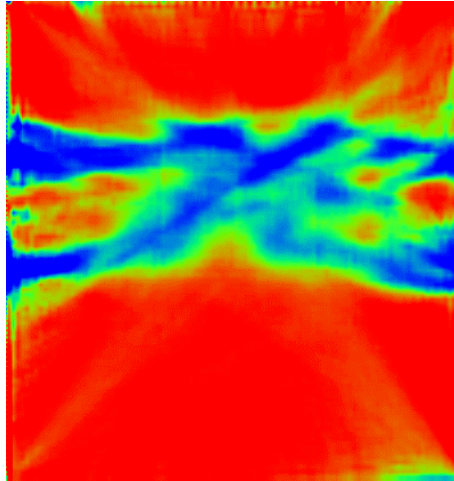

Software enhances view of aircraft flaws

The day the roof ripped off Aloha Airlines flight 243 at 24,000 feet over the Pacific Ocean, aviation research took a new turn. Officials blamed widespread corrosion as a main culprit in the 1988 disaster. The incident intensified work in a field known as nondestructive evaluation—analyzing the guts of materials without cutting them open.

Scientists have now designed software that they say should enable a portable scanning machine to check a plane's fuselage for corrosion more quickly, effectively, and safely than any current tool. Eugene V. Malyarenko and Mark K. Hinders of the College of William and Mary in Williamsburg, Va., describe their system in the October JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA.

A scanning machine clocks how quickly ultrasonic waves travel within a plane's skin. Pulses that arrive at an endpoint faster than expected serve as an early indicator of thinning material, a sign of corrosion. The technique is akin to one that seismologists use to picture Earth's interior.

For years, engineers using ultrasound have peered into the skin of a jet, but they've been able to examine a mere postage stamp-size area at a time. They've used only a small number of transducers because the computing power wasn't



Red spots inside the blue-green area show single-thickness regions, where a reinforcing strip has separated from an aluminum plate. The surrounding red area is also single thickness.

available to interpret signals from a larger array. What's more, it's taken an expert in mechanical-waveguide physics to make sense of the data collected.

Hinders says the new approach will rely on several thousand transducers. Arranged in a frame that's 1 meter square, these will send and receive the ultrasonic signals and relay data to an attached computer the size of a lunchbox. Within

about 30 seconds, the new software will map the thickness of the fuselage bounded by the frame.

"Our strategy is to put the smarts required for the measurements inside of the instrument itself," Malyarenko and Hinders say. Their software will crunch heaps of data, select what's most important, and produce a large map that's relatively easy to interpret, they say.

The images will describe the extent of a defect, not just its location, says James C. P. McKeon, director of development and research at Sonix in Springfield, Va. McKeon worked with Hinders early in the project.

The cost of the instrument remains an issue; the prototype will run about \$500,000, estimates Christopher S. Domack, president of Nascent Technology Solutions in Hampton, Va. The price needs to drop to about \$50,000, he says. His company aims to produce and market the enhanced scanning device to industries including airlines, railcar makers, and ship builders. Domack adds, "A commercial product could be a couple years down the road."

This technology "wouldn't be something we would require," says Alison Duquette of the Federal Aviation Administration. "The airlines currently perform inspections adequately, in line with the Aging Aircraft Program set up after the Aloha Airlines incident."

--L. Sivitz