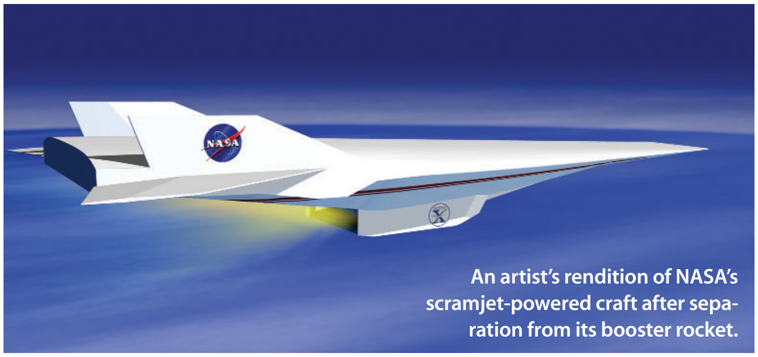


An artist's rendition of NASA's scramjet-powered craft after separation from its booster rocket.

SECOND CHANCE FOR SCRAMJET

SPACE | In its maiden test flight last June, a hypersonic plane developed by NASA veered off course and was destroyed. Despite the failure, the agency is now trying to breathe new life into its tests of the craft's novel jet engine, called a scramjet. NASA expects that future versions of the engine will serve as a low-cost way to get payloads into orbit by lifting space cargoes to nearly stratospheric altitudes before they continue their journeys on rocket power.

The X-43A, a 3.7-meter-long, unpiloted research vehicle, is the current focus of the $185 million effort. A conventional jet engine, with its spinning blades and turbines, would tear apart at lower speeds than those envisioned for the X-43A; but the scramjet has no moving parts. That means air can safely rush through it at many times the speed of sound, combusting with hydrogen fuel to boost the vehicle to hypersonic speeds (above Mach 5). Of course, conventional liquid-fueled rockets fly even faster, but they must carry both fuel and the oxygen needed to burn it—an expensive proposition. A future craft with both scramjet and rocket power could travel to the edge of space before firing its rockets, requiring less oxygen and leaving more room for the payload.

To test that theory, NASA contractors built three X-43As; the first was to have flown last June, becoming the first air-breathing craft to fly at hypersonic speeds. But the mission ended in disaster even before the scramjet could fire up. The craft's Pegasus booster rocket—built by Dulles, VA-based Orbital Sciences to carry the X-43A to 29,000 meters and Mach 7 before its scramjets ignited—went violently out of control just seconds after the two mated vehicles were released from their B-52 carrier plane, forcing mission controllers to send an auto-destruct signal.

Late last year a NASA investigative board tentatively blamed the disaster on the Pegasus rocket, ruling out the X-43A as the cause of the failure. Charles R. McClinton, technology manager for the scramjet program at the NASA Langley Research Center in Hampton, VA, says, "We're convinced that we can be back to flying by the end of this year." If the agency does get its craft off the ground, those waiting for a cheaper, more efficient way into space can begin to breathe easier. *—Wade Roush*

HIDING IN PLAIN SIGHT

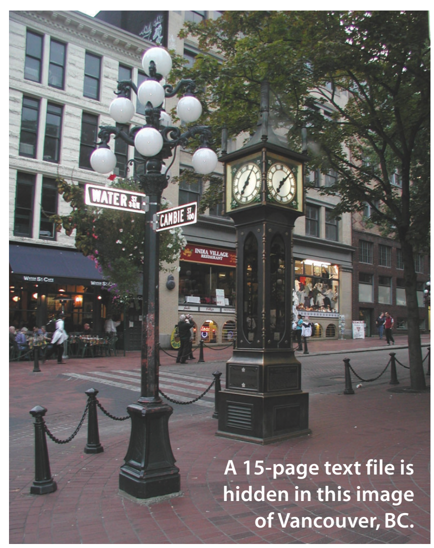
SOFTWARE | In the weeks after the September 11 terror attacks, reports surfaced that terrorists might have communicated with each other through messages embedded in images posted on the Web. So far, no such hidden communications have been confirmed publicly, but intelligence agencies are certainly keen on finding them if they exist. To aid in the search, a computer scientist at the State University of New York at Binghamton has developed a way to screen digital images for evidence of hidden content.

Binghamton's Jessica Fridrich says her algorithms examine the numbers that encode color in pixels, the colored or gray dots that make up an image. When an image conceals information—say, a 15-page text file—the numbers that encode its pixel colors are changed slightly. While the human eye can't see the resulting color changes, Fridrich's algorithms can detect statistical anomalies in the underlying numbers. In most kinds of image files, Fridrich's tool can detect the signatures of a number of concealment—or "steganography"—programs, all widely shared in the hacker subculture. Cryptographers must then decode any images that have been altered.

Fridrich delivered the first version of the software to her U.S. Air Force sponsors last year. "What they do with it, I'm not allowed to know. We can only assume the government is somehow using it," she says.

"Her work is first rate," says computer scientist Rafael Alonso, technical director of Web informatics at Princeton, NJ-based Sarnoff. But the software requires investigators to make preliminary guesses about which Web sites might harbor images with hidden messages. In the future, says Alonso, to narrow the range of images to scan, algorithms like Fridrich's might be combined with search engine software capable of "shining a flashlight in the sewers of the Web"—dredging obscure sites like personal pages and classified ads that are presumably attractive for covert communications.

Fridrich predicts "sharp competition in the next few years" from other approaches



A 15-page text file is hidden in this image of Vancouver, BC.

to ferreting out hidden messages. Security won't come easy, though. Information could be stashed in video and music files as well as photos, for example. Still, Fridrich's tools mark an important first step toward finding pictures that contain thousands of words. *—David Talbot*

COURTESY OF JESSICA FRIDRICH (HIDING IN PLAIN SIGHT); COURTESY OF NASA (SCRAMJET)