



Imaging

Compact Chip Takes Flight

Unique chip architecture provides high-speed image processing for Earth and sky.

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To distinguish friend from foe in short order, or make sense of any visual scene, nothing beats a keen set of eyes and a quick-thinking brain. In fact, no machine can beat a human at this task—at least not yet. Computational Sensors Corporation (CSC; Santa Barbara, CA), however, has built a better silicon eye with a series of MDA SBIR contracts for the development of a chip with a new architecture specifically for high-speed image processing.

With the help of some MDA Phase I and II SBIRs and similar contracts with DARPA, CSC developed novel architectures and interconnects for massively parallel computing in a compact integrated circuit. Conventional image processors typically yield data output in the megahertz range, rapidly creating a backlog of information to be sorted and analyzed. To address this backlog and to prepare for high-speed operations, both of which are needed for missile threat discrimination, CSC stacked integrated circuits beneath a two-dimensional detector array. This very-large-scale integration approach enables the chip to perform the image processing onboard the circuitry, and to avoid the customary bottleneck at the tail end of the processing stream. The result is a fast, low-power imaging device that boasts a small footprint and a light weight. CSC's superior 3-D stacked sensors offer lightweight, highly sensitive image-processing ability with high resolution and very high frame rates.

CSC's small chip is ideal for applications that require high performance in small spaces, and its featherweight characteristics are attractive to aircraft manufacturers who hate weight. On the military side, the company is now working to outfit micro-unmanned aerial vehicles (micro-UAVs) with a thermal eye.

The weight savings also make the chips suitable for other applications, including more conventional UAVs, multiple kill vehicles, mobile military units, and medical imaging. For commercial aircraft, CSC sensors have applicability in threat discrimination. One outstanding risk to commercial airliners is the threat of a surface-to-air missile attack, an issue that arose in the years following September 11. To combat such a threat, small imaging sensors, placed on the fuselage of a jet and coupled with relevant software, could give warning of an incoming object in time for a pilot to take evasive action.

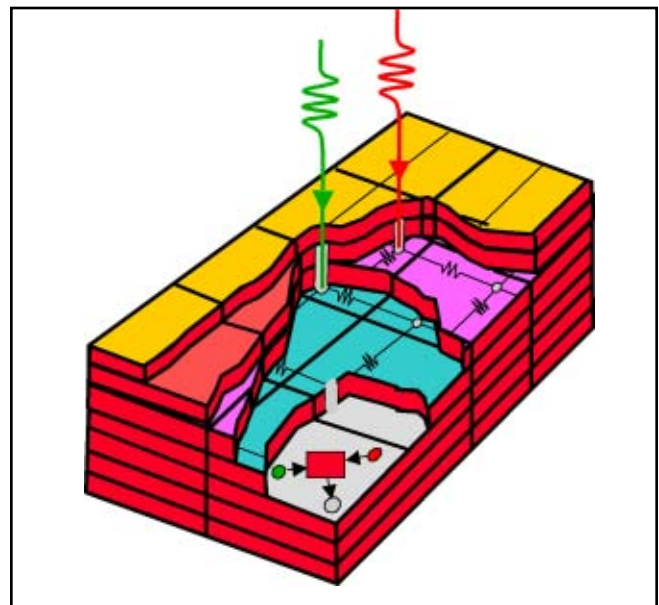
A more earthbound application is in border security, where infrared cameras are already used to detect movements

in the vast and scrubby areas that constitute much of the U.S. border with Mexico. CSC's image-processing chip, when outfitted with infrared capabilities, could offer better performance to the Border Patrol.

On the medical side, CSC is currently testing its technology in collaboration with researchers at Lawrence Berkeley National Laboratory and the University of California, San Francisco, Medical School for iterative reconstruction of CAT scan and MRI images. Particularly relevant for CAT scans, faster digital image processing can lower the total radiation dosage for patients. In addition, curtailing the dwell time in MRI machines can reduce the anxiety that some people experience while inside the noisy and closely confining units.

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▲ Computational Sensors' compact lightweight chip.