Astrophysical Device Will Sniff Out Terrorism

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Astrophysicists spend most of their time looking for objects in the sky, but 9/11 changed Ryan McLean's orientation.

Right after the terrorist attacks, the Caltech staff scientist began applying his knowledge about detectors that study galaxies to the design of new sensors for detecting radioactive materials near possible terrorist targets. A few months ago, the U.S. Department of Homeland Security awarded McLean the first phase of a $2.2 million contract to develop a radiation-detection module.

"Before 9/11, I had a safe feeling that life was great," says McLean, who came to Caltech in 1999 to work for Professor of Physics Christopher Martin, developing projects in which rockets were launched with instruments that, during their five minutes above the atmosphere, observed the dust and hot gases in the Milky Way. "But I have two young kids, and now I realize that things may not be so stable."

The first part of McLean's project is to create a specialized chip that turns a semiconducting crystal into a detector that can find a radiation source up to 100 meters away and tell whether it's harmful radiation from a dirty bomb, or harmless radiation from, say, a truckload of fertilizer. In the second phase, which could begin by the middle of 2006, he'll build a workable device.

The problem with current detectors is that they are often set off by essentially benign materials. They also tend to be large pieces of

equipment located only at the nation's entry points, such as ports.

McLean wants to make detectors that will ignore natural radiation sources like fertilizer and that will also be small and mobile, so that security officers can take them anywhere and target any ship, truck, or building.

McLean, who has also contributed to a project at the Lawrence Livermore National Laboratory (LLNL) to build a radiation detector the size of a cell phone, plans to use a sensor made of cadmium zinc telluride, which has been used in telescopes to detect gamma rays and X rays. The advantage of these crystals is that they work at room temperature, unlike other sensors that work only at very low temperatures.

To accomplish this, McLean teamed with the X-ray/gamma-ray group at Caltech's Space Radiation Laboratory (SRL), which is led by Professor of Physics Fiona Harrison. The SRL has been developing cadmium zinc telluride gamma-ray sensors, as well as custom, low-noise, low-power electronic chips for X-ray and gamma-ray instruments, for more than 10 years. While SRL's efforts have largely focused on developing these sensors for space missions, after 9/11 SRL teamed with LLNL to develop a chip for a handheld radiation monitor for Homeland Security.

Surprisingly, looking for radiation on the ground is not much different from searching for it in space. "What we are doing with Ryan is taking the best of what we developed for the previous Homeland Security device, and combining it with the best of what we developed for our space instruments," says senior SRL engineer Rick Cook. Everything SRL has learned about the pros and cons of the cadmium zinc telluride itself will also be key to making this project a success.

McLean says that he does not expect the project to put Caltech into the

antiterrorism radiation-detection business. If his device shows promise, the technology could be licensed to a company that would manufacture a range of detection products at relatively low cost, making widespread use feasible.

"The idea is that if you could have lots of small detectors, you might have a better chance of detecting harmful nuclear material than if you're stationed only at central locations, like bridges and ports," he says.

Given government officials' warnings that it is only a matter of time before the next terrorist attack in the United States, McLean says that there is a lot of pressure to complete the work quickly. "It helps push the project along."

Source: Caltech