UNH scientists to build device for detecting contraband radioactive material

September 8 2011

Researchers at the University of New Hampshire's Space Science Center (SSC), in partnership with Michigan Aerospace Corporation, have been contracted by the federal Defense Threat Reduction Agency (DTRA) to build a highly sensitive instrument that will detect illicit radioactive materials with pinpoint accuracy from a safe distance. Such materials, located in shipping ports, train stations, truck stops or warehouses, potentially could be used to make "dirty bombs" or associated with a nuclear device itself.

The one-year contract of $303,000 will include a realistic field test of the device's capabilities in 2012.

The Portable Neutron Spectroscope, or NSPECT for short, is a next-generation instrument based on those originally designed and built at the SSC for space-based missions studying high-energy neutrons and gamma rays emanating from the Sun and distant astronomical objects. NSPECT will have the capability to detect, make an image of, and identify hazardous and dangerous nuclear materials because such sources emit radiation similar to that in space. The device will be useful for security and proliferation deterrence, as well as for nuclear waste characterization and monitoring.

"This type of capability doesn't exist at the moment," says lead scientist James Ryan of the UNH Institute for the Study of Earth, Oceans, and Space and the department of physics. Ryan adds, "There are several designs in development in the U.S. but, basically, what people have to do now is go into a building or a container and fish around in hopes of finding the source. The expertise that has been acquired over many years in the space program can now be brought to bear on this problem to better find and locate nuclear bomb-making material."

DTRA is the U.S. Department of Defense's official combat support agency for countering weapons of mass destruction, and its programs include basic science research and development.

"The funding from DTRA enables us to significantly advance the NSPECT technology and accelerate its deployment," says Dominique Fourguette, chief technology officer at Michigan Aerospace. "One of our primary goals is to produce a robust instrument that can be put to use as quickly as possible," she adds.

To build the instrument, UNH is leveraging 40 years of experience conducting space-based neutron and gamma-ray detection, with university scientists and engineers developing all the related instrument hardware and software. Michigan Aerospace is responsible for the support engineering that will turn the bench-top instrument into a rugged field-deployable device equipped with a nimble graphical user interface and live video imaging capability.

NSPECT will have the capability to detect both gamma rays and neutrons but it is the neutron detection that is of greatest interest to DTRA.

Unlike other forms of radiation, such as gamma rays, penetrating neutron emission is very uncommon and neutrons are by their nature resistant to detection and defy easy imaging. Indeed, for every one neutron that can be detected 10,000 hurtle past unseen. And when detection is achieved, extracting any meaningful information about the particle is challenging. And therein lies the key to the neutron detector.

While a Geiger counter simply clicks at a higher rate the closer it is to a source of radiation and cannot filter out the ever-present background radiation, the neutron camera discreetly records every neutron that interacts with the instrument and puts each one in a specific "bucket" based on what direction that neutron came from. The buckets are then emptied and, using software developed at SSC, the instrument "focuses" the neutrons into a coherent picture, emerging just like an image in a Polaroid snapshot.

"You need a complicated instrument that allows you to follow the neutron and give you information about its velocity and the direction it's coming from," says Ryan. "Our instrument will be very sensitive, and when it detects these neutrons it will be able to construct images of the emission pattern and report the neutron spectrum, which in turn will allow us to nail down what type of nuclear material we're dealing with."

He adds that, unlike gamma rays, which if detected would alert authorities to something like radioactive medical waste that could be used to construct a dirty bomb, "If you were to get a neutron signal at some port, for example, you'd bring everything to a halt because what you're potentially dealing with there is someone trying to smuggle in material for a nuclear device, or a nuke itself."

Provided by University of New Hampshire

Citation: UNH scientists to build device for detecting contraband radioactive material (2011, September 8) retrieved 26 April 2024 from https://phys.org/news/2011-09-unh-scientists-device-contraband-radioactive.html