Team designs two-dimensional radar reflector to measure subtle ground movement

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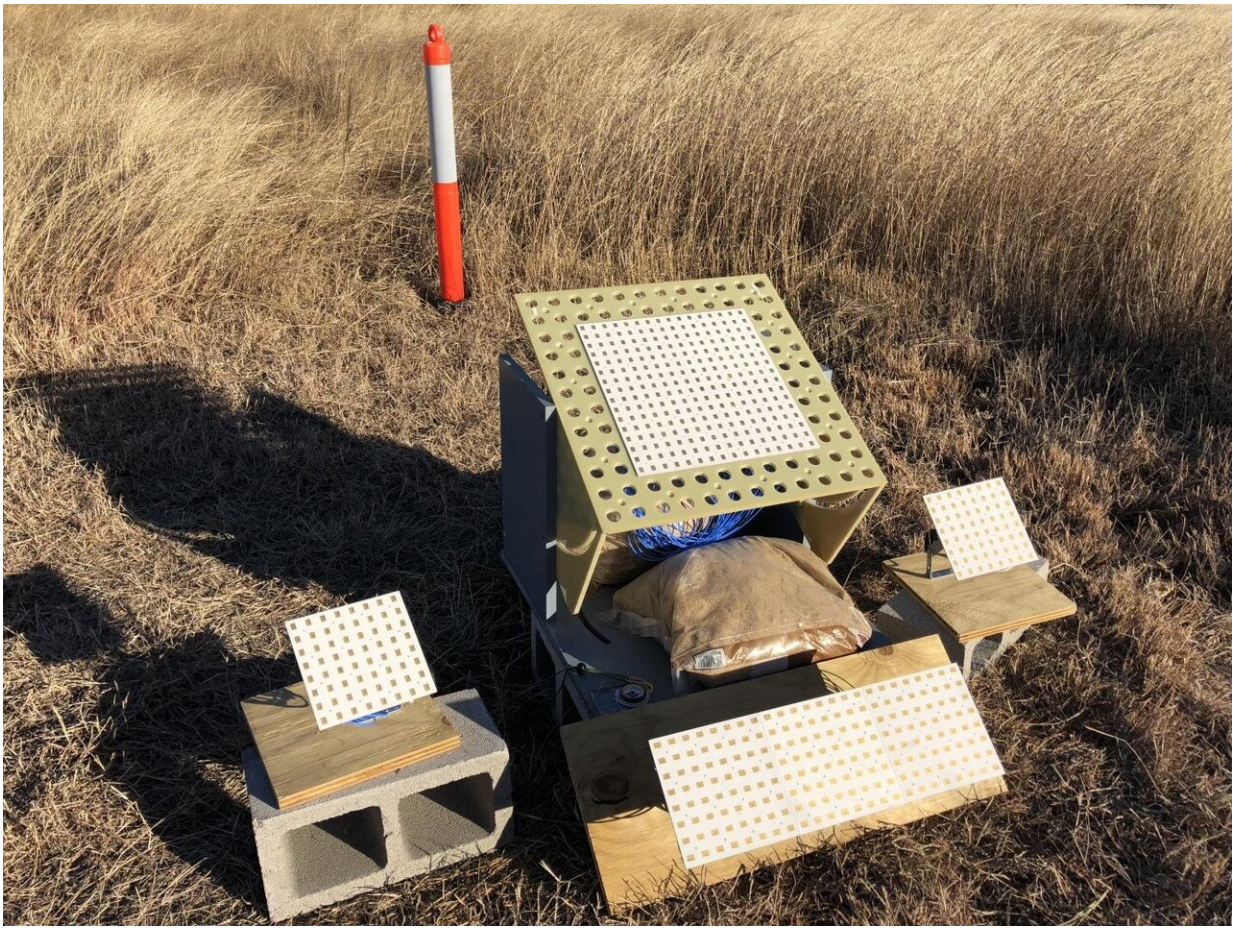

The compact Van Atta retroreflector panels designed by SwRI can be arranged in various geometric patterns, making them easy to flush mount to a surface and less susceptible to damage. Credit: Southwest Research Institute

A Southwest Research Institute science and engineering team designed a two-dimensional radar retroreflector that remotely monitors subtle shifts in the Earth's crust. The patent-pending Van Atta retroreflector works in conjunction with satellites to precisely measure ground movement caused by earthquakes, oil production, mining and other processes. Movement can pose a risk to critical infrastructure such as nuclear facilities, airports and bridges.

"By monitoring shifts in the Earth's crust, emergency managers, city leaders or anyone with an interest in community safety can detect and anticipate instabilities in a particular area," said SwRI Senior Research Scientist Dr. Marius Necsoiu who created the Van Atta retroreflector concept with support from SwRI engineers Emilio Martinez and B. David Moore. "This allows proactive planning and solutions to address unstable ground."

The Van Atta retroreflector incorporates an antenna array patented by Dr. L.C. Van Atta in 1959. His unique array design sends energy back in the direction of arrival over a wide range of angles. SwRI's Van Atta retroreflector merges Van Atta's principles with radar interferometry, a satellite-based method of measuring ground movement with radar signals. When monitored over time, the reflected signals show whether the ground in a particular location is shifting, detecting even slight movement.

"Analyzing subtle changes from space requires markers on the ground that don't change over time," Necsoiu said. "The compact Van Atta retroreflector provides that consistency. The flat design allows secure, flush mounting to structures or the ground. In addition, the retroreflector can withstand a range of challenging environments and temperatures, making it ideal for this type of data collection."

Traditional, three-dimensional reflectors, known as corner reflectors, are

bulky and susceptible to damage or vandalism. The Van Atta retroreflector panels, which measure less than 1 foot x 1 foot, can be painted to match any surface and configured in various patterns, making them easier to conceal and less prone to damage. Additional applications include measuring changes in natural formations such as rock glaciers, and military tracking and communication.

"When attached to outdoor equipment, the Van Atta retroreflector acts as a tracker of any subsequent movement. Commercial radio frequency imaging satellites can locate and identify marked objects anywhere on the globe, day or night and in all weather," said James Moryl, director of SwRI's Radio Frequency Sensors and Systems Department. "The reflector can also work in conjunction with a handheld or drone-mounted reader. The Van Atta technology provides a longer operating range and wider coverage area than competing commercial and military tracking solutions."

SwRI's Van Atta retroreflector can be adapted for a range of frequencies, making it compatible with any satellite, drone or radio device. This technology is currently available for government and industry projects.

Provided by Southwest Research Institute

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