John Szajgin, a contractor with the National Geospatial-Intelligence Agency's InnoVision directorate, and U.S. Air Force Maj. Andy Lundin, use a Light Detecting and Ranging, or LiDAR, scanner to create a three dimensional image of graves at the University of Tennessee's Forensic Anthropology Center. NGA and UT scientists are using LiDAR and other instruments to create a verifiable method for remotely detecting mass graves. Photo by Amy Smotherman Burgess, courtesy of Knoxville News Sentinel

NGA, University of Tennessee partner in study of mass graves

By Jason Moll, Office of Corporate Communications

SCIENTISTS FROM THE NATIONAL GEOSPATIAL-INTELLIGENCE Agency and the University of Tennessee are combining resources to improve remote identification of mass graves during conflicts and humanitarian crises.

The cooperative research and development agreement, or CRADA, pairs UT's expertise in human decomposition with NGA's proficiency in remote sensing, said Whitney Nelson, a project scientist with the agency's InnoVision directorate.

Apart from having observers on the ground, there is no verifiable method for remotely identifying a grave once it has been covered, said Nelson.

"We're hoping to create an entire methodology for identifying these graves from a distance," said Nelson.

Creating a verifiable method for remotely detecting mass graves could improve the accuracy of geospatial reporting during a humanitarian crisis and negate the need to put observers in harm's way, said Nelson.

Faculty and staff from UT's department of anthropology buried 10 bodies across three graves in February and left another grave empty as a control, said Katie Corcoran, a doctoral student in the department of anthropology who works on the project. All of the bodies were donated for scientific research.

Scientists will monitor the graves for three years looking for detectable signatures, said Nelson. In the first year, scientists used various instruments to detect changes in the earth, variations in temperature, and the presence of gasses or residues, said Nelson.

"Initially, the biggest signature is the disturbed earth – and that's readily seen from panchromatic imagery," said Nelson. "As time moves on, it starts to get hotter inside the grave as the body breaks down. This process is well understood when it's a single person. What we really want to know is what it looks like when you have multiple bodies in a single grave."

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–Whitney Nelson

"So far, we have collected only ground-based data, said Nelson. If we determine there are unique observables, we hope to begin collecting data from (other) platforms."

Researchers have so far received a significant amount of data, which they are analyzing, said Corcoran. Initial results appear to show higher temperatures in and around the graves at certain times of day.

But the research is more complicated than simply taking measurements, said Corcoran.

Continued on page 6

"THERE is a lot of activity that happens underground and in graves," said Corcoran. "But it all depends on the (composition of the bodies), the soil, the temperature, and how moist it is."

The department has enlisted the help of multiple departments at the university, and at Oak Ridge National Laboratory to account for these variables, said Nelson. ORNL is supporting the processing of data on its high performance computing systems.

"There is a team from the UT Institute of Agriculture that does soil chemistry work," said Nelson. "There's a team from the biology department that is looking to see if there is any (chemical) difference in the vegetation over the graves, as opposed to where there is nothing. And, there are also people looking at microbes and what kinds of gases or volatile organic compounds are being released. So, what the (department is doing) is one small part of a much larger project."

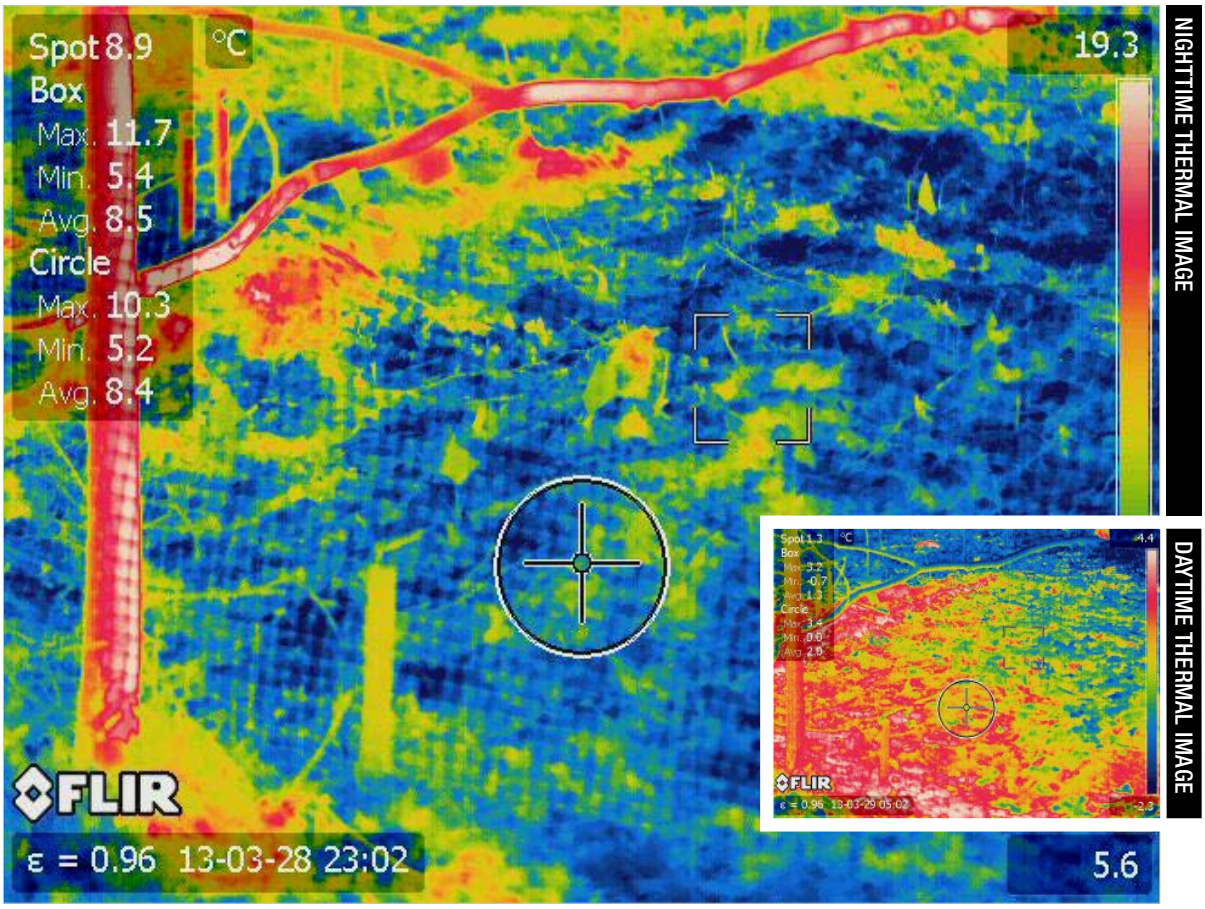
Partnering with NGA has provided the department of anthropology with instruments and access to data, said Corcoran.

"NGA is providing a tremendous opportunity for data collection," said Corcoran. "Now we have the ability to access data that are not very easy to get a hold of in any other context. In a broad sense, our access to data will help us understand what sensors will be better than others."

Scientists will monitor the graves to see how they change over time, said Nelson. NGA scientists hope to partner with the department as they create mass graves in different parts of the country to see if the observables are affected by different soil types and climate regimes.

The department of anthropology hopes to develop an entire course dedicated to the study of mass graves once their research is complete, said Corcoran.

Ultimately, the most important part of their research is that it helps people, said Corcoran.

"Hundreds of thousands, if not millions, of people remain missing from conflict," said Corcoran. "There are a lot of people who would like to find them. Whether it's for bringing criminals to justice, or finding and identifying the victims so they can be repatriated back to families, there are a lot of very good reasons for doing this work."

Nighttime and daytime (inset) thermal images of a grave containing six cadavers show a measurable difference in surface temperatures between the two times. Scientists from the University of Tennessee's anthropology department and NGA's InnoVision directorate are trying to determine if the difference can be attributed to subsurface temperature increases caused by body decomposition. NGA photos.