



UNC CHARLOTTE

The William States Lee College of Engineering



**Dr. Andrew Willis  
Brings Engineering Expertise  
to Archeology**

# Modern engineering recreating ancient sites

Working to recreate Mayan Indian temples and medieval fortresses, Dr. Andrew Willis employs a seemingly unexpected tool: electrical and computer engineering. Joining teams in Mexico's Yucatan Peninsula and on Israel's Mediterranean coast, Dr. Willis works side by side with traditional archaeologists. But while they use brushes and small shovels, he uses scanners and computers.

An assistant professor in the Lee College of Engineering's Electrical and Computer Engineering Department, Dr. Willis, and collaborator Dr. William Ringle of Davidson College, visited two ancient Mayan villages last year. The remote sites of Huntichmul and Kuic on the Yucatan Peninsula required the use of portable equipment that could be easily carried through dense jungle and operate in the harsh, hot, humid conditions. Dr. Willis developed, designed and built a laser range scanner to work in these specific field conditions.

"The scanner is a light, distance and ranging system," Dr. Willis said. "It measures three-dimensional surface images, providing up to 3 million surface positions. We scanned big chunks of dwellings, some of which were standing, some partially collapsed and some completely collapsed."

Back in the lab, the next step was to interpret the data. "It is essentially a signal processing problem," Dr. Willis said. "We are collecting digital range data, from which I'm looking to create geometric images. All buildings have some predictable structural components. We look at the pieces and try

to understand the way the people built the structures, and come up with a estimates for what the complete structures looked like."

Dr. Willis participated in a second archaeological



study last year, this one at the site of the Crusader fortress of Apollonia-Arsuf in Herzilya, Israel. The project focuses on reconstructing the entire fortress, drawing on a host of expertise including professors from Brown University and Tel-Aviv University. This initial trip concentrated on analysis of the forward castle defenses: the front gate, towers and drawbridge.

Situated on the edge of a cliff, abutting the Mediterranean Sea, the fortress had been built by the crusaders of the Knights Hospitaller. In 1266, the knights were defeated, and the castle was razed. The remains continued to decay in the harsh environment, with much of the ruins now lying at the bottom of the cliff or in the Mediterranean.

The coastal location brought different equipment challenges than Mexico's jungles. In Israel, "the sun was so bright it interfered with the laser scanning equipment," Dr. Willis said. "So we had to work at night and sleep during the day. Scanning at night offered a whole new set of challenges."

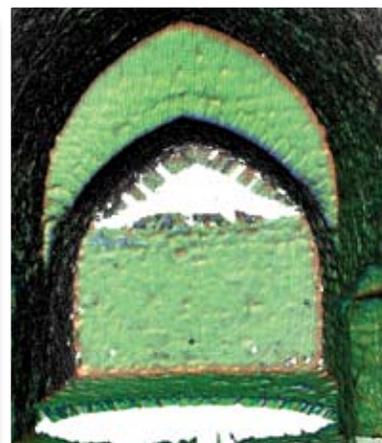
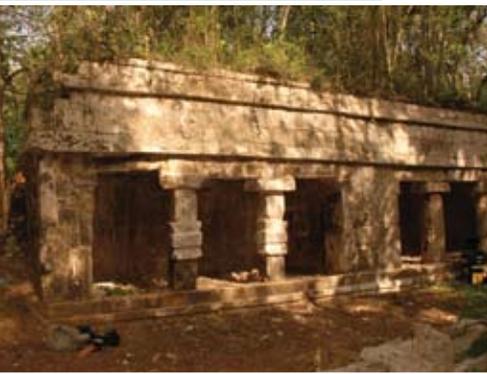
Dr. Willis and his team scanned the collapsed structures, and are developing software that enables archaeologists to use the measured data to develop 3D models. The developed models provide new insights to the structure and provide powerful new tools for testing and validating archaeological hypotheses.

"Our measurement technologies can contribute a great deal," Dr. Willis said. "This work is just a beginning. There are many other areas where new technologies can assist archaeologists. Recent use of these technologies have already begun to revolutionize our understanding of the past."

photos

right - Dr. Andrew Willis, his team and scanning equipment in Mexico.

below - A Mayan structure at Kuic. - Scanning at night because of Israel's bright sun.



photos

right - An arch from the crusader fortress at Apollonia-Arsuf. A 3D scan of the arch has been colorized to highlight geometric variations in the walls, which can be used to automatically estimate weathering of the structure, and the size and spacing of stones.