

Pre-Columbian Road Hunt Goes High-Tech

By ROBERT GOODIER

Tico Times Staff

THREE U.S. National Aeronautics and Space Administration (NASA) jets outfitted with infrared cameras and radar have detected a subterranean network of ancient rock-paved roads that lace Costa Rica from the Central Valley throughout the Caribbean slope.

Sometime between 8,000 B.C. and the Spanish conquest in the 16th century, still-undetermined numbers of people laid the stones that now poke through the topsoil in places – on farms, in highway cuts, or anywhere the sites have been disturbed or have avoided soil deposits over time.

Since the late 1970s, Costa Rican archaeologists tracked the roads by word of mouth and a steel rod. They would follow rumors of ancient roads on mountainous jungle estates until they found the rocky evidence of a stone-paved road. Then they'd walk along it, sinking a metal bar into the earth every few steps – if it struck stone, they were on track.

Maureen Sánchez, an archaeology professor at the University of Costa Rica (UCR), called it road finding through the "oral tradition." Highway cuts, she said, were a boon when they intersected with an ancient path. They yielded the currency of the archaeological trade: pot shards, the remains of campfires and other clues to the cultures of the thousands of people who lived here before the conquest.

NOW, training the power of space-age technology on the remnants of those civilizations, the UCR archeology and physics departments have teamed up to apply infrared sensors and radar to a science that was floundering in the dark ages.

NASA teams combed most of Costa Rica's national territory in three jets starting in 2003, with the last series of flights ending in April (TT, April 8). Outfitted with radar, as well as infrared and conventional cameras, the jets recorded thousands of images and hundreds of hours of digital video, most of which has not yet returned from being processed at NASA.

"It's much faster – archaeologists still have to go to the field to confirm the findings, but the photos tell us where to direct our attention," Sánchez said.

The information gleaned from the first series of flights in March 2003 has broadened archeologists' understanding of the people who lived here before the Spanish arrived.

"**THE** technology allowed us to see that some drawings we had made were incomplete," Sánchez said. "The photos let us see that some structures had different shapes and they helped us find other structures."

Perhaps more importantly, the collaboration provided an addictive first taste of the power of a multidisciplinary focus on archaeology.

"The project is just beginning," Sánchez said. "Later we could see these students in archaeology, physics, chemistry, even engineering studying (these civilizations). We want to encourage that – it's a broad new field of research."

In March 2003, a WB-57 high-altitude research aircraft flew over 70% of the country, equipped with an RC10 color infrared camera and a MASTER multi-spectral sensor that can take up to 50 photos simultaneously, overlapping the images to see minute detail.

THE cameras film visible light and near, mid-range and far, or thermal,

infrared waves. Thermal infrared is the heat any object radiates; the warmer the object, the more thermal infrared waves it emits, although even cold objects, such as ice, emit infrared light. Since objects in the ground conduct heat at different rates, they emit different amounts and types of infrared waves, a tendency that shows up in pictures. A partially buried stone wall, for example, looks different to an infrared sensor than the sand surrounding it.

Javier Bonatti, a UCR physics professor, translates the images as they return from NASA, helping the archaeologists understand what they are seeing.

"Simple sight is useless... with this technology, (the details) are startling. But it is subtle. You have to do a more precise job later," Bonatti said, referring to the archaeological fieldwork that follows.

IN March 2004, a DC-8 made a series of flights over the country equipped with the Airborne Synthetic Aperture Radar (AirSAR), which can penetrate the forest canopy and record images of structures as many as 10 meters underground (TT, March 4, 2004).

A WB-57 made the latest series of flights this year, this time equipped with a HyMap hyperspectral sensor, a geological mapping device used in such fields as commercial mineral exploration. A conglomeration of government institutions including the Environment Ministry and the National Water and Sewer Institute (AyA) contracted the equipment to gather information for land-use studies, and the archaeology department hitched on to broaden its research.

The last flights patched the holes left by the flights in 2003, when clouds obscured the Guápiles region, on the Caribbean slope, and others, Bonatti said.

He is anxious to see the photos and the radar images from the last two series of flights, he said, but does not expect them for several more months.

Each of the series of flights cost about \$2 million, Bonatti said, but NASA helped foot the bill through an agreement with Costa Rica's National Center for High Technology (CENAT).

GUAYABO, near Turrialba in the eastern mountains, is the site of the largest Costa Rican civilization before the arrival of the Spaniards. Hunter and gatherer societies were living in the Turrialba Valley as far back as 10,000 years ago, at the end of the last ice age, Sánchez said.

There, the first pre-Columbian road, called a *calzada* in Spanish, was discovered in 1979. It was named calzada Caragra, "just to give it a name," Sánchez said, and runs southeast from Guayabo. In 1982 and 1983, another road running northwest was discovered. Both roads support branched networks of secondary roads.

The Spanish explorers, who were not familiar with the rain forest, must have used the roads, Sánchez said. They later widened them to support their pack animals – beasts that, with the exception of the Peruvian llama, had not set foot in the Americas since their extinction there 8,500 years before.

Sánchez and other researchers tracked roads to riversides, then detoured to cross the river at a safe point. When they arrived at the point directly across from where the road had left off, the road picked up again.

"It made me think that they perfectly well could have made bridges," she said. "Photos from 100 years ago show hammock bridges made of plant fibers" that indigenous cultures maintained.



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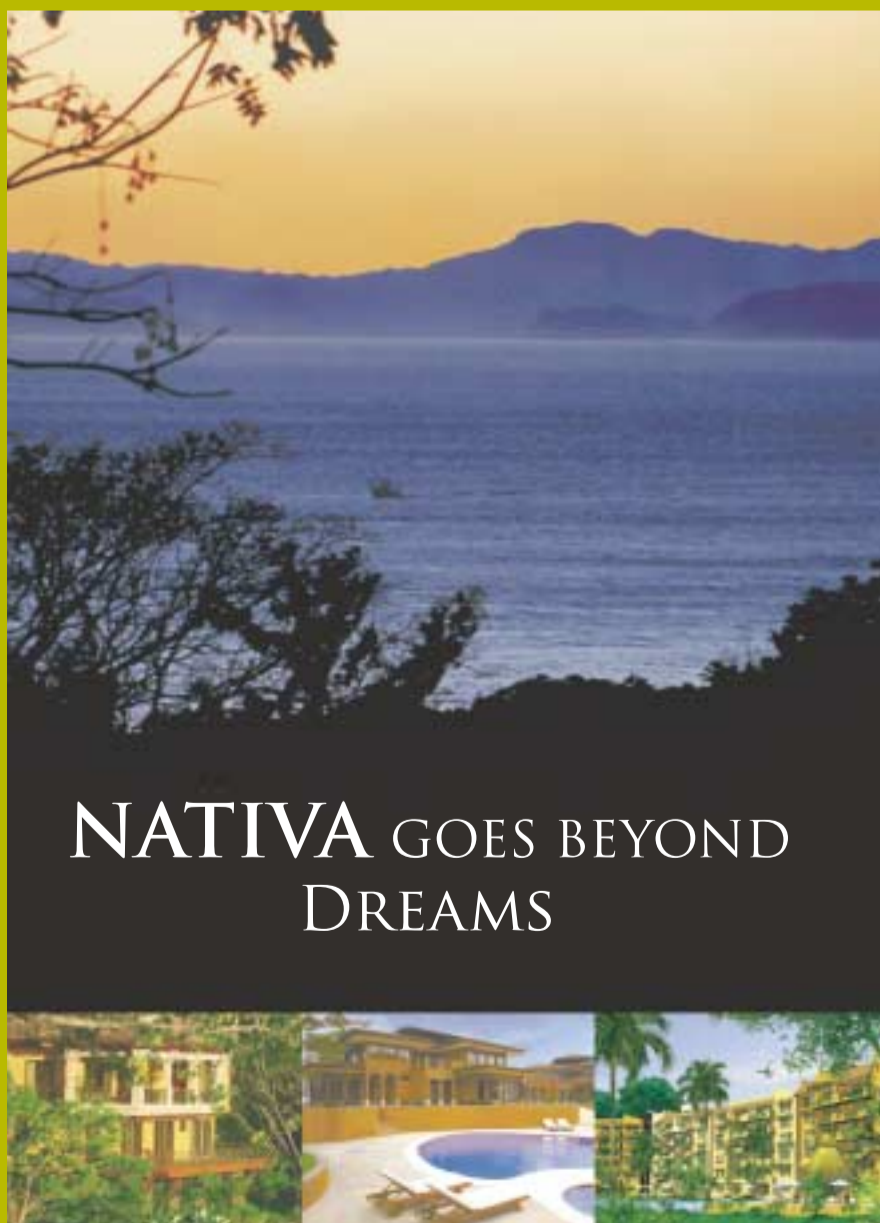
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