

SUCCESS STORY | OAK RIDGE NATIONAL LABORATORY

# A 21ST CENTURY PLANNING TOOL BUILT ON AI

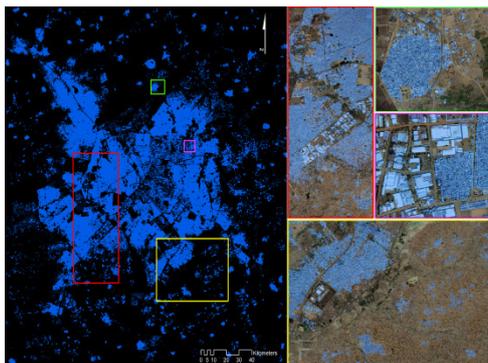


Kano, Nigeria: automated delineation of human settlement, produced from Oak Ridge National Laboratory's Settlement Mapping Tool.



# NVIDIA GPU-powered ai accelerates mapping and analysis of population distribution around the globe.

## MAPPING THE NEEDS OF HUMANITY



Kano subsets

With the Earth's population at 7 billion and growing, understanding population distribution is essential to meeting societal needs for infrastructure, resources, and vital services. Scientists at Oak Ridge National Laboratory (ORNL) work to create a more complete picture of the Earth's residents -including people who have never been accounted for in our history- in order to predict future resource requirements.

ORNL's efforts are focused on creating and analyzing large-scale geographic data for developing solutions to solve multidisciplinary

and complex problems, including understanding and mapping human settlements, processing large volumes of satellite images to determine sizes of homes and office buildings, and how much attendant energy, water, transportation, schools and more will be needed for predicted population growth. With 7.4 billion people on the planet to plan for, that's a lot of data—and a lot of computing capability to process it.

"We were limited by our computing capabilities," says Budhendra Bhaduri, Director of the Urban Dynamics Institute and Group Leader, Geographic Information Science and Technology (GIST) group. "The old problem was we were drowning in data with not enough computing to extract information. We have now turned the problem on its head—we're not compute limited, but limited by the ability to have data."

### CUSTOMER PROFILE



Organizations  
Oak Ridge National  
Laboratory

Industry  
Research

Location  
Oak Ridge, TN

Employees  
4,000



Kano periphery

## PRODUCTS

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Titan Supercomputer with  
NVIDIA® Tesla™ GPUs

## UNDERSTANDING A CITY IN SECONDS

Mapping settlements involves advanced algorithms capable of extracting, representing, modeling, and interpreting satellite image features. A decade ago, automated feature extraction algorithms on CPU-based architectures helped speed the identification of settlements. But identifying quick shifts in population—such as migration or changes after a natural disaster—required more computing power. Using GPUs and ORNL’s LandScan high-definition global population data, the ORNL team can now quickly process high-resolution satellite imagery to map human settlements and changing urban dynamics. The parallel-processing capability of NVIDIA® Tesla™ GPUs allowed researchers to develop and use the computationally expensive feature descriptor algorithms to process imagery at dramatic speed-ups of up to 200x.

The acceleration of processing time is invaluable to such a large-scale project. Bhaduri explained, “We can process Addis Ababa - the capital of Ethiopia, which is roughly 200 square miles - in less than 20 seconds. We can extract every building that stands on the surface in that amount of time, something that used to take days.”

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“With unprecedented capability to process satellite imagery, we have discovered people who have never been accounted for in any census.”

Budhendra Bhaduri,  
Director of the  
Urban Dynamics  
Institute and Group  
Leader, Geographic  
Information Science  
and Technology (GIST)  
group, Oak Ridge  
National Laboratory

## IMPACTING THE LIVES OF 7 BILLION

The results of ORNL’s work have the potential to influence the lives of everyone on the planet. NVIDIA GPUs are accelerating the mapping of global communities, which is critical for planning key societal services such as schools and education, water distribution, and more. It’s enabling more efficient planning, delivery of goods and services, and more efficient use of scarce resources.

Bhaduri continued, “With such unprecedented capability to process satellite imagery, we have discovered people who have never been accounted for in any census. Understanding previously unknown population distributions will help us provide basic human services across the globe.” Knowledge gleaned from polio eradication efforts was even applied to the emergency response to the West African Ebola outbreak.

When disaster strikes, ORNL can quickly create maps and analysis for responders to assess damage and react accordingly. “If there is a disaster anywhere in the world,” said Bhaduri, “as soon as we have imaging we can create very useful information for responders, empowering recovery in a matter of hours rather than days.”

GPUs have enabled ORNL researchers to analyze datasets in ways they never could before, from periodically mapping refugee camps to plan for humanitarian assistance to identifying mobile home settlements vulnerable to tornadoes. At the end of the day, their work is saving lives - and there is no better use of technology.

[nvidia.com/ai](https://www.nvidia.com/ai)

