Remote Sensing

Center for Transportation Analysis (CTA) Research Areas

Aviation Safety
Air Traffic Management Analysis
Data, Statistical Analysis
Geo-Spatial Information Tools
Defense Transportation
Energy Policy Analysis
Environmental Policy Analysis
Highway Safety
Intelligent Transportation Systems
Logistics Management
Supply Chain Management
Modeling and Simulation
Transportation Operations
Planning and Systems Analysis
Transportation Security

ORNL has a staff with extensive experience in remote sensing technologies in support of transportation and environmental data collection and analysis. Remote sensing is the use of sensors carried by aircraft, satellites, remotely located devices, or ground-based mobile systems to gather information about targeted objects and their environment. Most of these sensors record emitted or reflected electromagnetic radiation from the objects. Through visual and digital image processing and interpretation, the characteristics of this radiation are analyzed to locate, identify, and understand the objects in the area of interest. With a transportation focus, ORNL puts emphasis on advanced remote sensing solutions that address complex real world problems. ORNL also pays special attentions to the integration of remote sensing technologies with geospatial modeling capabilities to support applications that require effective, rapid, accurate data acquisition and analysis, applications such as roadway characterization, environmental impact assessment, emergency routing and analysis, and disaster assessment and recovering planning.

ORNL's Capabilities

- Analysis and use of remotely sensed data from multiple platforms, including satellites, aircraft, and ground mobile systems
- Interpretation and measurement of images from different sensors, at different viewing angles, and with different geographic scales, e.g., multispectral images, LIght Detection And Ranging (LIDAR) data, and stereo aerial photography, and 360 degree video log.
- Combined use of remotely sensed images with GIS databases, and Global Positioning System (GPS) data, and data acquired from the field.
- Development of roadway feature and characteristics database for highways, railways, waterways, ports, and intermodal facilities
- Classification and identification of land use patterns and their changes in the area of interest
- Environmental analysis and impact assessment for transportation corridors
- Rapid geospatial data acquisition and analysis for preparedness, assessment, response, and recovering planning during emergency
- Dynamic population distribution estimation and household location and attribute synthesis
- Automated and interactive feature extraction from remote sensing images and automated and semi-automated map matching and geospatial data integration

Questions ORNL Can Help Answer

- What types of land use occur at a specific time in a specific area and how the land use patterns evolve for a given time interval or in a time series?
- What is the estimated daytime and nighttime population of an area based on estimated census records and land use patterns and what is the population characteristics, e.g., housing, car ownership, age, race, etc?
- What are the infrastructure characteristics for a given roadway, e.g., transportation mode, connectivity, bridge locations, roadway width, intersections, etc?
- What does the background look like for a given transportation facility, e.g., are there any houses, industry establishments, or drinking water sources associated with a facility?
- Are there any damages and how serious are the damages for a given lifeline during an emergency?
- What is the current traffic conditions along the given evacuation route, e.g., traffic counts, or incident locations?
- Who and how many people are affected during an emergency, and are there any property damages and how much?
- What are the impacts to the natural environment for given hazardous

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conditions, air or water population, incidents of hazardous material release?

ORNL's Comparative Advantage

- Focused solutions targeting customer's unique application problems
- Comprehensive approaches that make use of state-of-the-art remote sensing technologies coupled with geospatial information modeling and analysis capabilities
- Experience with applications at national, regional, and local scales to provide increased values to the customer in the understanding of the problem context and detailed implementation procedures
- Interdisciplinary staff who provide unbiased analysis and recommendations and make best use of diversified commercial and customized application solutions
- Collaborations and partnerships with universities, commercial software companies, data providers, and consulting firms

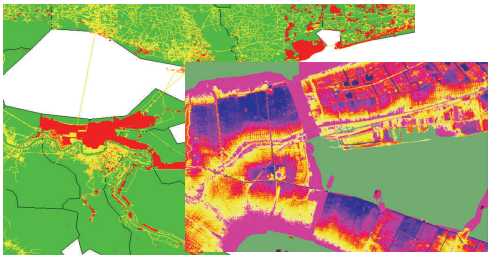
Experience

ORNL has developed remote sensing and data analysis methods and approaches for rapid characterization of transportation infrastructure and transportation corridors. These characteristics include road geometry, bridge attributes, traffic control systems, highway attributes, and surrounding land use patterns. These methods and approaches have been used to support development of roadway inventories, route planning, and disaster and emergency assessment and recovery planning.

Roadway characterization with multiplatform images.

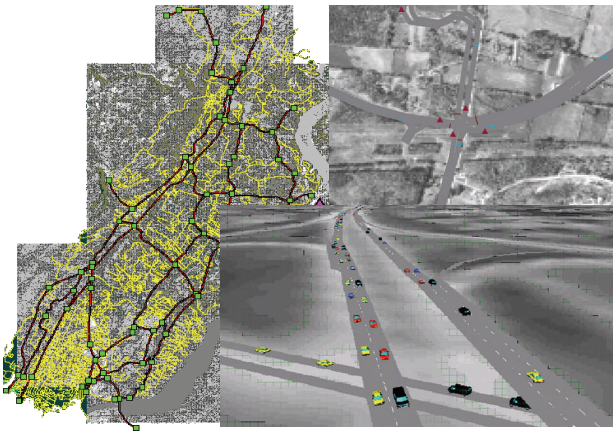
ORNL worked with the Florida Department of Transportation (DOT), U.S. DOT, and several private companies to make combined use of images from multiplatform sensors to acquire multi-scale, multi-spectral, and 3-D information for road networks, e.g., information about traffic signals and control characteristics, centerlines, through lanes, shoulders, intersections, and land use patterns along transportation corridors.

Through the sponsorship of the U.S. Department of Housing and Urban Development, ORNL developed methods to estimate population for communities along the U.S.-Mexico border. Remote sensing images, GIS databases, and census population data are utilized to locate and align neighborhood boundaries, identify housing distribution patterns, and synthesize demographic characteristics for the border communities. These methods were also used to generate population estimations for flooded areas after Hurricanes Katrina and Rita.



Population estimations for flooded areas after Hurricanes Katrina and Rita.

ORNL also worked with the National Consortium of Remote Sensing for Transportation, the Hamilton County GIS Department, and the University of Tennessee to simulate traffic for the surrounding areas of the Sequoyah nuclear power plant site in Hamilton County, Tennessee, using data derived from remote sensed images and other geospatial data sources. This simulation helps to establish a basis for the assessment of transportation lifeline conditions such as network connectivity, capacity, and vulnerability.



Traffic simulation and network condition assessment using remote sensing and other geospatial data sources.

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