GEOGRAPHIC INFORMATION SYSTEMS

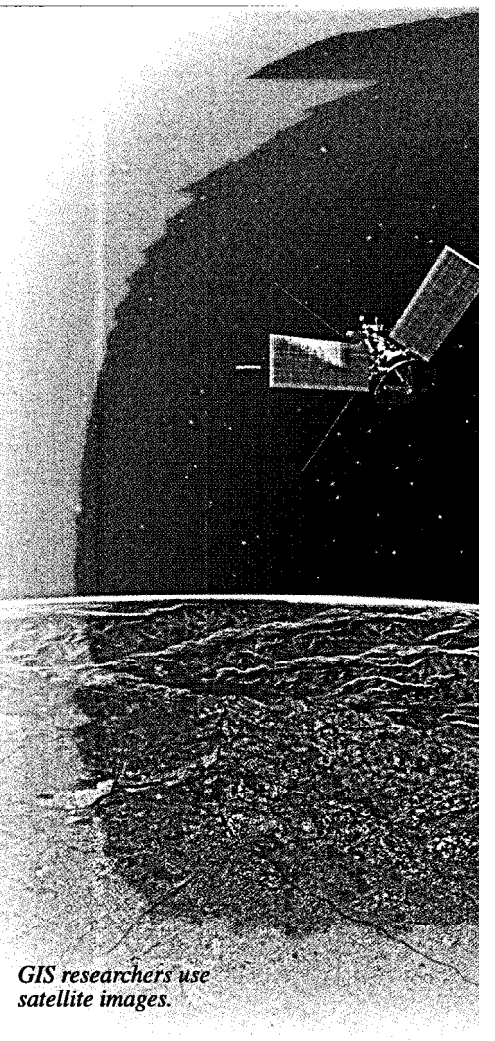
Tracking the Globe

Geographic information science was pioneered at ORNL in 1969, more than a decade before the commercial geographic information system (GIS) industry blossomed. A GIS is a computer system that can assemble, store, manipulate, and display geographic information, including images collected by satellites and aircraft. ORNL has used GIS to integrate multidisciplinary research projects addressing issues of local to global scale.

In the mid-1980s, ORNL researchers performed studies for the U.S. Army Toxic and Hazardous Materials Agency to help it decide the safest way to dispose of nerve gas weapons stored in Alabama, Arkansas, Kentucky, Oregon, and Utah. Researchers used GIS methodologies to examine truck and rail routes between sites and evaluate the safety of transporting the weapons to a central incinerator. The Army adopted ORNL's recommendation to build an incinerator at each site to avoid the potential dangers of transporting material to one site.

In the late 1980s, the National Oceanic and Atmospheric Administration's National Marine Fisheries Services funded studies to relate coastal fish population declines to increased urbanization and agricultural alteration of coastal landscapes. ORNL researchers led the technical effort that resulted in a standardized database of land cover change for all U.S. coastal areas.

A key to dealing successfully with any disaster is to accurately estimate the daytime and nighttime population of the affected area. Combining GIS and remote sensing technologies, an ORNL team developed Landscan, the most accurate and detailed of global population databases, to help decision makers. LandScan enables ORNL's Hazard Prediction and Assessment Capability (HPAC) software to help emergency planners "see" where and how much of a chemical or biological agent will disperse and also which populations need protection. HPAC is used by some 2000 employees with U.S. and foreign governments and military branches in the North Atlantic Treaty Organization and with state and local emergency planning and response units. LandScan is used by the United Nations and government agencies worldwide.



GIS researchers use satellite images.

TRANSPORTATION LOGISTICS

Finding the Shortest Path

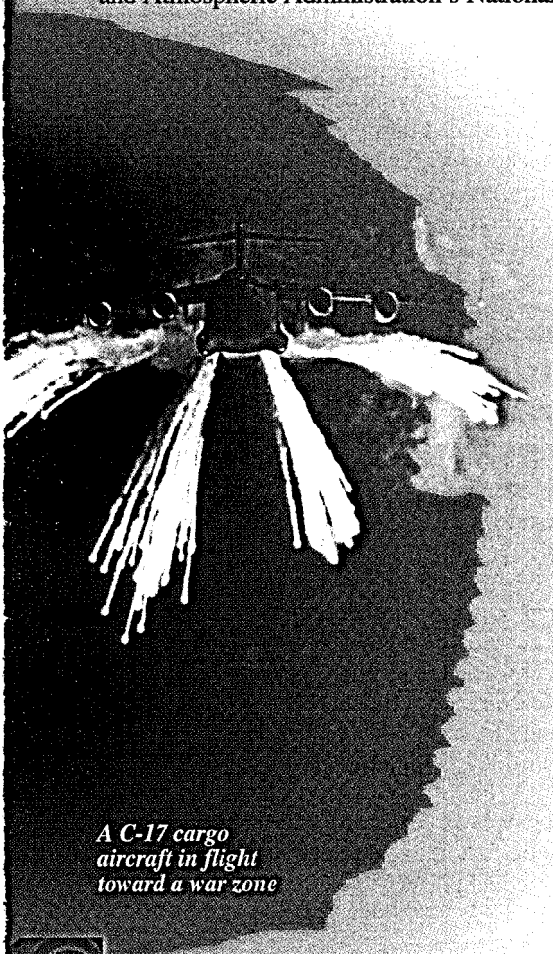
What is the fastest way to transport troops and needed equipment from American bases to foreign bases for possible military action? Thanks to special software developed for the Air Force by ORNL and University of Tennessee researchers, U.S. military troops and equipment have been airlifted to potential war zones more quickly than before.

The Air Mobility Command (AMC) Deployment Analysis System (ADANS) is a series of aircraft-scheduling algorithms and tools that enabled the AMC to deploy troops and equipment to the Persian Gulf in 1990 and 1991 more rapidly and more efficiently. The system was developed by ORNL and UT researchers led by Mike Hilliard and Charlie Davis.

Since 1990, ADANS has been used for all U.S. deployments, including those to Somalia, Haiti, Rwanda, Bosnia, Kosovo, Afghanistan, and Iraq. ORNL researchers have enhanced and supported the operation of the system, which has been renamed CAMPS (Consolidated Air Mobility Planning System). They are modifying scheduling algorithms to work with a new database management system.

What is the fastest and safest way to transfer spent nuclear fuel from U.S. power plants in the East to a permanent waste repository planned for the West? The Transportation Routing Analysis Geographic Information System (TRAGIS), developed by ORNL researchers Paul Johnson and Richard Michelhaugh, can determine the fastest highway, railroad, or waterway routes from starting point to destination. TRAGIS provides information on population distribution and densities. It picks routes that conform with government regulations (e.g., trucks carrying radioactive waste must go around, not through, cities), and it calculates alternative routes if a preferred route is blocked.

Users of TRAGIS include the U.S. Energy, Defense, and Transportation departments and the Nuclear Regulatory Commission.



A C-17 cargo aircraft in flight toward a war zone