

Intelligent Transportation Systems



Southwest Research Institute®
San Antonio, Texas

Southwest Research Institute®

Founded in 1947 as an independent, nonprofit research and development organization, Southwest Research Institute provides a significant research, engineering, and testing resource for industry, business, and government. The Institute uses a multidisciplinary, integrated approach to solving complex problems in science and applied technology. As part of a long-held tradition, patent rights arising from sponsored research at the Institute are often assigned to the client. SwRI generally retains the rights to Institute-funded advancements.

About the Cover: Busy highways carry traffic more efficiently and safely when traffic management centers optimize traffic flow. SwRI engineers have been designing and implementing solutions for traffic management centers for more than a decade.

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Committed to Diversity in the Workplace.

With more than 40 years of experience in developing automated data systems, Southwest Research Institute (SwRI®) provides innovative and cost-effective solutions to transportation system problems. In the field of intelligent transportation systems (ITS), SwRI has demonstrated broad capabilities in software, electronic, and communication technologies. As a multidisciplinary organization, the Institute offers a diverse range of technical skills, including:



- System integration
- Software engineering
- Electrical engineering
- Mechanical engineering
- Communication and network engineering
- Computer vision



ITS-generated camera images, accessible to the public via web or broadcast television, assist metropolitan freeway traffic.



SwRI is an independent organization, enabling Institute engineers to fulfill client goals in the most efficient and cost-effective manner. To achieve these goals, SwRI incorporates into ITS projects:

- Innovation
- Integration
- Implementation

Innovation

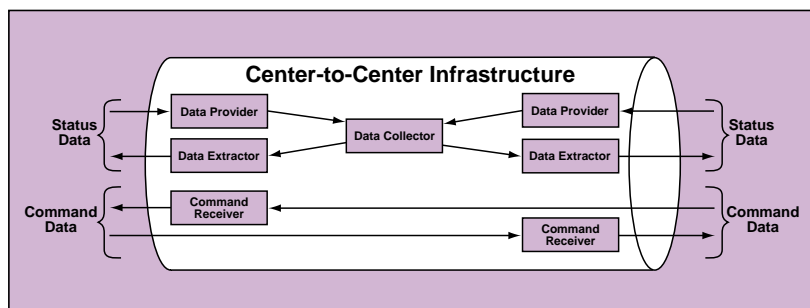
SwRI engineers and scientists specialize in innovative solutions to difficult and complex problems. Beginning with requirement-gathering and consensus-building, SwRI staff members incorporate the client's vision into first-of-kind or best-of-kind implementation so that the system meets the client requirements. Institute scientists and engineers continue to deploy new ideas and technologies to provide solutions in transportation and emergency management, including infrastructure security, information security, and systems integration. With the use of innovative technologies, SwRI engineers have developed state-of-the-art systems that have resulted in multiple national awards for ITS excellence.

Integration

SwRI software and communication engineers are leaders in the international effort to establish standards for intelligent transportation system protocols. Many tasks involve integrating systems that have not previously worked together or implementing standards where none had existed. Using development practices consistent with the U.S. Federal Highway Administration standards and other publicly available technologies, SwRI engineers can perform integration with all U.S.-developed intelligent traffic systems.

Implementation

Many clients have only a perception of a need. With its experience and expertise, SwRI designs, validates, implements, deploys, tests, and maintains solutions that make measurable improvements in traffic operations. Implementation of an Institute-developed system, whether in one city, statewide, or across several states, results in dramatic public exposure and impact.



SwRI has developed an XML-based software infrastructure that allows exchange of information among dissimilar systems. The center-to-center infrastructure uses ITS standards to support both status and command and control requests.



Institute engineers use a multidisciplinary, integrated approach to problem solving that continually produces innovations in the presence of evolving technologies and market forces.



SwRI software engineers have designed and deployed dynamic message sign (DMS) subsystems in many traffic management centers (TMC). These subsystems integrate different DMS protocols to give TMC operators a seamless operation in displaying to the public messages such as Amber Alerts.

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Texas Department of Transportation License Agreement

The Institute has established a license agreement with the Texas Department of Transportation (TxDOT) that authorizes SwRI to promote and make certain TxDOT intelligent transportation system (ITS) software products available to state, U.S. government, or other nonprofit governmental agencies through the establishment of a sublicense.

Through this license agreement, SwRI has access to a multitude of ITS applications and systems that TxDOT has developed and proven over the years, many of which SwRI helped develop and maintain. Through a separate contract for services, SwRI will incorporate those applications into ITS solutions for other government entities.

SwRI's System Works Together

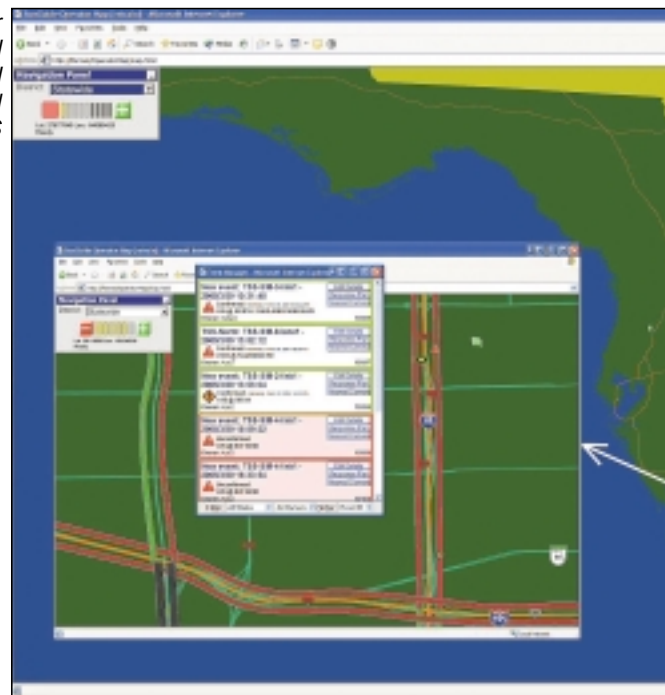
Institute-developed systems use appropriate ITS standards to provide convenient and easily available information to participating organizations. Municipalities and agencies can easily coordinate their efforts, share costs, and increase mutual benefits.

SwRI engineers designed and developed a real-time, two-way video teleconferencing capability (LifeLink™) between hospital emergency rooms and ambulances, helping to save lives.



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Traffic management center staff use SwRI-developed web-based maps to send command and control requests to deployed ITS field equipment.



Institute engineers integrate advanced traffic management software as part of the construction of traffic management centers.

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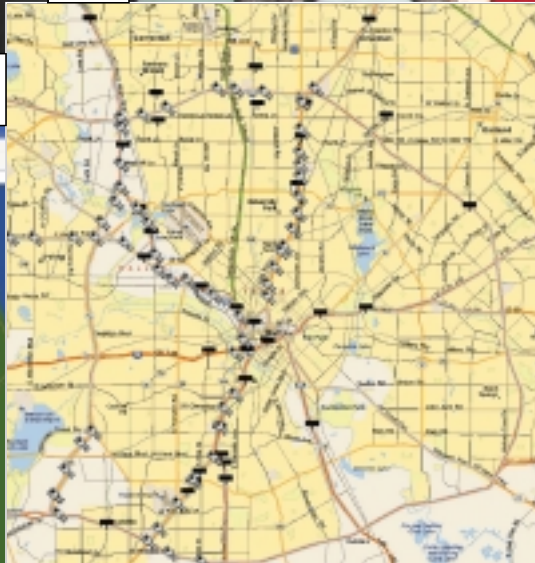
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Using information gathered from closed-circuit television cameras and other traffic sensors, the fiber-optic freeway communication system distributes data to determine travel speeds and traffic congestion. The data are then used to update travel time messages on dynamic message signs.

For the San Antonio TransGuide™ Traffic Management Center, Institute engineers developed advanced traffic management system control center software. Serving as software contractor and integration consultant, SwRI evaluated design decisions during TransGuide implementation.



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Data from cameras and traffic sensors are used to update roadway field equipment, including dynamic message signs and lane control signs. Traffic management center staff operate this equipment using SwRI-designed and implemented real-time device drivers.



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SwRI engineers designed and deployed wireless communication including video to improve communication between courtesy patrol vehicles and the traffic management center.

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Communication & Network System Design and Development

SwRI engineers have extensive experience in planning, designing, deploying, and managing communication infrastructure and network systems. Working closely with the client, Institute engineers ensure accurate development and fulfillment of client requirements. SwRI offers a variety of communication system services, including:

- Development of infrastructure requirements
- Design of infrastructure to support legacy equipment
- Identification, comparison, and evaluation of network technology
- Specification of standards-based technologies to prevent sole-source procurement scenarios
- Modeling, analysis, prototyping, and testing of network communication infrastructures
- Design of manageable devices to improve network maintenance and operations
- Provision of system backup and restoration to increase network resilience

Institute engineers have comprehensive expertise in a range of network communication requirements, including:

- Infrastructure design and analysis
- Network and system security
- Network system design using commercial-off-the-shelf components



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Institute engineers design network systems to operate in conditions that are not environmentally controlled.

Using up-to-date facilities and equipment, SwRI engineers create hybrid network topologies that support converging voice, video, and data. These prototype topologies are then used to test interoperability, performance, network security, and custom hardware.



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Institute engineers designed a remote incident-management system that uses satellite communications to provide command and control capability for rural ITS applications.

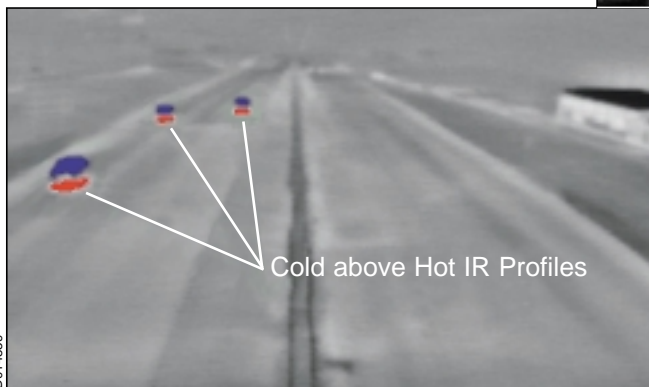
Institute Contributions to Intelligent Transportation Systems

Since its founding more than half a century ago, the Institute has actively promoted innovative solutions to technical problems through internal research programs. Recent examples of these projects applicable to advanced traffic management systems (ATMS) technology include:

- **Automatic ATMS map generation**
ATMS-generated standard Geographic Information System data files were converted into “smart highway objects,” permitting easy display and manipulation.
- **Automatic scenario generation for ATMS**
Engineers developed a set of algorithms that created solution scenario rules and coupled these rules with the roadway geometry (GIS) data to create solution scenarios in a dynamic fashion.



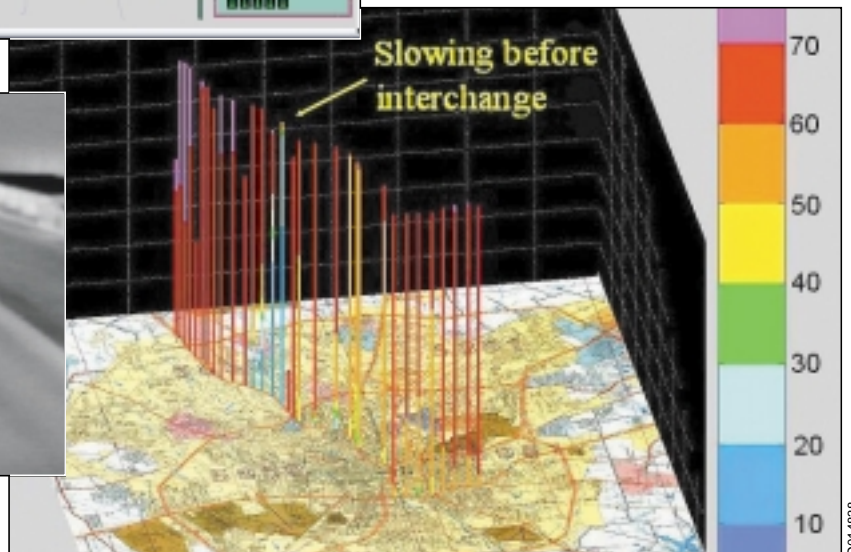
Supported by SwRI internal funding, software engineers converted standard GIS data files into a format more easily displayed and manipulated on ATMS displays.



Combining long-wave infrared thermal imagery with image-processing techniques enabled SwRI scientists to develop a real-time incident-detection technique.

- **Alternative center-to-center protocols**
Staff members investigated protocols to determine if CORBA or XML is appropriate to implement the real-time requirements of center-to-center applications.
- **Infrared incident detection**
Engineers combined long-wave infrared thermal imaging with image-processing techniques to detect, verify, and classify traffic-impacting incidents such as deer crossing the roadway.
- **Data warehousing and mining**
Data visualization is a powerful tool for gaining useful insights into massive amounts of data.
- **Automated monitoring of critical transportation infrastructure assets**
Adaptive image processing was applied to signals from a variety of imaging sensors to detect anomalous events for bridges, overpasses, tunnels, major freeway corridors, mass transit hubs, and waterways.

- **Under-vehicle surveillance**
An SwRI-developed system inspects vehicle undercarriages to detect anomalous material, preventing prohibited material from being transported into or from a facility.



The data mining system can visualize many types of ITS data across space and time.

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Southwest Research Institute is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres and provides nearly two million square feet of laboratories, test facilities, workshops, and offices for more than 2,900 employees who perform contract work for industry and government clients.

*We welcome your inquiries.
For more information, please contact:*



Steve Dellenback, Director
Intelligent Transportation Systems
Automation and Data Systems Division
(210) 522-3914 • Fax (210) 522-3396
E-mail: sdellenback@swri.org

Southwest Research Institute
6220 Culebra Road • P.O. Drawer 28510
San Antonio, Texas 78228-0510
SwRI Web Site: www.swri.org

Web Site: its.swri.org