



Alberto Broggi
University of Padua, Italy
broggi@ce.unipr.it

The IEEE and ITS

Robert L. French, R&D French Associates

Undoubtedly, intelligent transportation systems will be part of our lives in the future. Our vehicles will incorporate many different electronic devices that improve mobility by increasing safety, reducing pollution, reducing travel times, and enhancing road-network efficiency.

Such devices will result from research activities spread over many different areas such as computer science, electronics, communications, control, robotics, and signal processing. This multidisciplinary nature increases the problem's complexity because it requires knowledge transfer and cooperation among different research areas.

This column, written in cooperation with the recently established IEEE Intelligent Transportation Systems Council, will focus on different aspects of future transportation systems, starting in this issue with an overview of the IEEE ITSC and its mission. Future articles will cover vehicle and infrastructure issues and will describe the most advanced projects worldwide.

For further information and to make suggestions, contact me at broggi@ce.unipr.it; www.ce.unipr.it/people/broggi.

—Alberto Broggi

Alberto Broggi is an associate professor of artificial intelligence at the Department of Computer and Systems Engineering at the University of Pavia, Italy. His research interests include real-time computer-vision approaches for unmanned-vehicle navigation, and the development of low-cost computer systems for use with autonomous agents. He is the coordinator of the ARGO project, which aims to design, develop, and test innovative solutions for the vehicles of the future. He is the editor of the *Newsletter of the IEEE Intelligent Transportation Systems Council* and will be the program chair of the 2000 IEEE Intelligent Vehicles Symposium. He received his master's in electronic engineering and PhD in information technology from the University of Parma, Italy.

This article highlights the IEEE's role in shaping the Intelligent Transportation Systems movement, which sprouted during the '60s, lay partly dormant during the '70s, blossomed during the '80s, and started bearing fruit with its many deploy-

ments throughout the world during the '90s. I also outline the mission of the IEEE's new ITS Council for coordinating ITS interests among the numerous IEEE societies whose scope includes technologies used for implementing ITS functions and services.

ITS background¹

Intelligent transportation systems is an umbrella term that covers the application of a wide variety of computer, communication, positioning, sensing, control, and other information-related technologies to improve

the efficiency, safety, and environmental aspects of surface transportation. Major categories of ITS include traffic-management systems (for example, adaptive traffic signals, automatic incident detection, electronic toll collection, and emission sensing) and traveler information systems (for example, pretrip planning, motorist information, and dynamic route guidance).

ITS also include systems for public transportation (automatic vehicle location, signal preemption, smart cards for fare collection, dynamic ride sharing, and so

on) and for commercial-vehicle operations (fleet management, weigh in motion—weighing trucks as they travel, automatic vehicle classification, international-border crossing, and so on). Safety-related ITS include intelligent cruise control, collision warning, collision avoidance, night vision, and platooning. Other examples of ITS include automatic Mayday signaling, coordinated emergency response, and signal preemption for emergency vehicles.

Automated in-vehicle route-guidance systems based on mechanical principles were on the market in the US around 1910; vehicle-actuated traffic signals debuted in 1928; and a concept for automated highway systems was shown at the 1939 World's Fair. However, by any practical measure, the ITS movement didn't take root until the '60s, when the first computer-controlled traffic signals and changeable message signs appeared. A US research project established concepts in the late '60s for dynamic route guidance based on real-time traffic conditions, but was canceled by Congress before testing.

Tests of similar dynamic systems occurred in both Japan and Germany in the '70s. That decade also brought the microprocessor and the beginning of GPS development and testing. Although these technologies were not associated with ITS at the time, they are now major components of many ITS systems.

Thus, many of the underlying concepts and basic technologies for ITS were in place for the flurry of government-subsidized and industry-funded development programs that got underway in the mid '80s in Europe—for example, Drive and Prometheus—and Japan—for example, RACS (Road/Automobile Communication System) and Amtics (Advanced Mobile Traffic Information and Communications System).

In the late '80s, Mobility 2000, an informal organization, spurred ITS in the US. Mobility 2000 laid the groundwork for the formation in 1990 of ITS America (origi-

nally called IVHS [Intelligent Vehicle Highway Systems] America). ITS America is a public-private forum for consolidating national ITS interests and promoting international cooperation in ITS. The IVHS Act of 1991 then formalized the US ITS program and funded development through 1997. By the late 1990s, the main focus of ITS programs around the world had shifted to large-scale integration and deployment.

IEEE involvement

The following selected highlights illustrate the IEEE's past and continuing involvement in the ITS movement.

Publications. The transactions and other publications of numerous IEEE societies have contained occasional papers or articles related to individual ITS technologies. However, special issues of *Transactions on Vehicular Technology* gave a comprehensive snapshot of ITS developments in the February 1970, May 1980, and February 1991 issues. The cover article of the May 1991 *IEEE Spectrum* was a special report on ITS.

Besides these occasional articles, the IEEE ITS Council has established two publications devoted to ITS:

- *Newsletter of the ITS Council.* Edited by Alberto Broggi of the University of Pavia, this electronic newsletter has been posted quarterly at the IEEE ITS Council's Web site (www.ieee.org/its) since January 1999. Individual e-mail subscriptions to the newsletter are also available at the Web site.
- *IEEE Transactions on ITS.* Edited by Chelsea C. (Chip) White III of the University of Michigan, this quarterly refereed journal is slated to start publication in March 2000. It will focus on the design, analysis, and control of information technology as it is applied to transportation systems. The call for papers is posted on the ITS Council Web site.

Conferences. Individual conferences of several IEEE societies have included papers and even entire sessions on ITS—for example, the Plans (Position-Location and Navigation Systems) Conference of the Aerospace & Electronic Systems Society. However, certain IEEE conferences have focused exclusively on ITS since 1989.

The Vehicular Technology Society originated the Vehicular Navigation and Information Systems Conference in 1989 in Toronto,

which was the world's first ITS conference. The VNIS conferences were subsumed by the Intelligent Transportation Systems Conference series, starting with ITSC '97 in Boston. The ITSC series was started by the IEEE Ad Hoc Committee on ITS (the ITS Council's predecessor) and has been continued by the council.

Starting with ITSC '99, held in Tokyo from 5 to 8 October, the ITSC became annual. A major objective of the series is to focus more strongly than other conferences on cutting-edge-electronics-based technologies and their implications for ITS. The next ITSC will be from 1 to 3 October 2000 in Dearborn, Michigan. The call for papers is at the ITS Council Web site.

Another IEEE conference series devoted exclusively to ITS is the Intelligent Vehicles Symposium, which the Industrial Electronics Society originated in the early '90s. IV now continues under the ITS Council's auspices. The next symposium, which focuses on basic research and present and future applications for intelligent vehicles and intelligent infrastructures, will be from 4 to 5 October 2000 in Dearborn. The call for papers is at the ITS Council Web site.

Standards. In July 1991, the IEEE Standards Board approved the establishment of an ITS Standards Coordinating Committee. Known as SCC32, the committee became the 16th IEEE committee for coordinating standards in specific technology areas. Its scope reads as follows:

SCC32 shall be responsible for coordinating, developing, and maintaining standards, recommended practices, and guidelines related to Intelligent Transportation Systems (ITS) within the scope of IEEE interests. SCC32 shall work with other national and international standards writing bodies to coordinate area of involvement.²

Recent standards developed by SCC32 include

- 1455-1999: Standard for Message Sets for Vehicle/Roadside Communications.
- 1489-1999: Standard for Data Dictionaries for Intelligent Transportation Systems.

SCC32 projects at the ballot stage include

- P1488: Standard for Message Set Template (MST) for Intelligent Transportation Systems.
- P1512: Standard for Common Incident

Management Message Sets for Use by Emergency Management Centers.

Detailed information on SCC32 is available at its Web site: grouper.ieee.org/groups/scc32.

The IEEE ITS Council

On 1 January 1999, the IEEE ITS Council joined ranks with the 37 Societies and Technical Councils that constitute the 320,000-member IEEE. The ITS Council is scientific, literary, and educational in character. Its purpose is to advance and coordinate ITS activities throughout the IEEE. Its field of interest includes the theoretical, experimental, and operational aspects of electrical and electronics engineering and information technologies as applied to ITS. The council will further its work by

- publishing appropriate periodicals,
- sponsoring IEEE ITS-related conferences and conference sessions,
- sponsoring IEEE Press publications, and
- pursuing other activities in its field of interest.

Background. The ITS Council culminates an effort that began in 1993 when, at the Vehicular Technology Society's urging, several IEEE Societies with ITS interests banded together under the Technical Activities Board to create the cross-cutting Ad Hoc Committee on ITS. Although the IEEE is the world's largest professional organization, it previously had no unified vision of its role in the ITS movement. With the exception of SCC32, the IEEE's ITS interests before forming the ad hoc committee had been scattered among individual activities of the semiautonomous IEEE societies. A major concern both inside and outside the IEEE was the lack of a single point of contact for coordinating with non-IEEE ITS activities. For example, unlike other major engineering societies such as the American Society of Civil Engineers, the Institute of Transportation Engineers, and the Society of Automotive Engineers, the IEEE was not a member of ITS America, until after the ad hoc committee resolved at its organizational meeting to seek empowerment to become a member on behalf of the IEEE.

The committee focused early on ITS conference activities, starting with a special session on the IEEE's role in ITS that it organized for the First ITS World Congress, in

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Paris in 1994. In conjunction with VNIS and IV, the committee organized approximately 10 sessions for the Third ITS World Congress, in Orlando in 1996. The committee soon pursued plans to become a permanent IEEE entity. They successfully petitioned the Technical Activities Board for council status, a rarity in the IEEE (the Neural Networks Council is the only other IEEE Council).

Membership and organization. Unlike IEEE Societies, an IEEE Council does not have individual members. Instead, the membership comprises individual IEEE Societies that demonstrate interest in ITS technical activities and agree to share responsibility for all the council's obligations. The ITS Council's founding members include these societies:

- Aerospace & Electronic Systems
- Antennas & Propagation
- Communications
- Computer
- Consumer Electronics
- Control Systems
- Electromagnetic Compatibility
- Electron Devices
- Industrial Electronics
- Instrumentation & Measurement
- Microwave Theory & Techniques
- Power Electronics

- Professional Communication
- Reliability
- Robotics & Automation
- Signal Processing
- Systems, Man & Cybernetics
- Vehicular Technology

Additional societies may become members upon application and approval by the ITS Council.

Each member society appoints two representatives to serve on the ITS Council. In addition to funds allocated by the council's member societies, the council derives financial support from subscription sales of council publications, any surplus from conferences that it organizes or sponsors, and other sponsored activities. The council is governed by a president, vice president, secretary, and treasurer, elected annually. For additional details on the ITS Council, visit its Web site.

The IEEE has had significant roles in ITS since the movement's earliest days. With its ITS Council now in place, the IEEE is positioned to be an important ITS player in the new millennium. ■

References

1. R.L. French et al., *A Comparison of IVHS Progress in the United States, Japan & Europe through 1993*, Report IVHS AMER-94-5, Intelligent Transportation Soc. of America, Washington, D.C., 31 Mar. 1994.
2. "IEEE SCC32—Standards Coordinating Committee on Intelligent Transportation Systems (ITS)," IEEE, Washington, D.C.; grouper.ieee.org/groups/scc32 (current 20 Oct. 1999).

Robert L. French is the principal consultant with R&D French Associates, where he has assessed ITS technologies and markets, conducted educational seminars, published newsletters, and provided strategic advice and management information services to an international clientele. He has been involved with automobile navigation and intelligent transportation systems since 1969 and has written over 80 publications on these topics. He received his BS in physics and mathematics from Murray State University and an MS in physics from Vanderbilt University. A senior life member of the IEEE, he is a member of the Vehicular Technology Society's Board of Governors and represents that society on the IEEE ITS Council. He is also a member of the Institute of Navigation and the Society of Automotive Engineers and was a founding member of ITS America. Contact him at R&D French Associates, 6137 Tuliptree Lane, Nashville, TN 37221; r.french@ieee.org.