

**Current and Future Federal Applications  
of Tagging and Tracking Technology**

**June 18, 1996**

**Summary of Proceedings**

**August 1996**

**Transportation Strategic Planning  
and Analysis Office  
John A. Volpe National  
Transportation Systems Center**

**Sponsored by:  
Research and Special Programs Administration  
U.S. Department of Transportation**

These proceedings offer a summary of the seminar on Current and Future Federal Applications of Tagging and Tracking Technology, held at the Volpe Center on June 18, 1996. They do not propose or advocate any specific views or actions, nor do they necessarily reflect the policies or views of the Department of Transportation or any of its elements.

## **Current and Future Federal Applications of Tagging and Tracking Technology**

### **I. Foreword**

On October 26-27, 1995, more than 200 transportation leaders and decision makers from around the nation convened in Cambridge, Massachusetts, to participate in a two-day symposium on "Challenges and Opportunities for Global Transportation in the 21st Century." The symposium was held at the John A. Volpe National Transportation Systems Center, or Volpe Center, which is part of the Research and Special Programs Administration of the U.S. Department of Transportation. The purpose of this event was to support effective public and private sector policy decisions by focusing on the core issues that underlie several of the most challenging transportation topics now on the national agenda.

As a follow-up to this event, the Volpe Center is conducting a series of six seminars in 1996 to explore in greater detail critical issues in transportation for the next century that were identified at the symposium. These six issues, and the planned dates for the seminars, are:

- "Emerging Issues in Transportation Information Infrastructure Security" (May 21).
- "Current and Future Federal Applications of Tagging and Tracking Technology" (June 18).
- "Mesoscale Weather Forecasting: Technological and Institutional Challenges" (July 16).
- "Spectrum Availability and Digital Communications Links" (August 20).
- "Travel and Tourism as the World's Largest Industry: Transportation Challenges and Opportunities" (September 18).
- "Transportation Health Effects: A Current Assessment" (October 16).

Each seminar assembles approximately 40 to 50 public and private sector experts and transportation officials to provide in-depth focus on these important issues and identify potential areas where policy changes or further research and analysis may be required. This report summarizes the presentations and discussions that occurred during the second of these seminars, "Current and Future Federal Applications of Tagging and Tracking Technology," which was held at the Volpe Center on June 18, 1996.

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### III. Overview of the Issue

Worldwide, transportation and logistics are rapidly being transformed by the ability to use information technology to identify and track cargoes and vehicles virtually anywhere on the globe. In the freight sector, many shippers now work closely with customers to plan integrated origin-to-destination shipments on extremely tight schedules. Here, the use of information technologies is becoming common practice, particularly electronic data interchange and automatic equipment identification via bar code readers, radiofrequency tags, and satellite-based transponders.

Today's freight transportation sector is well on the way to achieving the capacity for seamless, global goods movements. Likewise, many Federal agencies are applying the same tagging and tracking technologies to their own transportation and logistics operations. As both users and providers, a number of Government agencies have significant transportation and logistics responsibilities, with total expenditures in this area exceeding \$20 billion a year. The Department of Defense, or DOD, is the largest single consumer of transportation and logistics services, spending more than \$9 billion annually. The U.S. Postal Service spends about \$3.5 billion each year for transportation of the mail. Still other Federal agencies with significant transportation and logistics operations include the Department of Energy, or DOE, the U.S. Customs Service, and the U.S. Marshals Service.

Within the Federal Government, transportation and logistics mean far more than the movement of passengers and cargo. Other critical Federal operational responsibilities include search and rescue, emergency and disaster response, hazardous materials transportation, traffic control, and facilitating state and national border crossings. Agencies use tagging and tracking to support all of these Federal roles—and more.

Although “tagging and tracking” is typically defined as application of technologies in freight transportation for cargo tracking and logistics management, here it refers more broadly to information technology applications that identify and track cargo and vehicles in support of a wide range of Federal transportation operations. These technology applications include, but are

not limited to, automatic equipment identification (via bar code labels, radiofrequency tags, smart cards, or other technologies); automatic vehicle location (land- or satellite-based); electronic vehicle clearance; computer-aided dispatch; in-vehicle navigation; automated traffic management; and route guidance.

#### IV. Topic 1: Tagging and Tracking for Logistics

##### (a) Background

The U.S. Government is the world's largest shipper. Within the Government, the biggest shipping operation is that of the DOD. Each year the Defense Transportation System, or DTS, moves about 266,000 short tons of cargo and 440,000 passengers through the airlift system and, on surface, 10.7 million metric tons, 177,000 containers, and 642,000 individual household goods shipments. The Air Mobility Command spends \$700 million a year to charter commercial aircraft, part of a \$1.2 billion shipping business.

In managing their shipping activities, DOD and other agencies have sought to develop more effective solutions for the logistics of freight movement. These are largely based on innovative applications of tagging and tracking technologies. For DOD, one such solution has been the move to in-transit visibility, or ITV, defined as the ability to obtain real-time in-transit status updates of units, equipment, and personnel as they move through the DTS. ITV is based on the use of automated identification technologies, such as radiofrequency tags, laser optical cards, and bar code labels, to capture and encode data on the contents of military containers and pallets. Personnel may then access the data remotely, via hand-held readers, or through a central database.

ITV is just one part of DOD's ultimate goal: a Global Transportation Network, or GTN, that will provide total asset visibility for all operations of the DTS—both military and commercial. However, as DOD moves toward implementation of the GTN, it will be faced with a number of critical technological and institutional issues. Moreover, other Federal agencies face similar issues, whether they are just beginning to employ tagging and tracking systems or are planning for the next generation of technologies.

##### (b) Discussion

Logistics management is one of the more mature applications of tagging and tracking within the Federal Government. For the past few years, this technology has been helping agencies, particularly DOD, to improve significantly the efficiency and productivity of their logistics operations. Yet, a number of obstacles stand in the way of further developing these applications. One is the need for agencies to change their automated information systems to accommodate the tagging and tracking technology and make full use of the data collected. Another broader issue is the tendency of Federal agencies to view tagging and tracking as an end in itself, rather than as part of an entire logistics management process; moreover,

frequently the introduction of the technology calls for rethinking and redesigning this process.

A third problem is that agencies may have purchased technology before fully understanding their logistics problems or requirements. As one participant put it, too often tagging and tracking systems represent pre-designed solutions to undefined problems. Even so, it is not the technology itself that is the problem; the problem is agencies' failure to understand their needs and requirements before selecting a technological solution.

According to one panelist, this failure to address real logistics problems is the greatest institutional barrier to maximizing the benefits of tagging and tracking systems. This panelist spoke of "cultural gulfs" that exist within large, complex agencies wherein many people have various functions and requirements. In such agencies, conflicts over what technologies to choose—which reflect differences in definitions of requirements and problems to be solved—often get in the way of a rational investment strategy. Another critical question is the skills and expertise needed to plan and deploy logistics tagging and tracking systems. Because the technology will only get more complex, argued this panelist, it is inevitable that most Government organizations will eventually privatize their logistics operations.

## V. Topic 2: Tagging and Tracking for Incident Response

### (a) Background

The seminar addressed tagging and tracking for incident response in two general areas: transportation of hazardous materials and emergency response. These tagging and tracking systems typically employ technologies including automatic equipment identification, automatic vehicle location, computer-aided dispatch, automated route guidance, and mayday signaling.

Tracking shipments of hazardous materials is the responsibility of a number of Government agencies. The Defense Nuclear Agency, for example, monitors shipments of nuclear weapons from the former Soviet Union in support of disarmament provisions of the START treaty; DOD also tracks movements of its own nuclear weapons, munitions, and other hazardous cargo. Within DOE, a tracking center at Oak Ridge National Laboratory monitors shipments of certain radioactive materials. Finally, the U.S. Coast Guard tracks ships carrying toxic chemicals and other dangerous cargo and responds to hazardous materials incidents at sea.

Emergency response applications comprise both search and rescue operations and emergency management. Among the applications for search and rescue is the worldwide COSPAS-SARSAT system, managed by the United States and 26 other nations, which uses polar-orbiting satellites to detect emergency signals from high-frequency search and rescue beacons on board ships and aircraft. Emergency management systems range from simple incident management programs, which allow local agencies to identify and respond to highway accidents and breakdowns, to full-scale emergency response capabilities, often utilizing geographic information system mapping, automatic vehicle location, automated emergency routing, traffic control, and even transportation infrastructure monitoring.

## (b) Discussion

Panelists at the seminar agreed that three primary issues have impeded the use of tagging and tracking for incident response: the cost of the systems, political pressures for control from states and local communities, and a lack of standardization among technologies and procedures.

Although tagging and tracking technologies are advancing rapidly, many applications, among them incident response, are still expensive and limited in performance. In particular, several participants spoke of the high costs of tracking hazardous materials. The Directorate of Aerospace Fuels Management at Kelly Air Force Base, for example, has been looking closely at ways of containing the costs of its hazardous-fuels tracking and response operations; two options being considered are opening up the process to more competitive bidders and using Global Positioning System tracking for less-than-truckload shipments. DOD also is trying to reduce the costs of commercial carriers' tracking, via satellite, of arms, munitions, and explosives. Still another participant stated that the cost of tracking certain radioactive materials is so high that DOE is looking at privatizing many of these operations; however, a major impediment to privatization is DOE's commitment to state and local jurisdictions to maintain "visibility" of these shipments. As a result, the agency would need to retain a great deal of control over these operations.

Likewise, according to this panelist, the controversial nature of DOE's shipments has led to much "push and pull" among Federal agencies, state and local governments, and contract carriers for control. Because it is a Government agency, DOE is far more responsible to the public than a private company. Even though it is not required to do so, DOE informs state and local jurisdictions whenever tracked shipments will cross their borders; moreover, these state and local agencies have the same tracking system computers that DOE uses to monitor its shipments. DOD's Directorate of Aerospace Fuels Management also notifies state or local officials of hazardous shipments whenever the communities request it to do so.

A third issue complicating the implementation of incident response systems is the frequent lack of standardization among technologies, data flows, and procedures. To be successful, these applications depend upon several parties—private companies and citizens as well as public agencies—working closely to deploy compatible technologies and implement common procedures. Yet, all too often, achieving consensus is a major challenge. One participant discussed the difficulties experienced by the Naval Ordnance Center in ensuring standardized data flows and emergency procedures among the private and public groups involved in its munitions tracking program. Another spoke of the challenges faced in developing a prototype system for locating and responding to hazardous materials incidents along the 130-mile Gary–Chicago–Milwaukee corridor. This tri-state cooperative program, which involves the efforts of the Chicago Fire Department, Argonne National Laboratory, and the Jet Propulsion Laboratory—and requires the cooperation of automobile manufacturers and private carriers—will demonstrate an autonomous emergency location system for hazardous materials spills. Among the issues that the program must address is the need to integrate the

participating states' different technologies, procedures, and telecommunications standards, and to ensure compatibility with similar response systems in other regions. Finally, a third participant pointed to the difficulty of "wiring in" numerous agencies and governments as a primary hurdle in the implementation of commercial mobile satellite services for international search and rescue operations.

## VI. Topic 3: Tagging and Tracking for Border Crossings

### (a) Background

Federal agencies are using tagging and tracking technologies to alleviate delays at state and international borders while effectively monitoring the passage of goods and people.

On December 18, 1995, the borders between the United States, Canada, and Mexico opened up to commercial truckers, part of the first phase of market liberalization under the North American Free Trade Agreement, or NAFTA. American and Canadian trucking companies now are able to pick up and deliver internationally in the six northern Mexico states, and Mexican truckers have reciprocal access to California, Arizona, New Mexico, and Texas. Commerce among the three trading partners has increased significantly since NAFTA was passed; trade grew by \$50 billion in 1994 alone. However, along with increased trade has come increased traffic—and the need for more efficient and safer border crossings.

Tagging and tracking systems are improving safety and automating the clearance of passengers and commercial traffic across the U.S.-Mexico, U.S.-Canada, and state borders. One such system, HELP, Inc., began as a DOT pilot project but is now a private not-for-profit service covering 11 states; this program allows trucks equipped with transponders to be weighed at highway speeds and have all credentials checked electronically when crossing state borders. The Advantage program, another Federally funded automatic clearance project, covers the I-75 corridor in the United States and Ontario, Canada. A third project, funded by DOT and the State of California, is a new automated truck safety inspection and weight enforcement facility at Otay Mesa, California, near the Mexico border. Also at Otay Mesa is an automated border crossing system, called SENTRI, that screens and clears travelers who frequently enter the U.S. Travelers participating in this program have all been pre-approved and determined to pose little risk to border security.

### (b) Discussion

Traffic across U.S. borders will grow significantly over the next several years. As stated by one participant, by 2010, the 450 million people who crossed our borders in 1995 could grow to 600 million. The volume of freight traffic may grow even more rapidly. To monitor this increased traffic and alleviate congestion, the U.S. Customs Service, Immigration and Naturalization Service, and other agencies will rely on automation—namely, tagging and tracking systems.

A number of Federal tagging and tracking programs are under way to facilitate legal border traffic. In one, the U.S. Customs Service is using these technologies to monitor and ease commercial vehicle operations across the Mexico–U.S. border. Another, the Immigration and Naturalization Service’s SENTRI program, employs a dedicated, automated lane to facilitate crossings by legitimate commuters. Both of these efforts attempt to balance the need for border access with that for border security.

According to one panelist, a key issue that has arisen in implementing tagging and tracking for border crossing is the sometimes-conflicting missions and requirements of the various agencies involved. For instance, agencies may differ as to the element of a freight shipment needing to be tracked: one agency may wish to track the driver; another, the cab; a third, the chassis; and still another, the container. Or an agency may need to track some combination of these. Another issue is who pays for these systems. Border crossing applications of tagging and tracking are still relatively new and are quite expensive. Typically, neither state and local law enforcement nor federal agencies can afford a system that meets all of their performance requirements. The U.S. Customs Service, for example, stated that it has opted to trade some information security in its covert operations by foregoing encryption in an effort to keep down the cost and size of tags.

With several agencies sharing an interest in border crossing, the integration of data from many sources, and the standardization of data interfaces, are further concerns. Likewise, these applications depend on the cooperation of many parties outside the Federal Government, for example, the installation of tags by motor carriers and agreement on a common truck tag among states. Even when a single agency is involved, integration of systems around different specific functions is a major challenge. A number of panelists stated the need for a single Federal voice for border crossing applications of tagging and tracking, particularly for commercial traffic. One panelist felt that it was not the role of agencies that watch the borders to develop standards for transponders and other technologies; rather, this was a task for the private sector and agencies with broader interests—especially DOT.

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