I. Program Structure and Approach

The focus of this project was to specify and develop the components and policies that would enable the deployment of the North American Transportation Security Center (NATSC) to enhance hazmat shipment security. Research included development of the Fedtrak software to support the deployment of the NATSC and evaluation of the current technologies used for vehicle tracking.

This project originally had a three-year period of performance supporting the Transportation Security Administration's (TSA) efforts to implement its hazmat truck tracking program. DHS/S&T funded this effort through NIHS. TSA later added additional funding to the project, which extended the work by two years.

A. Program Concept of Operations

In 2004, the U.S. Federal Motor Carrier Safety Administration (FMCSA) completed a study to determine if "smart truck" technology such as GPS tracking, wireless modems, panic buttons, and on-board computers could be used to enhance hazmat shipment security. The FMCSA study concluded that "smart truck" technology will be highly effective in protecting hazmat shipments from terrorists. The FMCSA study also concluded that "smart truck" technology deployment will produce a huge security benefit and an overwhelmingly positive return on investment for hazmat carriers.

The FMCSA study led to TSA's Hazmat Truck Security Pilot. This congressionally mandated pilot program was undertaken to demonstrate whether a hazmat truck tracking center was feasible from a technology and systems perspective and to determine if existing truck tracking systems can interface with government intelligence centers and first responders.

The contract for the Hazmat Truck Security Pilot program had three tasks:

- Develop and demonstrate a prototype for a centralized truck tracking center that could be used to continually track truck locations and load types. The truck tracking center would also be used to coordinate incident response with a government intelligence operations center, state, local, and Federal law enforcement agencies and first responders.

- Develop and demonstrate a non-proprietary universal interface or set of communication protocols that would allow alerts and tracking information to be transmitted from all commercially available tracking systems to a prototype truck tracking center.

- Analyze the feasibility and benefits of applying a risk-based approach to identifying and managing hazmat security risks and incidents involving trucks on U.S. highways; demonstrate the capability of using the Hazmat Truck Security System (HTSS), with a commercial-off-the-shelf (COTS) rules-based risk assessment tool; and conduct a public showcase demonstration of the entire HTSS.

The Hazmat Truck Security Pilot demonstrated that a hazmat truck tracking center is feasible and in August 2007, Congress enacted PL 110-53. Section 1554 of PL 110-53 which directed the Secretary of the Department of Homeland Security, through the TSA Administrator, to develop a program to facilitate the tracking of motor carrier shipments of security-sensitive materials and to equip vehicles used in such shipments with technology that provides frequent or continuous communications, vehicle position location and tracking capabilities, and a feature that allows the driver to broadcast an emergency distress signal.

TSA's Assistant Administrator for Transportation Sector Network Management issued guidance that recognizes two tiers of highway security-sensitive materials.

- Tier 1 Highway Security-Sensitive Materials (Tier 1 HSSM) – HSSM transported by motor vehicle whose potential consequences from an act of terrorism include a highly significant level of adverse effects on human life, environmental damage, transportation system disruption, or economic disruption.

- Tier 2 Highway Security-Sensitive Materials (Tier 2 HSSM) - HSSM transported by motor vehicle whose potential consequences from an act of terrorism include moderately significant level of adverse effects on human life or health, environmental damage, transportation system disruption, or economic disruption.

The University of Kentucky Transportation Center Team has, under funding from NIHS:

- Developed requirements for a truck tracking center that will meet TSA's Tier 1 HSSM tracking needs

- Conducted a preliminary assessment concluding that a truck tracking system is feasible, but that major enhancements were needed to support a Tier 1 HSSM tracking center.
- Developed an architectural plan for a Tier 1 HSSM truck tracking center that will fully meet TSA's requirements under PL 110-53 and meet the requirements of TSA's guidance.
- Introduced FedTrak™, the name of the Tier 1 HSSM truck tracking center service proposed by the KTC project team.
- Examined regulatory and legislative drivers that will influence the development of TSA hazmat truck tracking program, concluding that regulations are needed to drive "smart truck" technology deployment and data reporting by hazmat shippers and carriers.

1. Market Update and Gap Analysis

The project team reviewed and updated work products completed under the TSA Hazmat Security Pilot program and other projects. Analyses were updated to reflect market or programmatic conditions that had changed. In addition, the project team conducted a market analysis of truck tracking vendor technology and service offerings. The project team also conducted a detailed gap analysis of the TSA Hazmat Truck Security Pilot technology prototype. The gap analysis described what must be added or enhanced to meet TSA's needs for a Tier 1 HSSM truck tracking system.

2. Deploy project collaboration hardware/software infrastructure

The project team installed all hardware and software needed to support the pilot program. Hardware was installed and maintained by the University of Kentucky. In addition to prototype hardware/software, the project team used collaboration software to support project communications and development needs.

3. Specifications and Release Plan

The project team completed a comprehensive Agile "quick start" conference to develop detailed specifications for FedTrak™. The session – essentially an intensive joint application design process - spanned over at least 10 business days. It was held at ThoughtWorks offices in Chicago.

4. Universal Communications Interface (UCI) Enhancement

The communications interface in the TSA Hazmat Truck Security Pilot (HTSP) program was built using the IEEE-1512 Standard for Common Incident Management Message Sets for Use by Emergency Management Centers (known as the 1512 Base Standard) and the IEEE-1512 Standard for Hazardous Material Incident Management Message Sets for use by Emergency Management Centers (known as the 1512.3 Standard). It was also built to conform to the National Transportation Communications for ITS Protocol (NTCIP).

The UCI was enhanced to receive the full set of messages and alerts needed to meet TSA's needs for a Tier 1 HSSM truck tracking center. The UCI was integrated into and tested within the overall FedTrak™ system.

5. Central Tracking Unit

The Central Tracking Unit (CTU) integrated data from shippers, carriers, and truck tracking vendors to generate actionable information. The following subtasks were completed to develop CTU functionality in FedTrak™.

Data from shippers, carriers, and truck tracking vendors flowed into FedTrak™. Shippers and carriers fed corporate (registration) data as well as electronic manifests and electronic route plans into FedTrak™ via the FedTrak™ portal. Truck tracking vendors fed alerts and messages into FedTrak™ using VPNs. The Central Tracking Unit (CTU) of FedTrak™ efficiently merged data to create actionable information. The following questions about an individual shipment could be answered once the data was merged.

- What was the truck carrying? What was the shipment risk profile?
- Who was driving the truck?
- What was the truck's location?
- Was there a problem? What?
- What was the truck's destination?
- What route had the truck followed?
- Was the truck off-route?

Tier 1 HSSM shippers and carriers connected to FedTrak™ using their own "My FedTrak™" page. From the My FedTrak.com™ page, a carrier prepared and stored

electronic manifests and electronic routes. The carrier also had 24/7 access to corporate data though their My FedTrak™ page, and was able to edit corporate information on-line. For example, a carrier could add or delete drivers or customers. The carrier also had access to shipment data (in transit and completed) via MyFedTrak™.

An electronic manifest included data critical to the functioning of a truck tracking center. It listed the materials (type, quantity) that were in the shipment as well as information on the shipper, the carrier, and the consignee. The e-manifest initiated the shipment business process. It had to be completed before custody of the shipment could shift from the shipper to the carrier, and before the shipment left the shipper's facility. E-manifest transaction events – such as application of digital signatures – were events that a truck tracking center received and processed to signal the initiation of a new hazmat shipment. An e-manifest had to be submitted prior to "gate out" in order for the truck tracking center to have visibility for that shipment. Without submission of an electronic manifest, the tracking center would not have the basic information on shipper, carrier, and load even though the vehicle was traveling over the roads. FedTrak™ used XFML electronic forms for its electronic manifest applications. Tier 1 HSSM shippers/carriers filed electronic manifests via the FedTrak™ portal.

Electronic route plans are critical to a truck tracking program. Without an electronic route plan, a truck tracking system cannot track carrier route adherence and the geofence and risk management capabilities of a truck tracking system were substantially degraded.

Like the electronic manifest, the electronic route plan must be submitted prior to "gate out" so that the truck tracking center could match the vehicle's location with its planned route.

PL 110-53 required motor carriers that had a hazardous material safety permit under part 385 of title 49, Code of Federal Regulations, to maintain, follow, and carry a route plan, in written or electronic format. FedTrak.com™ allowed carriers to prepare and submit electronic route plans on-line. Carriers were required to select an electronic route plan in FedTrak.com™ before "gate out" of a Tier 1 HSSM shipment. After "gate out", FedTrak.com™ systems tracked the movement of Tier 1 HSSM shipments against the electronic route plan filed by the carrier.

Tier 1 HSSM shippers/carriers used FedTrak.com™ GIS route-authoring tools to prepare electronic route plans. A shipper or carrier was able to prepare and store multiple routes on FedTrak.com™. If a carrier knew that it followed one of five routes from a shipper to a consignee, for example, the carrier could prepare and store all five routes on FedTrak.com™. The carrier could select the appropriate route when preparing the electronic route plan.

6. Security Specialist Desktop

FedTrak.com™ was designed to track up to 5 million hazmat shipments per year. To be viable under this transaction loading, FedTrak.com™ identified the "riskiest" shipments and presented information on them to CTU Security Specialists in a form and format such that Security Specialists could efficiently manage "real" emerging threats. Too many "false positives" created an overwhelming workload that prevented CTU Security Specialists from effectively managing their oversight responsibilities. Considerable work was done to prepare the FedTrak.com™ graphical user interface so that a Transportation Security Specialist could efficiently manage multiple (simultaneous) transportation security incidents and interact efficiently with state and federal action agencies.

This task supported development of a functional set of screen views and management tools for CTU Security Specialists.

7. Risk Analysis Profile System – Business Rules Engine

The Central Tracking Unit fed data on Tier 1 HSSM shipments to the Risk Analysis Profile System (RAPS). RAPS was built using a COTS business rules engine. This task allowed the project team to select and integrate a COTS business rules engine into FedTrak™ but would not support development of more than a very simple set of business rules.

8. Security Incident Management System

Security Incident Management System (SIMS) served as the interface between FedTrak™ Security Specialists and TSA, state action agencies, Tier 1 HSSM carriers, and first responders. When a driver panic alert was received by FedTrak™, the Security Specialist contacted the carrier first to determine if the alert was a "false alarm". If

so, the case was closed. However, if it was determined that the alarm was genuine, the Security Specialist bridged a TSA Watch Officer and the state operations center into a conference call. The TSA Watch Officer had the option of declaring the shipment of “security interest” or declaring a “transportation security incident.”
From the CTU application, Security Specialists used a VOIP connection to initiate conference calls with hazmat carriers, drivers, TSA, and state agencies. Once an incident was declared, the CTU Security Specialist launched a new case and began passing information onto the parties that needed information to resolve the incident.

The project team developed a detailed architecture plan for SIMS and a detailed development/release plan.

9. Financial and Administrative Management System

The Financial and Administrative Management System (FAMS) was fed with data from shipper/carrier registration and shipment transactions (from CTU). FAMS enabled FedTrak.com™ personnel to provide help desk services to system users. The project team developed a detailed architecture plan for FAMS and a detailed development/release plan.

10. Regulatory Plan

This task supported continued development of regulatory elements and development of a regulatory plan. The task did not result in specific regulatory language nor did it support a rulemaking initiative in the Commonwealth. It did, however, result in a detailed list of regulatory requirements that the Commonwealth and/or TSA would need to be considered in a Tier 1 HSSM regulatory program.

11. Kentucky Pilot Program Design

In year three, the project team implemented a pilot implementation program in Kentucky. The project team prepared a detailed implementation plan for the pilot program. The pilot program was expanded to include additional states.

12. Stakeholder Management

There were a number of parties that were affected by a Tier 1 HSSM truck tracking program. The project team prepared a plan that described how the project team solicited and considered input from stakeholders as it completed this project.

B. Highway Security Sensitive Material Study (HSSM)

TSA supplied more funds to the original project for the team to research and identify new and existing tracking display systems. The KTC analyzed systems, that had a robust capability to collect, display, communicate, and manipulate tracking data and visually display data in a near real-time environment.

The study called for a report on the technologies that would be needed to support the operational needs of a sophisticated centralized risk management and tracking system such as the Fedtrak model. In addition, the team was asked to incorporate costs and benefits for using basic commercial off the shelf technologies or identify a rationale for more sophisticated display capabilities and data management systems as it relates to estimated numbers of vehicles transporting highway security sensitive materials per day.

Another component of the study consisted of structuring the Comparative Analysis Reports in a manner consistent with a company on the verge of making the decision to purchase tracking technologies to manage their fleets and provide security for their shipments. When a trucking company or freight forwarder is shopping for a tracking system (GPS, GPRS, Cellular, etc.), there are several components that need to be carefully examined. At a minimum, all of the following components should be addressed:

- The vendor - purchase from a reputable vendor. How many vendors/companies exist in the United States that develop and maintain software?
- Software used – Research and evaluate the leading software capabilities that the end-user will be running to track (vehicle locations and disposition) and report on vehicle/asset activity. Is the software evolving or stagnate?
- Customizing the software - Can the vendor customize their software to best suit individual needs? What are the average costs for such enhancements or customization? Is the vendor using commercial-off-the-shelf products?
- Wireless Networks - What is available and what are the different rate plans? What best suits GPS tracking needs? Is cellular suitable to provide basic tracking information for security purposes?

- Hardware Components - How does the tracking look? Does it accurately follow the roads? Is the tracking component hardened or tamper resistant? Is the tracking component covert or overt? Is there considerable or significant reception degradation with covert systems/components?
- Costs of interval reporting and communication- What is the average cost for unlimited use?
- How many telematics providers offer a flat monthly fee? What are the polling rates and monthly billing fees on average?
- How sophisticated is the GIS packaging? - Are the maps used detailed enough for tracking throughout the United States? Do companies typically utilize the most accurate map versions?
- Does the tracking technology display information that accurately follows the roads?

II. Results and Conclusions

In conclusion, this contract was to further develop and test important functional components of FedTrak™ in Kentucky. In year one, major components of the FedTrak™ prototype resulted in a Technology Readiness Level 6. The team further refined the project and the contract ended with the project at a Technology Readiness Level of 7.

The UK project team submitted all components of the project according to the tasks outlined in the contract, which included market research, policies and regulations, Fedtrak software development, cost and pricing evaluations, in addition to recommendations for how to move the NATSC and Fedtrak initiatives forward. The Fedtrak platform is complete, although the major issue remains policies and regulations surrounding the implementation of NATSC. Final reports on these studies are available from KTC at (859) 257-4513.

III. Transition to Use and Commercialization

The project team has been working with commercialization partner Coldstream Digital LLC and has involved other industry partners and potential customers as part of the project advisory team field testing of the Fedtrak system. There are potential users of the system once completed, but it will require the TSA or other government agencies to implement new regulations or mandatory requirements to implement a system like Fedtrak. The recommendations and cost factors for doing this have been studied and reported to TSA and DHS by the project team. No commercialization will occur until regulations or mandates become the norm for the industry.

TSA has been actively involved with all aspects of the development and has also provided funding for past and future enhancements.

In FY15, TSA is provided funding to continue the systems development and extend tracking/risk functionality through development of electronic manifests. This functionality will provide chain-of-custody control of HSSM shipments and address the problem of “insider” security threats. It will also enable the Public Sector Reporting Center to serve both as a tracking and a risk management platform. In addition, this project will examine the cost impact of implementing and regulating the HSSM tracking/chain-of-custody system from cradle-to-grave.

To learn more about this project, contact: Jay Robinson, Program Manager, at jay.robinson@hq.dhs.gov or Ewell Balltrip, NIHS, CEO at eballtrip@thenihs.org 2014-08-01.detail