Hazardous Material Transportation Safety and Security Field Operational Test Final Evaluation Plan

EXECUTIVE SUMMARY

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Introduction

The tragic events of September 11, 2001, and the more recent events of war with Iraq during the early spring of 2003, resulted in a significant heightened level of concern from federal government officials and transportation industry members regarding the secure transport of hazardous materials (HAZMAT). These security issues focus on HAZMAT shipments as potential targets for terrorists. HAZMAT shipments through intermodal connectors, modes, and facilities are all prospective targets for domestic acts of terrorism, and pose a much greater concern to public safety than most other shipment types. HAZMAT shipments, especially fuels and chemicals, present an attractive target for terrorists due to the multiple points of vulnerability. These vulnerabilities exist at shipper, motor carrier, and shipment recipient facilities and shipment movement en route throughout the nation's roadway infrastructure.

The Transportation Security Administration (TSA) and the Federal Motor Carrier Safety Administration (FMCSA) are seeking methods to reduce HAZMAT transportation security risks. Both agencies are proposing solutions to minimize those risks through a variety of proactive efforts. Current focus includes regulatory responses and industry outreach efforts to sensitize the HAZMAT industry to potential risks in their current HAZMAT shipment distribution chains.

Ninety-five percent of HAZMAT shipments are transported via motor carrier. Ideally, safeguards should be in place to help protect against the HAZMAT shipper, motor carrier and recipient, plus the surrounding community that would experience a direct and immediate negative economic impact following an incident. Secondary impacts may include business disruption to the transportation industry; continuing business restrictions on HAZMAT manufacturers; potential damage to financial markets; and general public pandemonium that is impossible to quantify.

Based on these concerns, after sponsoring an industry competitive procurement, FMCSA awarded a contract jointly funded with the U.S Department of Transportation's Intelligent Transportation Systems Joint Program Office. The team is led by Battelle will test major technologies that now exist that can offer solutions to minimize security risks throughout the HAZMAT movement chain. Several off-the-shelf technologies that enhance HAZMAT security and transport safety will be deployed and tested by the Battelle Team under this Operational Test, including:

- Wireless satellite or terrestrial communications (with global positioning systems [GPS]) provide for load/cargo positions and status updates readily assessable and visible to a dispatcher.
- Panic buttons that provide real-time emergency alert message notification by the driver to the dispatcher.
- Driver authentication accomplished by driver login via authorized user identification (ID) and password codes or through biometric login (fingerprint scan recognition).

- Intelligent onboard computers (OBCs) can be integrated with wireless communications and remote vehicle operating systems to enable vehicle-disabling capabilities.

Purpose of the Evaluation

The purpose of this effort is to independently evaluate the Battelle Operational Test Team to test methods for leveraging technology and operations to improve HAZMAT transport *security*, *safety*, and *operational efficiency*. As such, the preceding technologies will be demonstrated to decrease the existing vulnerabilities of HAZMAT shipments to terrorist activities. To achieve this goal, the preceding technologies will be combined with changes in shipper/carrier operations and tested across four distinct HAZMAT operational scenarios (see Figure ES-1). The evaluation will also focus on safety and operational efficiency impacts. The approach to this evaluation will encompass assessing technology solutions aimed at improving security, safety, and operational efficiency throughout the HAZMAT distribution chain.

Cost-Benefit Analysis

The three main evaluation impact categories examined by the Evaluation Team will be security; safety; and operational efficiency. These impact categories will then feed the benefit-cost analysis according to macroeconomic/societal (macro) public sector benefit-cost results (stemming from security and safety benefits) and microeconomic/industry (micro) private sector benefit-cost results (derived from operational efficiency improvements). The Evaluation Team will examine test technology systems users' perspectives in a Customer Satisfaction Study. An Institutional Challenges Study will document any information and communication improvements necessary to facilitate implementation of these test technology systems on a larger scale. The macro/societal and micro/industry benefit-cost measurements analysis will determine the following:

- Are the industry operational efficiency benefits significant enough to drive widespread industry deployment of test technology systems, or their equivalent?
- If not, are the macro benefits large enough to warrant government subsidization/new regulation to bring about wide-scale national deployment?

Operational Test Parameters

The Operational Test Team assembled a working group consisting of technology developers and vendors; HAZMAT industry shippers and carriers; and security experts to facilitate and manage the four selected operational test scenarios. The four operational test scenarios are composed of many participant stakeholders including shippers, motor carriers, and delivery recipients. Additional Operational Test Team members include Qualcomm, American Transportation Research Institute; Commercial Vehicle Safety Alliance; Total Security Services International, Inc.; Solutions Group, BioMetric, Inc.; and Savi Technology.

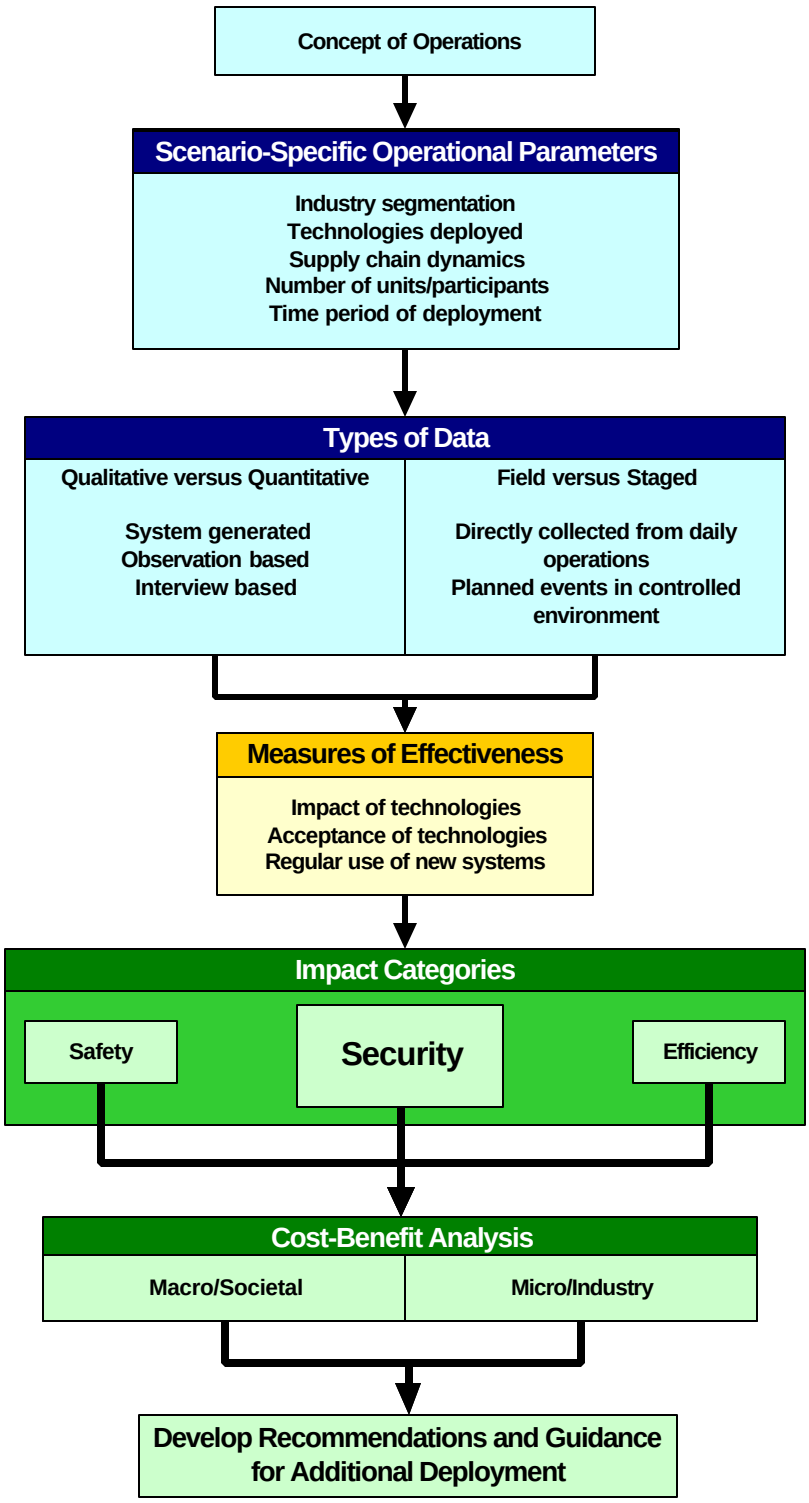

Figure ES-1. Evaluation Framework

As feasible, and given the constraints of the four operational test scenarios, each designed test will demonstrate an integrated operational approach highlighting 23 of the 25 FMCSA-identified functional operational risk activities. These activities occur within the following HAZMAT distribution chain action stages: the pick up HAZMAT from the shipper; the en-route HAZMAT transportation; and the HAZMAT shipment to receiver at the final destination. Each of the functional requirements is matched with one or more of the vulnerabilities that is inherently present in the HAZMAT distribution chain.

The four operational test scenarios will employ various current off-the-shelf technologies to address the functional requirements and produce expected HAZMAT transportation benefits including security, safety, and operational efficiency. Additionally, each scenario will deploy a unique set of technology solutions to account for the unique operational characteristics for a particular sector of the HAZMAT market. The selected technological solutions will also be broken out at several cost levels, depending on the comprehensive-ness of the deployed technology set (e.g., "low tech," "medium tech," "high tech"). The four major scenarios that comprise the operational test are Scenario 1: Bulk Fuel Delivery; Scenario 2: Less Than Truckload High Hazard; Scenario 3: Bulk Chemical; and Scenario 4: Truckload Explosives.

Test Period

The scheduled test period of the technologies is for a 6-month fully operational test to occur, beginning most likely in late summer to early Fall 2003. The four unique HAZMAT operational scenarios will each have multiple carriers, shippers, receivers, and a total of 25 tractor-trailer units. Each test scenario will involve picking up a HAZMAT shipment and applying technologies throughout the pick-up, transportation and delivery to the cargo recipient to while fulfill specific functional requirements of the operational test.

Evaluation Methodology

The Evaluation Team will measure the impact of technology solutions on the security, safety, and operational efficiency of HAZMAT movements from shipper to en-route transport to final delivery. The FOT will be administered by separating the test into four operational scenarios to allow each scenario to address a distinct segment of the HAZMAT industry. In some cases, the same technology will be tested in each scenario. In other instances, the testing of technologies will be limited to specific scenarios.

Each scenario will deploy a unique set of technology solutions to account for the unique operational characteristics for a particular sector of the HAZMAT market. The selected technological solutions for each scenario will seek to improve security, safety, and operational efficiency at several cost levels, depending on the comprehensiveness of the deployed technology set. The four scenarios were all scrutinized against security risk profiles that categorize and prioritize risk based on: the potential tactics terrorists might use; the most likely hazardous materials that could be involved; and by the type of shipment – bulk/truckload or less-than-truckload (LTL). This analysis was conducted as

the first step of the operational test to determine potential security gaps that might exist for each scenario.

Data Collection

Two types of data will be collected to support the technology-based and system-based evaluations: qualitative and quantitative. Qualitative data will be collected via on-site observations and personal interviews during the FOT. Interview guides will be designed and developed to collect data on operational effectiveness, customer satisfaction, and institutional challenges. For example, drivers will be asked about the ease of use of the various technologies, and how by adding the technology in question impacted their daily operations. These data will be critical for documenting the participant acceptance of the technologies. Also, if the quantitative data collected falls short of providing the necessary volume of data points for conclusive findings, the qualitative data will be available to verify and confirm the findings.

The quantitative data will be collected through primarily through the Qualcomm system-generated archived reports, which the Operational Test Team will make available to the Evaluation Team on-line in a secure manner. The Evaluation Team will work closely with the Operational Test Team to establish types of data and criteria for archiving data to ensure these data are available. Additionally, data archiving of event logs will provide ongoing data collection of use and performance of technology applications throughout the FOT. For example, activating a panic button will generate a log containing time, date, and location of the event, which can be linked to subsequent response activities by the dispatch.

Evaluation Study Areas

The Evaluation Team identified eight evaluation study areas to frame the relevant issues, drive the data collection effort, facilitate the analysis, and produce meaningful recommendations at the conclusion of the test period. Not all evaluation study areas will be applied to each of the four operational test scenarios, and only the applicable study areas will be implemented for each scenario.

- **Evaluation Study Area 1 – Security Benefits Assessment** and **Evaluation Study Area 2 – Safety Benefits Assessment**, will drive the information necessary to determine public sector macro/societal benefits.
- **Evaluation Study Area 3 – Operational Efficiency Assessment**, will provide the information to determine private sector micro/industry benefits
- **Evaluation Study Area 4 – Cost Assessment,** will provide current test system expense measures as well as future costs under full HAZMAT industry deployment
- **Evaluation Study Area 5 – Industry Technology Survey**, will explore viable, commercial alternatives with similar functionality to the test technologies.
- **Evaluation Study Area 6 – Customer Satisfaction**, will provide specific user perspectives on the test technology systems.

- **Evaluation Study Area 7 – Institutional Challenges** will identify information and communication barriers that need to be alleviated to ensure full cooperation between system users.
- **Evaluation Study Area 8 – Deployment Potential Assessment**, will determine if industry operational efficiency benefits are at a level to drive widespread HAZMAT industry deployment of test technology systems or their equivalent, or if the macro benefits are enough to cause government subsidization or implement new regulation to bring about wide-scale HAZMAT national deployment.

Final Report

A final report will present the findings, conclusions, and recommendations from the independent assessment, and is expected to include results for the following areas:

- Identify the effectiveness of the operational test technologies to improve security throughout the HAZMAT movement chain.
- Identify safety benefits by assessing the effectiveness of the operational test technologies to improve safety throughout the HAZMAT movement chain.
- Identify operational efficiency benefits by assessing the effectiveness of the operational test technologies to improve operational efficiency throughout the HAZMAT movement chain.
- Detail costs for individual test system components and integrated HAZMAT systems leading to a cost analysis that estimates the cost of deploying these technologies (both individual components and integrated systems) throughout the freight industry.
- Present a relevant benefit-cost analysis for individual test components and integrated test systems at both a micro-level focusing on industry operational efficiency gains, and a macro-level focusing on improved security and safety benefits to society

Finally, if the macro and micro benefit-cost analysis results are both positive, and the technologies tested are largely successful, then the Evaluation Team can be expected to make specific recommendations encouraging full-scale deployment related to both component test technologies and integrated test systems.