TRANSCOM: The Future Is Now

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INTRODUCTION

All across the nation there is growing interest in the transport of materials. The issues of interest vary from finding more efficient ways to use transportation fleets to improving emergency plans for responding to situations involving potentially harmful materials.

Shippers are looking for more efficient ways to keep track of their vehicles and cargo. CB radios, cellular or mobile phones, and roadside pay phones are quickly becoming outdated as the primary means of communicating with the home base. Recent trade journals, major newspapers, and transportation magazines report major trucking firms are purchasing tracking and satellite communications systems for this purpose. As reported in the Philadelphia Inquirer, "High-tech, space age gear is being installed in 18 wheelers to keep truckers in constant contact with their terminals and dispatchers while traveling the long, lonesome highway."[1]

There is growing interest at the State and local government level in the movement of radioactive materials across State boundaries. As a result, local government agencies are in search of better ways to prepare for and respond to emergency situations where the health or welfare of the public is perceived to be at risk. Better preparation requires prior knowledge of radioactive material shipments through the State, knowledge of the routes to be taken, and the ability to pinpoint the location of such shipments whenever necessary. For certain radioactive material shipments (e.g., High-level waste and Spent Fuel), the Nuclear Waste Policy Act (NWPA) of 1982 directs DOE to work in tandem with the States to resolve the sensitive issues of transportation.

Background

The U.S. Department of Energy (DOE) Office of Defense Waste and Transportation Management, Transportation Management

Division (TMD) has developed TRANSCOM, a transportation tracking and two-way satellite communication system that will be used to monitor the movement of unclassified radioactive material shipments. Transuranic waste, high-level waste, spent fuel, and other high visibility shipping campaigns are prime candidates for the TRANSCOM system.

The system was designed as a management tool to enhance DOE's oversight and operational control of radioactive material shipments. In addition, it is proving to be a key element for improving DOE relations with State and local government agencies.

Through the TRANSCOM system, the TRANSCOM Control Center (TCC) can communicate with vehicles carrying radioactive materials, as well as shippers, receivers, and concerned government agencies. Transcom's software and extensive database allows the TCC and the users to access key shipment information.

User access to the system centers on a user friendly software package, a confidential user password established during training, a standard telephone line, and relatively standard office computer equipment. The recommended user configuration is an IBM-AT class machine, equipped with a hard disk drive and at least 10 megabytes of free memory; a 1.2 megabyte floppy drive; 640 kilobytes of random access memory; an enhanced color graphics monitor and card; a 1200-baud Hayes compatible modem, and an optional mouse. Once the user's station has been established and training completed, a few simple key strokes and the cost of a long distance telephone call to the TCC provides the user with detailed shipment information.

KEY SHIPMENT INFORMATION [2] [3] [4]

Advance Shipment Information

The ADVANCE SHIPMENT information feature of the TRANSCOM system enables the user to view information about planned future shipments, including the shipment date and shipment ID, as well as the originating and destination facilities. The data is listed in order of shipment date and ID number.

Tracking

The TRACK feature is one of the most important and innovative features of the TRANSCOM system. Shipment positions are shown on simple computer generated maps displaying the continental United States and nearly every county in the U.S., for a total of more than 3,100 maps.

The TRACK feature allows the user to locate in-transit shipments anywhere in the continental United States, at any time of day.

A variety of information can be shown on the TRANSCOM maps, including major highways, railroad lines, and principal cities. Shipment positions are indicated by map symbols, which indicate at a single glance the shipment's overall status, whether it is loaded or unloaded, in the highway or rail mode, empty or full, and its message status.

Lading

Every shipment tracked by TRANSCOM will have a Bill of Lading. The Bill of Lading provides many different kinds of information about a shipment, including contents, shipment ID, shipper's name, cognizant DOE field office, material ID, hazard class, fissile class, weight, and planned route, as well as its current position status.

Emergency Response Checklist

TRANSCOM's Emergency Response feature gives users certain information essential to remedy an emergency situation. The Emergency Response Checklist displays names and addresses of emergency contacts for a shipment, and briefly summarizes information from the DOT Guidebook for Hazardous Materials, which can be used for handling various types of emergencies.

Two-Way Digital Messaging

The TRANSCOM DIGITAL MESSAGING feature provides a means of communication among the field offices, the TRANSCOM Control Center, and the active shipments. Only DOE and its contractors have access to this feature. Each message is assigned a priority of low, medium, high, or emergency. Emergency messages are addressed within 1 minute. The messaging screen informs the user of date, time, originator, recipient, and status (message acknowledgment).

Archive File

The ARCHIVE feature contains information about shipments removed from the active data base. This information is placed in an on-line archive file.

Report Generation

The REPORT feature provides immediate access to a shipment's in route report. For each shipment in route, the report lists the shipment number, the shipment date, the

originating and destination facility, and the material being shipped.

TRANSCOM SYSTEM EQUIPMENT

Communication among the various links in the TRANSCOM System is made possible through the technologies of navigation, satellite communication, computerized database management, user networking, and ground communication (Figure 1). Each vehicle is equipped with a LOng Range Aid to Navigation (LORAN) receiver and a two-way satellite communications package.

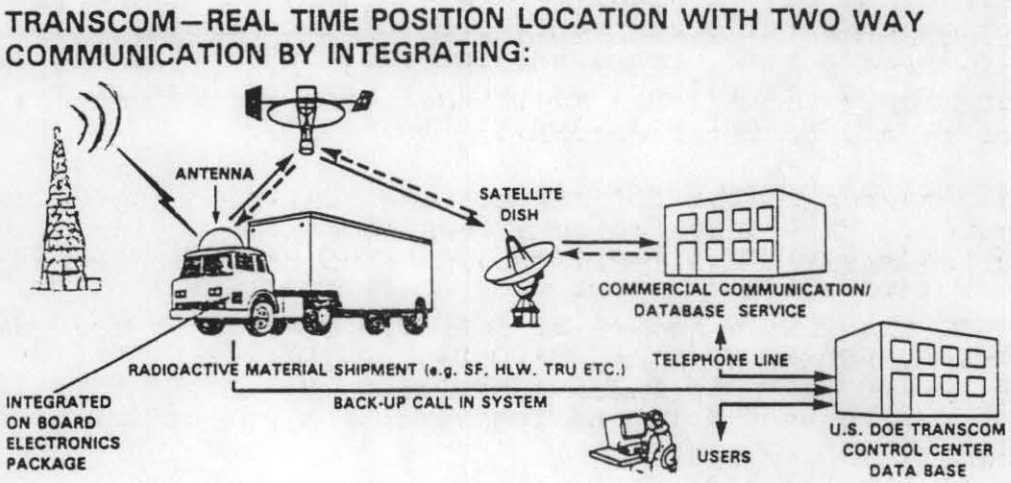

Figure 1. TRANSCOM Tracking and Communications System.

LORAN uses land-based radio transmitting stations and computerized radio receivers that convert an incoming pulse signal into a (latitude, longitude) position. This position information is then sent to the TCC using the satellite communications package on the vehicle. The signal is sent from the vehicle up to the satellite, which relays it to a ground station.

Two-way alpha-numeric messages are similarly passed between the vehicle and the TCC. Messages are displayed on a screen located in the vehicle cab, or on screens at user sites. If the satellite communication link fails, the vehicle operator reverts to a backup call-in procedure.

TRANSCOM CONTROL CENTER

The TCC, established in September 1988, is located at the Oak Ridge Operations Office (OR) in Oak Ridge, Tennessee. The TCC was established to monitor the movement of selected high visibility shipments. Operated by the Analysas

Corporation, under OR supervision, the TCC is responsible for the day-to-day operation of the TRANSCOM system.

Equipment Configuration:

Three "386" IBM-PC class computers are networked and operated using Xenix software. These computers control access to the system.

The central computer in the network is equipped with a 130 megabyte hard disk and a 135 megabyte tape drive. These drives store the active and backup TRANSCOM data. Each computer in the network is equipped with a communication board that allows the use of up to eight incoming modems. A rack of 32 modems services the network. This entire configuration is connected to an uniterruptible power supply, ensuring an orderly system shutdown if the normal power supply fails. Two additional "AT" type computers serve as TCC Operator Consoles.

Each computer in the TCC has an identically equipped backup computer. This duplication allows immediate replacement of a failed machine and rapid return to normal operations.

The TCC also has a number of "AT" computers that are used for map editing, back up, training, and general administrative functions.

Operation of the TCC:

The objective is to integrate TRANSCOM into the existing DOE transportation system with minimal disturbance while fulfilling the TRANSCOM mission of tracking shipments for various DOE facilities. To do this, a TRANSCOM Roles and Responsibilities document was prepared and presented for DOE internal review. This document is the foundation for the Standard Operating Procedures (SOPs).

The SOPs are a collection of documents that provide users enough information to handle any situation that may arise during their interaction with the system. These documents also delineate the responsibilities for different users. The SOPs include a Guide to the Standard Operating Procedures, a User's Guide, Training Course Material, a Software Installation Guide, several DOE transportation related fact sheets, and a Vehicle Equipment Installation Guide.

Staffing:

The TCC currently employs a staff of eight: a system manager, two programmers, four operators, and a secretary.

Staff members were selected whose experience includes transportation management, vehicle operation, programming, DOE regulations and procedures, and management. Each staff member is responsible for understanding the system as a whole and the SOP for the system. Cross training has occurred so that all operators can adequately handle any situation that could arise during the normal operation of the system.

When active shipments are being tracked, the TCC is staffed 24 hours a day. Other tasks performed by the TCC staff include the following.

Editing Maps

The TRANSCOM Map Database was developed from the U.S. Geologic Survey Map System. Changes in political boundaries, roads, and railways require the mapping features to be updated. Software for editing these maps has been installed at the TCC. The software allows TCC operators to add, delete, or modify most features found on the computer-generated maps.

Evaluation

Since Transcom is a new system, many requests for modifications are received. The TCC coordinates these requests and recommends changes to DOE. The TCC incorporates DOE authorized software changes and distributes revised software to the users.

Validation and Testing

Before distribution, the TCC staff tests and validates all software revisions.

Document Preparation

The TCC is responsible for the preparation, maintenance, and distribution of all TCC operations related documents and databases. The TCC also assists DOE with preparation of fact sheets and responses to information requests.

Training

One of the primary responsibilities of the TCC is to establish and conduct training sessions for all users of the system. Users are divided into four categories: (1) Full Users - TCC operators, (2) Shippers and Receivers - users needing write privileges to the system, (3) Other Government Agencies (OGA) - users not needing write privileges to the

system, and (4) Vehicle Operators - users operating the transport vehicles.

A user's category determines which set of SOPs are issued. For instance, since OGA users do not have to install vehicle equipment, the Vehicle Equipment Installation Guide would not be included in their SOP.

All users are invited to the TCC for comprehensive system training. During training, users are shown the equipment used at the TCC and on the vehicles. Users are instructed in the history and mission of TRANSCOM, Disk Operating System (DOS) commands required to install the TRANSCOM software, TRANSCOM software installation procedures and operation, user responsibilities, and procedures for getting help. Upon completion of the training, each user is issued a TRANSCOM software package, a set of SOPs, and a certificate of proficiency. After training, users are encouraged to bring the system up at their home offices to demonstrate to the TCC that they can operate the system proficiently. The TCC works closely with each user to ensure correct operation of the system at the user site.

The TCC has trained representatives from five States (Idaho, Utah, Wyoming, Colorado, and New Mexico), five Indian government agencies (Shoshone Bannock, Pojoaque, San Felipe, Santa Domingo, and Tesuque), and eight DOE facilities (DOE Headquarters Germantown, Richland Operations Office, Oak Ridge Operations Office, Idaho National Engineering Laboratory, Argonne National Laboratory, the Waste Isolation Pilot Plant, Rocky Flats Plant, and the Oak Ridge National Laboratory).

System Maintenance

The TCC is responsible for staying abreast of technological advances in the tracking and communication industry. Contracts for tracking and communication equipment and services are let through the TCC. Equipment maintenance, file backup and integrity, security issues, and trouble shooting are also responsibilities of the TCC.

Integration and Testing

In-house demonstration shipments are being conducted to help the TCC in testing the equipment, software, and the reactions of the TCC operators. During these shipments, the vehicle operators may be requested to simulate abnormal conditions. The TCC operators are then expected to react to these conditions in accordance with established SOPs.

FUTURE PLANS:

The TRANSCOM Control Center is designed to provide tracking and communication services to DOE. In the coming months, system use is expected to increase as more shipments come on line. In addition, new requirements will be added as users become more familiar with current system capabilities. In the future, the TRANSCOM system could tie into other DOE databases, thereby creating an interactive network of transportation information.

Other federal agencies are developing an interest in tracking and communication with enroute vehicles using concepts similar to those employed by TRANSCOM. The unique features of the TRANSCOM system are its software tailored to DOE shipping needs and an established control center servicing a variety of users. The system is designed for easy expansion and could be modified to service the specific needs of other federal agencies. Adapting the TRANSCOM System to other federal agencies could minimize duplication of research and development costs and assist in the coordination of technologies within the agencies of the federal government.

Transportation literature and State political interest in the transport of potentially hazardous materials suggests that tracking vehicles and communicating with them while they are enroute is more than a passing trend. DOE will continue to examine and implement new technology to provide public assurance for responsible transportation of its shipments.

REFERENCES

[1]The Philadelphia Inquirer, Friday, March 31, 1989.

[2]The Nuclear Waste Policy Act, 1982, Public Law 97-425, January 7, 1983.

[3]Transcom Shippers and Receivers User's Manual, March 27, 1989, U.S. DOE, Transcom Control Center, Oak Ridge, TN.

[4]L. H. Harmon, E. P. Habib, J. D. Hurley, and R. D. Carlson, Tracking Radioactive Shipments Using Radio-Navigation and Satellite Telecommunications Systems: Transcom Update, March 1988, Proceedings of the Waste Processing, Transportation, Storage and Disposal Technical Programs and Public Education Waste Management, 1988, Vol. 1 LLW.