TRUPACT MONITORING AND DISPATCHING SYSTEM*

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ABSTRACT

The Department of Energy (DOE) currently plans to ship contact-handled (CH) transuranic waste from various DOE facilities throughout the continental United States to the Waste Isolation Pilot Plant in southeastern New Mexico. In order to facilitate the safe and efficient movement of this waste and to monitor vehicle movement and status, the Joint Integration Office developed the TRUPACT Monitoring And Dispatching System (TMADS). The system will utilize both computer and satellite technologies as a means of tracking and communicating with these vehicles.

Overview

Transportation of transuranic wastes from the various Department of Energy facilities to the Waste Isolation Pilot Plant will utilize a dedicated fleet of more than twenty transuranic package transporters (TRUPACTs). Shipment of transuranic wastes from DOE facilities, see Fig. 1, are scheduled to begin in late 1988 and will continue until the year 2013.

Prior to 1988, TRUPACT shipments will move waste from the Rocky Flats Plant (RFP), Colorado to the Idaho National Engineering Laboratory (INEL), Idaho. As part of a program to ensure the safe, secure, and efficient transport of these materials, the Joint Integration Office, under the direction of the Department of Energy, has developed the TRUPACT Monitoring And Dispatching System (TMADS). This system is designed to utilize both computer and satellite technologies to assist in the management of the TRUPACT Fleet.

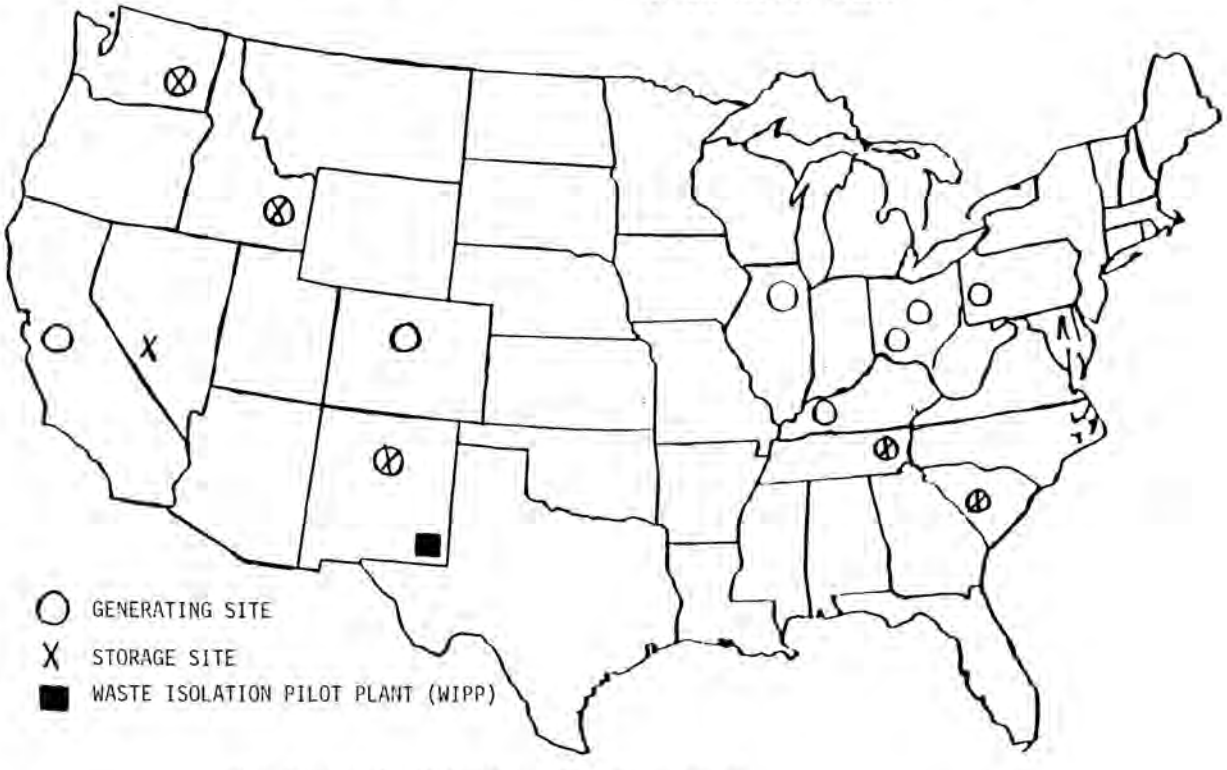

Fig. 1. Points of Origin and Destination of Contact-Handled Transuranic Waste.

Computer Technology

The computer portion of this system includes tracking software, informational databases, models to simulate the system, and a historical database. These different parts are designed to work as one system.

The tracking portion of the system, PHOENIX, will be used to monitor the position and status of the fleet at all times. This software is presently complete and only needs signals from a satellite system to be fully operational. The software includes the following state-of-the-art features:

Automatic Alarm Conditions

o Route Verification - In addition to determining if the vehicle is on a road the software can determine if the vehicle is on the route it is supposed to be on.

o Invalid Response - Response from the vehicle is nonexistent or out of range for valid responses (i.e., longitude and latitude not possible based on previous reading.)

o Improper Progress - The software determines if movement of vehicle is within acceptable limits (i.e., to fast, to slow or not moving).

Prenotification - The software determines and notifies the control center whenever a shipment is close enough to a state to be entering its jurisdiction within a given time frame.

Map Correction - Based on longitude and latitude readings, maps will be automatically updated using statistical analysis. If a vehicle deviates from routes that are defined, the system will create and save the new route using the signals received.

The above features are made possible because of the unique way in which the road and map data are recognized by the software. If these features were not present, system operators would have to spend their shifts watching the screens. However, TMADS is designed to automatically notify the system operators of any abnormal conditions via audio and visual alarm signals. Therefore, the system operators will be free to perform other duties thus saving many man years of effort.

The system has been designed to be transparent to drivers once the shipment is on the road. This means that the position of the vehicle can be determined by the control center without vehicle operator interaction. The vehicle operator only needs to get involved when an unusual event occurs and direct communication with the control center is necessary.

Informational Databases

The following is an overview listing of the type of information kept and utilized on each site:

Site Specifics - Operating days and hours, storage capacity, handling capacity, turn around times, travel times, generating rates, etc.

Waste Quantity - Total volume stored, amount certified and in what storage forms - boxes or drums, etc.

Shipments - Detailed manifest information, carrier, shipper, destination information, etc.

TRUPACT and trailer capacity, maintenance schedules, and miles traveled.

Models

The system incorporates models which simulate the transportation of the transuranic wastes. These models incorporate all information known about the system and assist the control center in optimizing the dispatching of empty TRUPACTs.

Unless carefully considered, the dispatching decision made today could cause unnecessary tie ups in the transportation schedule at a later date, e.g., TRUPACTs waiting for loading or unloading, site storage capacity exceeded, idle workers waiting to unload. The models can simulate the system and therefore allow the evaluation of many different strategies to determine the best decision.

Historical Database

All information collected by the system will be stored in a historical database. This information will then be used to review TRUPACT transportation history and form the basis of periodic reports and response to public inquiries concerning the transport system. In the event of a non-routine event, tracking data will be used to reconstruct the event

More information on the computer technology can be obtained by referring to the paper entitled TRUSYSTEM - A Computerized System for the Management of Defense Transuranic Waste by Adam, J.A., Vaccaro, H.S., Olive, R.O., Driscoll, K.L. which is also presented at the Waste Management 87' Conference.

Satellite System Technologies

In review of potential satellite-based systems two generic designs were encountered. The first of these, a Radio Determination Satellite System, is proposed by GEOSTAR Corp. and consists of two satellites in geosynchronous orbit, individual transceivers in each vehicle, and a network control center. Figure 2 provides a graphic explanation of how the system is anticipated to function. In this design, one of the satellites functions as a two-way relay while the other serves as a one-way pass through.

Transmissions from the truck, communications and/or positioning signals, are sent to the two satellites simultaneously. Signals received by the satellites are sent directly to the network control center. Position information signals are processed at the network control center and are relayed, along with communications, via land-lines or a commercial satellite to DOE. Communications from DOE to the transport vehicle would occur via the network control center. These signals would use the two-way relay satellite.

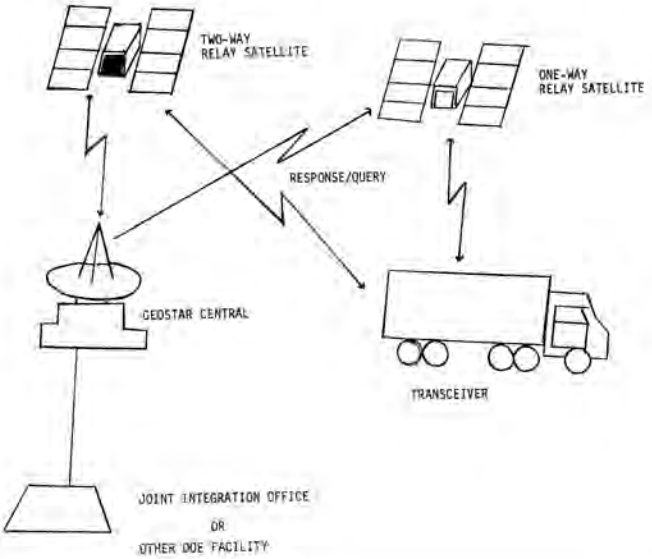

Fig. 2. GEOSTAR Concept.

In the second conceptual design, the Global Positioning System (GPS) would be used to determine vehicle location. The GPS design consists of a total of twenty-one NAVSTAR satellites in non-geosynchronous orbit. These satellites transmit continuous signals which will allow an on board processor to determine longitude and latitude. This position/location data along with routine and non-routine communications will be relayed to a DOE center via a commercial satellite. Figure 3 shows the relationships in such a system.

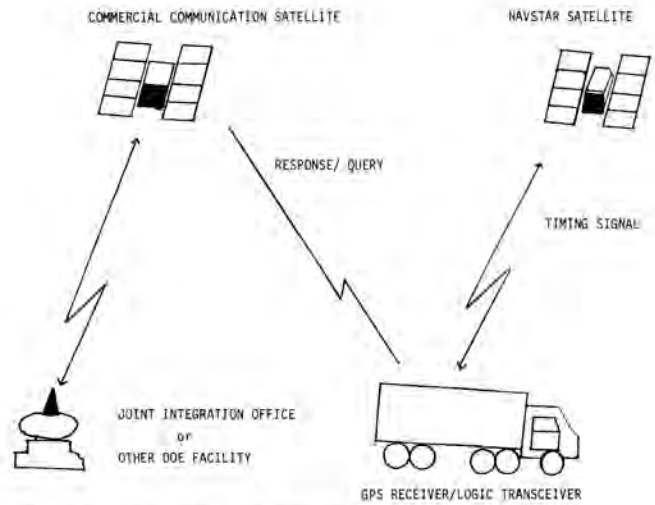

Fig. 3. SPS/COMSTAT System.

Each shipment will be equipped with individual transceivers that will allow the vehicle to communicate with the DOE center. All communications between the transport vehicle and DOE will be digital and will be either pre-defined messages entered via code #'s or nonstandard messages entered through a key board.

Control Center

It is presently envisioned that the Joint Integration Office (JIO) will function as the TRUPACT system control center. This center will be equipped with a visual, multi-screen display system that will allow the operators to monitor the location and status of all active TRUPACT shipments. It is anticipated that the use of the TRUPACT Monitoring and Dispatching System will improve both the dispatching and scheduling of TRUPACTs and also provide secure and reliable communications and improve overall safety and efficiency. In addition to these operational concerns, an effective system will permit DOE to address institutional issues such as state prenotification and emergency response.

Program Status

The U.S. Department of Energy is committed to the use of a fleet management and monitoring system that will ensure the safe and efficient transport of CH transuranic waste to WIPP. The tracking software, PHOENIX, is complete and requires only a signal providing two-way communications with the vehicle, vehicle ID code and vehicle longitude and latitude to be fully operational. The Modeling software is also complete..

After review of available satellite-based communications systems, DOE has selected the design from GEOSTAR Corporation. It is anticipated that the system will be demonstrated during calender year 1987.

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