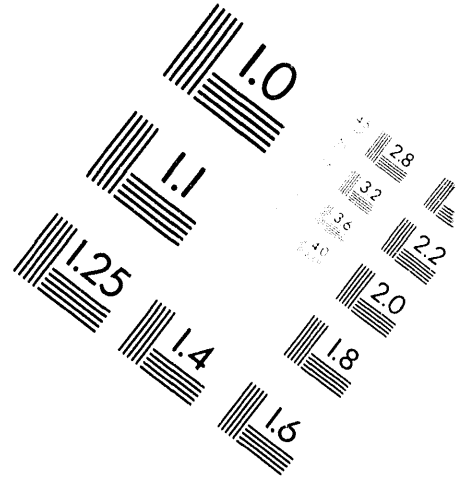
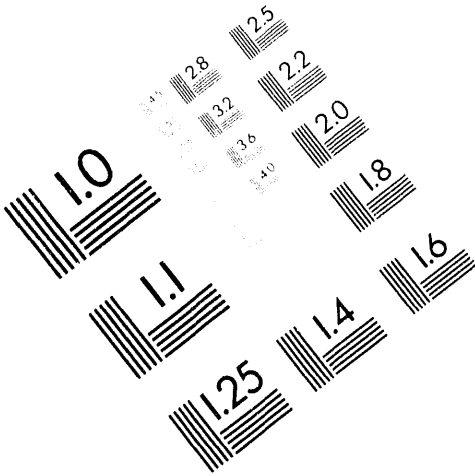




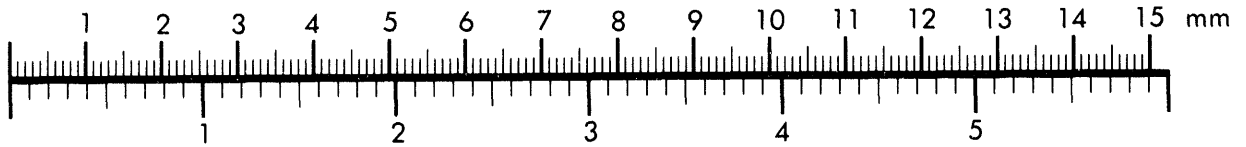
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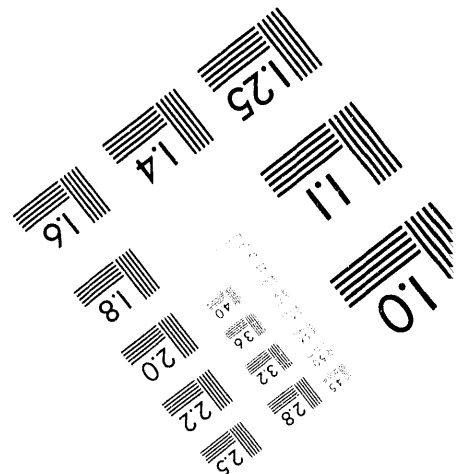
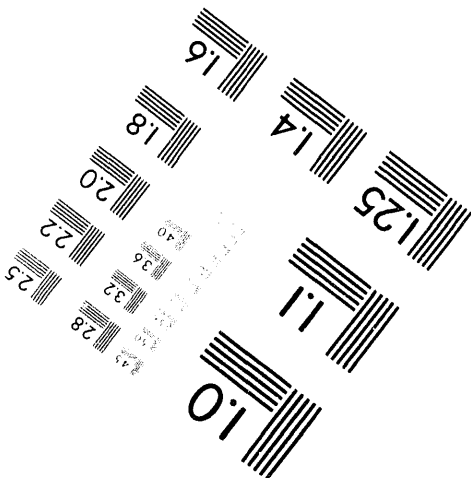
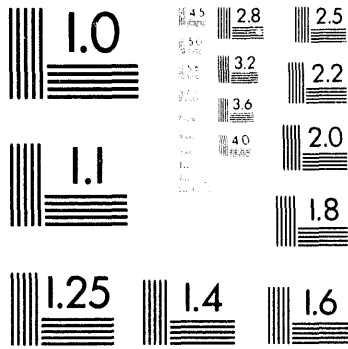
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Centimeter



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U.S. Department of Energy Automated Transportation Management System

J. H. Portsmouth

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January 1994

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U.S. DEPARTMENT OF ENERGY AUTOMATED TRANSPORTATION MANAGEMENT SYSTEM

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ABSTRACT

The U.S. Department of Energy (DOE) Transportation Management Division (TMD) is responsible for managing its various programs via a diverse combination of Government-Owned/Contractor-Operated facilities.

TMD is seeking to update its automation capabilities in capturing and processing DOE transportation information. TMD's Transportation Information Network (TIN) is an attempt to bring together transportation management, shipment tracking, research activities and software products in various stages of development.

The TMD's Automated Transportation Management System (ATMS) proposes to assist the DOE and its contractors in performing their daily transportation management activities and to assist the DOE Environmental Management Division in its waste management responsibilities throughout the DOE complex.

The ATMS system will center about the storage, handling and documentation involved in the environmental clean-up of DOE sites. Waste shipments will be moved to approved Treatment, Storage and Disposal (TSD) facilities and/or nuclear material repositories. An additional investment in shipping samples to analytical laboratories also involves packaging and documentation according to all applicable U.S. Department of Transportation (DOT) or International Air Transport Association (IATA) regulations.

The most immediate goal of effectively managing DOE transportation management functions during the 1990's is an increase in automation capabilities of the DOE and its contractors. Subject-matter experts from various DOE site locations will be brought together to develop and refine these capabilities through the maximum use of computer applications. A major part of this effort will be the identification of the most economical modes of transportation and enhanced management reporting capabilities for transportation analysis.

The ATMS system will also provide for increased strategic and shipment analysis during the 1990's and beyond in support of the DOE environmental mission.

U.S. DEPARTMENT OF ENERGY AUTOMATED TRANSPORTATION MANAGEMENT SYSTEM

The U.S. Department of Energy (DOE) Transportation Management Division (TMD) has the overall responsibility to provide a well-managed transportation program for the safe, efficient, and economical transportation of DOE-owned materials.

TMD oversees its various transportation management programs via a diverse combination of Government-Owned/Contractor-Operated facilities, many of which have not kept pace with advances in overall transportation management

automation capability. Consequently, there is a wide variety of procedures and systems employed to capture and process DOE transportation information.

TMD's Transportation Information Network (TIN) is an attempt by the TMD to integrate "under one umbrella" the various transportation management, packaging development, shipment tracking and transportation related research activities and software products either under development or presently in day-to-day operation throughout the DOE complex.

One such component of the TIN, which will be the topic of this paper is the TMD's Automated Transportation Management System (ATMS).

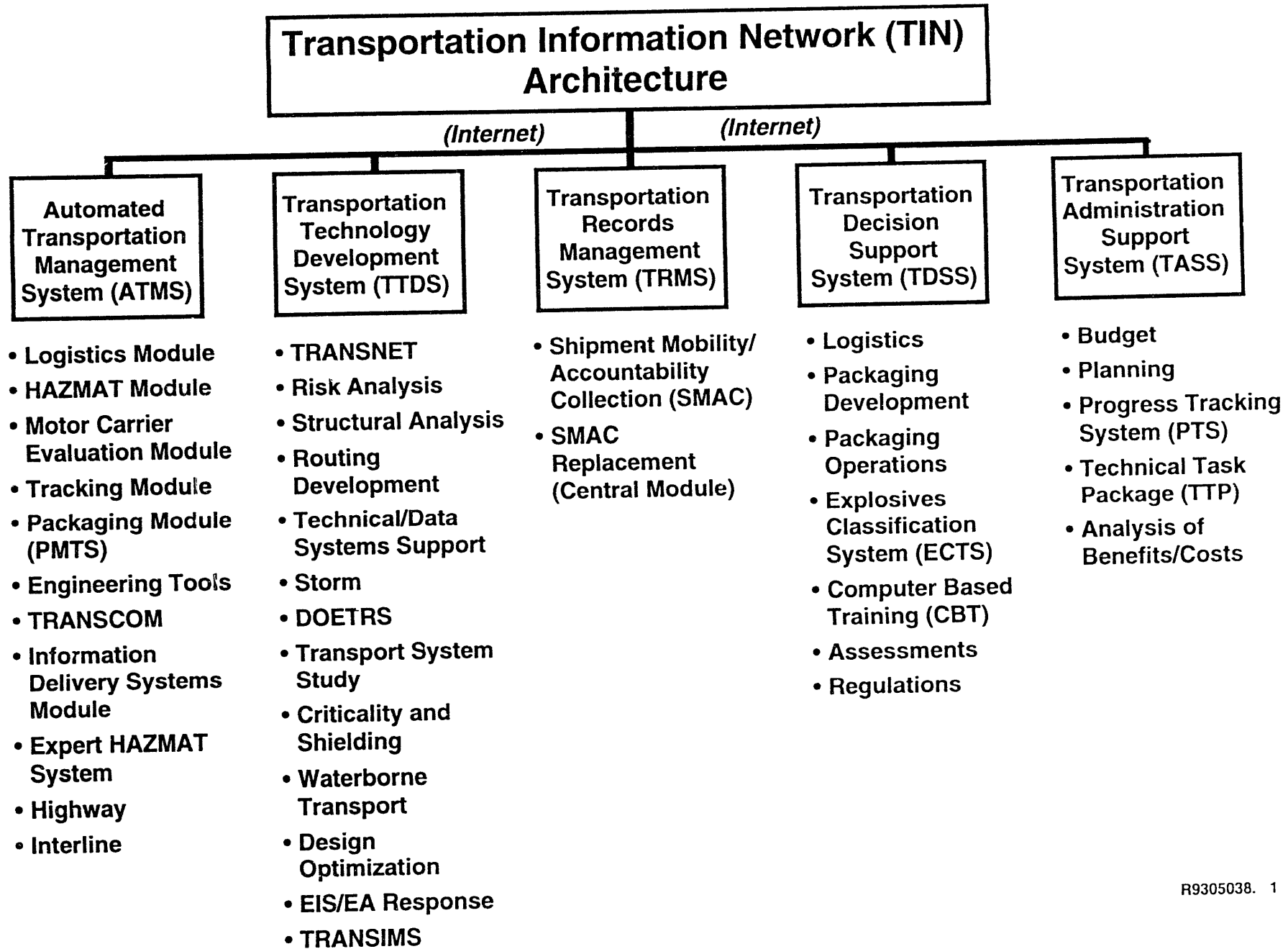
Government transportation (as well as other) programs have become increasingly scrutinized in recent years. DOE has not been immune to this scrutiny, as evidenced by the DOE Inspector General (IG) and other reviews. Furthermore, the development of automated transportation management tools over the last several years provides an opportunity for DOE to modernize its transportation management and packaging operations.

DOE presently has limited automated capability in the transportation and packaging realm at some of its site locations. Examples of DOE-developed software products currently being utilized by its various contractors include the Shipment Mobility/Accountability Collection (SMAC) historical shipment data base, Radioactive Materials Packaging (RAMPAC), which is an information data base used to retrieve information on unclassified radioactive packages, Transportation, Tracking, and Communications System (TRANSCOM), which provides satellite tracking capabilities for "high visibility" shipments such as high level waste and spent fuel, and Automated Carrier Evaluation (ACE) software, which identifies the DOE-preferred carrier routing for all types and sizes of shipments. TMD also has many software products such as Radioactive Materials Transportation (RADTRAN) and Radioactive Materials Incidence Reports (RMIR) that are used by scientists, engineers, and stakeholders to do research in shipment of radioactive materials. They are also used to do "what if" calculations in case of an unlikely accident involving a Type B package resulting in a spill of radioactive materials.

However, as a whole, the DOE organization has in the past lacked automation support at the local level to perform day-to-day traffic management activities. Instead "islands of automation" exist at some DOE facilities, while the majority of the DOE transportation management organizations generally suffers from a lack of automation support.

Although individual automation efforts have been going on for years it has been only recently that the TMD has attempted to optimize this process with a concerted effort to implement a comprehensive, integrated TIN as shown in Figure 1.

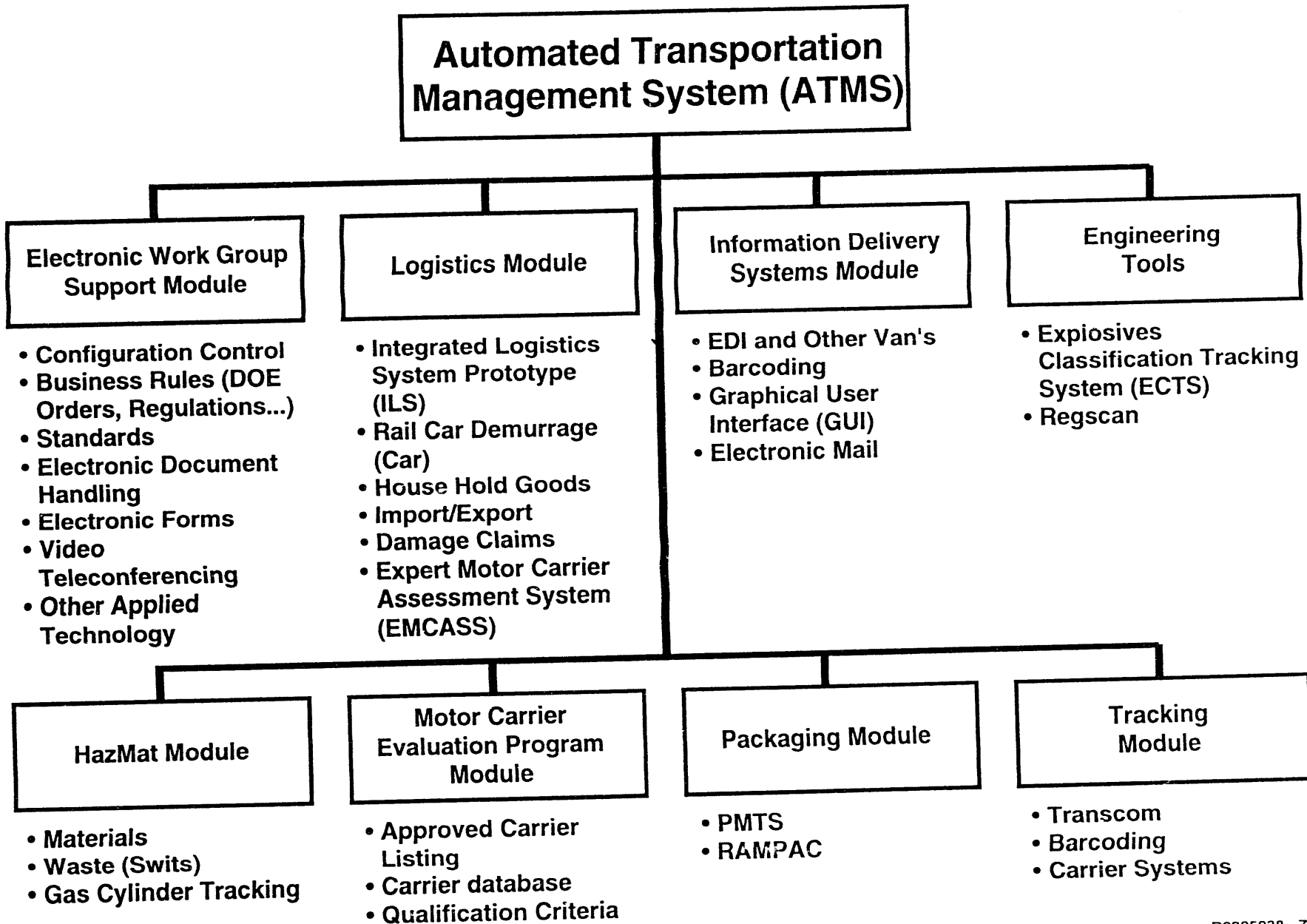
This paper will delineate the mission, objectives, and functions of the ATMS component of the TMD TIN architecture. The paper will also describe how the ATMS software will assist DOE and its contractors in the performance of their day-to-day transportation management activities and show how this program will assist the DOE Environmental Management Division in its complex task of waste management throughout the DOE complex.



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Fig. 1. DOE-HQ Transportation Management Division (TMD) Transportation Information Network (TIN)



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Fig. 2. Automated Transportation Management System Architecture

Figure 2 summarizes the functional components of the proposed ATMS and illustrates how existing software will be integrated into the ATMS program. This system is designed to support the vast majority of DOE transportation management and operational requirements. It will go beyond simply automating current manual tasks. While that kind of support is fundamental to the system, it is only a small part of ATMS's potential. In addition, development of a fully integrated system tailored to fit the specific needs of the DOE and its contractors will significantly improve functions already automated. By collecting and analyzing data describing historic shipment activities, ATMS will enable transportation managers to take advantage of previously lost opportunities. These include:

- DOE-wide analysis of tonnage patterns and carrier usage,
- Development of a better understanding of where DOE's transportation dollar are spent,
- More efficient rate negotiations with carriers,
- Great use of current technology such as Electronic Data Interchange (EDI),
- Increased regulatory compliance capabilities for hazardous materials and waste shipments.

Transportation management will play an increasingly significant role in the environmental clean-up of DOE's sites during this decade and beyond. Transportation management personnel will be directly involved in the selection of packaging, marking, labeling, preparation of shipping documentation such as bills of lading, and the Uniform Hazardous Waste Manifest (UHWM). They will also be involved in the storage and handling of waste containers and arranging for the transportation of both high and low-level radioactive wastes, chemical wastes, and mixed wastes from DOE site locations to approved Treatment Storage and Disposal (TSD) facilities and or nuclear materials repositories.

Transportation management personnel also are frequently involved in shipping numerous samples to analytical laboratories for analysis and waste designation. However, even though these materials are considered small quantity samples of hazardous materials, they nevertheless must be properly packaged, marked, labeled, and documented according to all applicable U.S. Department of Transportation (DOT) or International Air Transport Association (IATA) regulations.

A significant problem encountered by the TMD is the difficulty in managing such a diverse transportation management community in the current environment. The significant number of contractors involved, the large number of geographically diverse facilities located throughout the United States, and limited DOE resources make efficient transportation management operations very difficult. This decentralized organizational structure and the lack of interaction between the DOE sites in many cases causes various contractor transportation departments to replicate efforts or "reinvent the wheel" when attempting to automate their transportation management processes.

In recent years, many government agencies, including the DOE, have taken a lead from their civilian counterparts in studying the feasibility of

automating their transportation management processes. Automation of transportation management applications, including the use of EDI in the private sector (particularly among many Fortune 500 companies), has increased significantly since the *Motor Carrier Deregulation Act of 1980*. This recent interest by the Federal government in automating transportation management operations is partially the result of the various government agencies recognizing the benefit in reducing the amount of paperwork involved in the transportation management process. The U.S. Congress also has mandated in Public Law 99-267 that all government agencies study automating their transportation management activities.

Additionally, the advances in computer technology during the last 5 years, in particular the downsizing of computing platforms and reduction in the costs of computer hardware, have made it more feasible to design and develop a DOE complex-wide distributed information system to automate many of the previous labor-intensive, manual tasks performed in the transportation management field.

To more efficiently manage the transportation management function of DOE during the 1990's, an increase in the automation capabilities of DOE and its contractors will be required. A large nationwide organization such as DOE, with a shipment volume of 375,000 shipments annually and a transportation bill exceeding \$35 million per year, requires the development and successful deployment of ATMS.

The direct administrative and strategic benefits of ATMS to the TMD and its contractors include the following:

- Increased speed of document transfer
- Improved information integrity by reducing manual data entry to ensure the timeliness of the data information
- Reduced data entry costs
- More efficient use of human resources
- Increased regulatory compliance assurance for hazardous material shipments.

The ATMS is a program that will integrate existing computer capabilities and future computer applications in the DOE/contractor transportation management organizations. Although automated transportation management capabilities are currently available within the TMD, until recently this effort was fragmented and lacked a common direction. In some cases, several DOE contractors were working on similar computer applications in the transportation management area, with little communication or interaction with one another. In many cases, this lack of interaction caused the TMD and its contractors to duplicate automation efforts, costing the taxpayer unnecessary expense.

The ATMS Program has been a very successful effort on the part of TMD to bring subject-matter experts from various DOE site locations together to define the problem and work on its solution. In particular the software development effort for the ATMS program is being shared by the Oak Ridge and the Hanford Sites with considerable expertise and assistance from the DOE Nevada Operations office and its contractors. In addition the Integrated Logistics

System (ILS) software, which served as a "prototype" for the ATMS Logistics Module was jointly "beta tested" at 16 different participating DOE site locations. Each "beta test" site had representation on the ATMS Users Group, which was the group developed to assure stakeholder participation in the ATMS development and testing of the software product. The effect of this teaming effort between the sites developing and testing the ATMS software products has resulted in a product that has been "tested under fire" in the day-to-day operational environment of the DOE and its contractors. An outgrowth of this associative development environment has been a synergy between the developing sites and the goal to develop a product that can be read across site boundaries.

The goal of the ATMS Program development effort is to use available computer applications, either through using TMD or DOE contractor software currently in use, or by obtaining available government or commercial software. The in-house development of application software will also be used as needed to assist in automating the day-to-day transportation management operations at the DOE field office and contractor level and to meet the unique needs of the DOE and its contractors in areas such as the transportation of hazardous materials and wastes.

A primary thrust of the ATMS is to provide day-to-day support to those actually performing transportation management activities. To accomplish this objective it is planned that each facility will have access to the ATMS software, either through the use of a personal computer (PC) based software product (Version 1.0) or a similar but more sophisticated product written in the ORACLE¹ programming language (Version 2.0). It is anticipated that the large volume-shipping site locations will use ORACLE Version 2.0, which will run on a Sun Sparks 10² "mini computers." The general operation of the ATMS is illustrated in Figure 3.

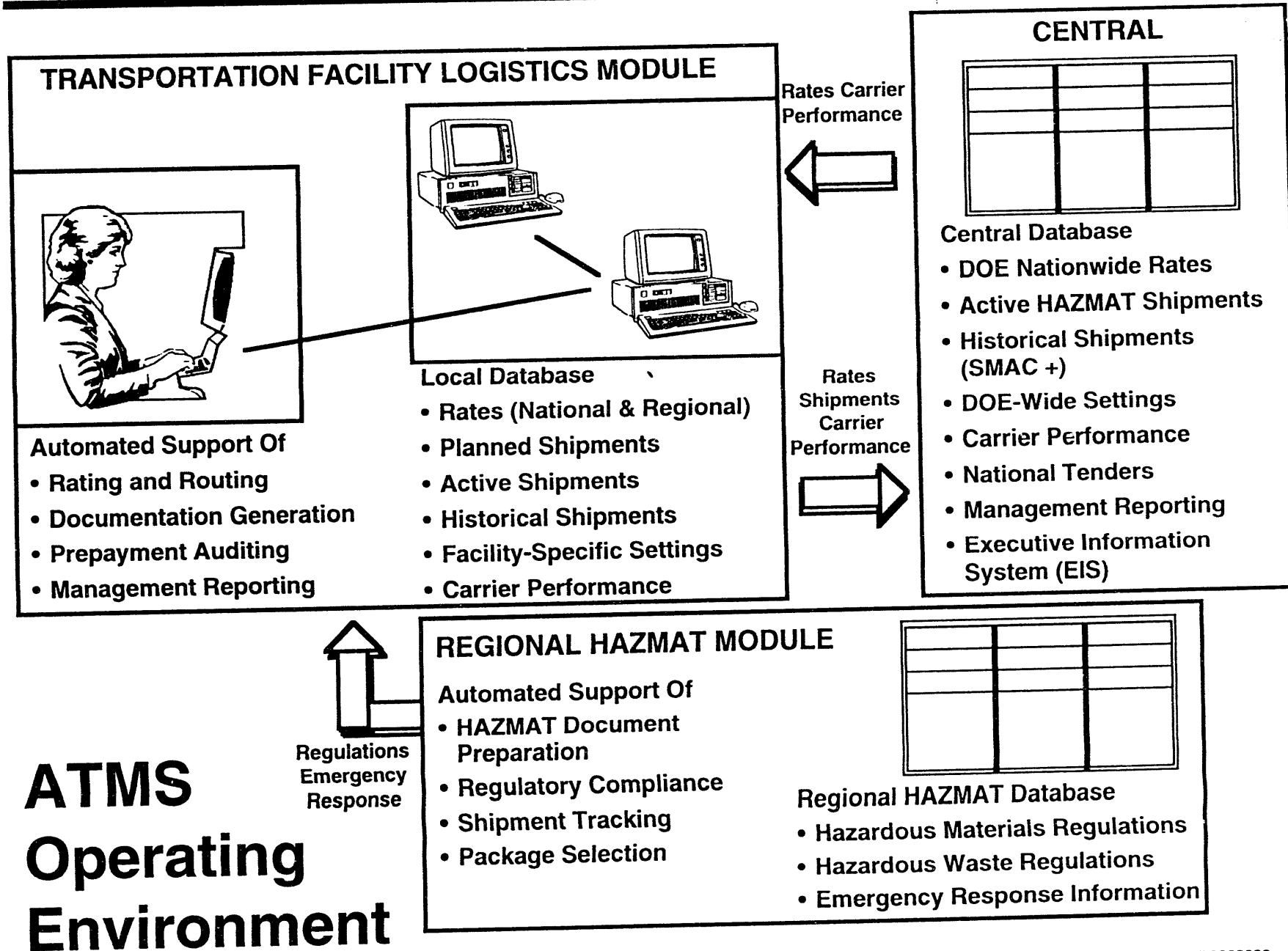
As illustrated in Figure 3 the ATMS consists of workstations or PCs at the local facilities, which may share information using a Local Area Network (LAN) or local host, and a centralized "main frame" computer component. The local ATMS system component will store and maintain all data related to that facility's operations (i.e., shipment information, rates and routes, prepayment auditing, preparation of shipping documentation, etc.).

To integrate and coordinate all participating contractor transportation management offices and field offices, the central component can collect and distribute information from the local ATMS components. This central data base will provide a resource for DOE complex-wide transportation analysis through interface with the SMAC system to maintain historical data on all shipments made by the DOE, including the shipment of Hazardous Materials (HAZMAT), Radioactive Materials (RAM) and hazardous wastes.

Integrating automated logistical functions into a centralized system will greatly enhance the efficiency of the TMD transportation program and reduce redundancy of automation development efforts that are occurring today.

¹ORACLE is a trademark of Oracle Corporation

²SUN Sparks 10 is a trademark of Sun Microsystems Incorporated



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ATMS Operating Environment

Fig. 3. ATMS Operating Environment

Because of the geographically diverse and decentralized organizational structure of the DOE transportation management environment, an architecture had to be developed to meet these particular operational requirements. The ATMS can then best be described as a truly "distributed transportation information system."

However, the TMD recognizes the need to provide operational support at the field office and operating contractor level with a certain degree of autonomy. To accomplish this, each field office and/or contractor must have a transportation management software package configured to their "site specific" needs. Guidelines and procedures will be developed for interface between the site computer systems and the centralized TMD computer.

The proposed ATMS Program will also support several TMD operational requirements during the 1990's by automating previous manual transportation management functions identified by the DOE-HQ Inspector General (DOE-IG) report of August 1989 as needing to be automated:

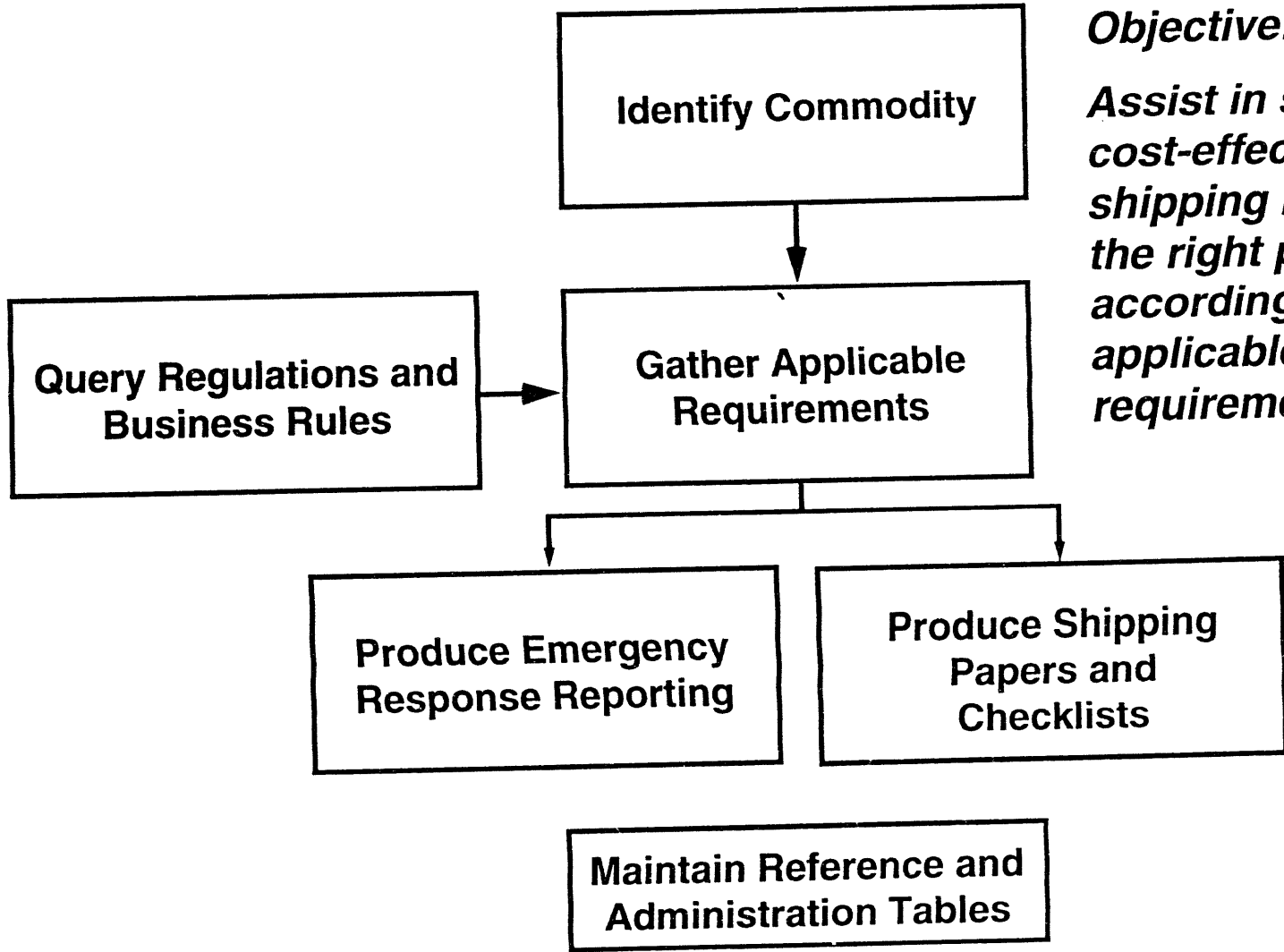
- Updating the DOE historical transportation data base (SMAC)
- Prepayment auditing and automated processing of carrier freight bills
- The use of EDI to reduce paperwork
- Preparation of shipping documents (i.e., bills of lading and carrier air bills)
- Performance of "should cost" calculations to determine the most economical mode and carrier to transport materials
- Enhanced management reporting capabilities for transportation analysis.

The ATMS developers currently are developing a specialized module of the ATMS to handle the complex requirements for the shipment of hazardous materials and wastes. The module known as the HAZMAT module will reside at several geographical locations throughout the DOE complex and will be accessed from a local workstation. The HAZMAT module is stored regionally to eliminate the need for the local facility to maintain all the current and numerous revisions to the complex Federal, state, and international regulations governing the storage, packaging, marking, labeling, vehicle placarding, preparation of shipping documentation, and transport of hazardous materials, including the shipment of hazardous wastes. These applicable transportation related regulations promulgated by agencies such as the DOT, U.S. Environmental Protection Agency (EPA), Nuclear Regulatory Commission (NRC), International Maritime Dangerous Goods (IMDG) Regulations and the IATA regulations will be maintained at and by the TMD. They will be updated periodically on the central mainframe computer and downloaded to the regional site HAZMAT machines to ensure that each site is using the same version of the applicable regulations. This process is shown in Figure 4.

When remotely accessed through the use of a modem connected to a standard PC workstation, or through direct access to one of the Sun Sparks 10 regional "mini computers," all applicable transportation related regulations, DOE orders, and information necessary to prepare a HAZMAT shipment for transport will be made available to the local site for use. All required

HAZMAT Module

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Objective:

Assist in safely and cost-effectively shipping materials in the right package according to all applicable requirements

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Fig. 4. HAZMAT Module

transportation-related documentation and shipping papers will be printed at the local site traffic office from the data supplied at the regional HAZMAT machine. It is anticipated that the first release (1.0) of the HAZMAT module will begin the "beta testing" phase of development early in the fall of 1994.

Additionally, information on the current status of hazardous materials shipments in transit will have increased importance to DOE transportation managers, as these types of shipments continue to have increased visibility in the public arena. Detailed information on these DOE-owned HAZMAT shipments will also be important in meeting TMD Emergency Response information needs.

The tracking of the current location and status of hazardous waste containers "from the cradle to the grave" at many DOE site locations is already presently possible through sophisticated software products. These onsite hazardous waste tracking systems will be enhanced through interface with the TMD's ATMS Program.

Interfacing the ATMS software with these "onsite" hazardous waste tracking systems such as the Hanford Solid Waste Information & Tracking System (SWITS) will give the DOE the capability to seamlessly integrate onsite waste operations activities with the transportation function necessary to properly package and transport the wastes to locations on and off DOE site locations. Additionally, required documentation such as the UHWM will be capable of being produced and transmitted electronically from the originator of the waste "onsite" to the transportation management personnel for regulatory review subsequent to the transportation of the wastes "offsite" by a commercial carrier. Ultimately it is conceived that this information can be sent directly to the TSD facility electronically. It also will be sent concurrently to the TMD central mainframe computer located in Oak Ridge, Tennessee for entry into DOE's historical transportation database.

When the shipment is in transit, the ATMS will also have the capability to track the status and location of the hazardous shipment enroute through the use of EDI technology for routine shipments. For high visibility shipments the ATMS presently has the capability to track the location of these shipments within 200 yards through the use of the TMD TRANSCOM system, which uses sophisticated satellite tracking capabilities.

It is envisioned that the ATMS Program also will provide DOE-HQ TMD program managers with an Executive Information System (EIS) that will provide opportunities for increased strategical planning and shipment analysis for a more proactive rather than reactive approach to transportation management during the 1990's and beyond.

In conclusion, the ATMS program with its comprehensive and integrated suite of transportation management software tools will support the vast majority of TMD's operational and informational requirements for the transportation of materials, including radioactive and hazardous materials and wastes in support of the DOE environmental mission.

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