

U.S. Military Transportation

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Recent closure or loss of overseas bases and assets now requires a greater dependence on deploying forces from the continental United States (CONUS), thus requiring efficient deployment planning. At the same time, widely scattered and increasingly numerous low-scale operations result in a greater pace of military deployments than ever before. Deploying from home station directly into theaters together with resupply and sustainment presents a highly complicated problem in military logistics that demands the application of appropriate technologies.

In the civilian world, technology and advanced logistics concepts have greatly increased transportation efficiency and capacity. The Department of Defense's (DoD's) theater commanders in chief (CINCs) have recognized the emergence of the new technologies and now routinely demand constant updates and estimates on when the "forces will close." Furthermore, the Wal-Mart approach to resupply and sustainment is becoming the norm.

In most military operations, early deployment cargo moves on military assets. Although these early movements may account for only a small portion of the total, they are often the most critical. Still, most military cargo, personnel, and war-fighting assets now move on commercial assets. For example, more than 95 percent of the equipment and cargo shipped in Desert Shield and Desert Storm moved on commercial carriers. Because of this, DoD instituted agreements with commercial carriers to ensure asset availability when needed. However, in an era of increasing need for military augmentation, competitive pressures have reduced civilian excess capacity and increased the need for closer coordination between the military and civilian carriers.

Civilian-sector efficiency improvements result from the rapidly increasing use of technology to identify, track, and quickly locate cargo and shipments. For example, global positioning systems are now commonplace in the commercial trucking industry. The military sector needs to adopt these commercial successes more rapidly. Many disciplines are available to improve the planning and execution of military deployments, such as information technology and computers; communications; network flow models; operations research and logistics science; design of lift assets; demand reduction; and vehicle scheduling, routing, and monitoring.

Many military transportation problems are being addressed by commercial companies or are the subject of research in universities and national laboratories. Because of the military's conservative nature, the research community has the lead in developing and

using advanced technology. We need a mechanism to bring these groups—military, business, and research centers—together to ensure that the latest developments in transportation are made available to solve military transportation problems. We believe that the Transportation Research Board's Committee on Military Transportation is that mechanism.

RECENT EFFORTS

Although development of advanced deployment planning, scheduling, and analysis systems using state-of-the-art computing technologies date from the 1970s, truly remarkable planning and execution systems did not evolve until the mid-1990s. Some systems are Component Command specific, such as the Air Deployment Analysis System and the Strategic Deployment Analysis System. Others, such as the Joint Flow Analysis System for Transportation (JFAST), operate in the joint arena and are becoming multimodal systems capable of rapid no-plan development and plan refinement. The Office of the Secretary of Defense selected several of these systems for further development.

An equally impressive suite of automated cargo-handling, shipment identification, and characterization technologies accompanies these evolving decision-support systems. Bar codes and microchip identification tags are becoming commonplace, and weigh-in-motion systems can provide real-time information for stow plans. Innovative automated systems to support rapid deployment and movement of cargo through both air- and seaports are being developed by the Center for the Commercial Development of Transportation Technologies (CCDOTT) program under the sponsorship of the U.S. Transportation Command (USTRANSCOM) and the U.S. Maritime Administration (MARAD). CCDOTT focuses on increasing inland, port, and terminal throughput and improving origin-to-destination movement.

The Tank Automotive Command recently initiated efforts to evolve vehicles of the future that require less maintenance, have a smaller footprint, are lighter in weight, and can self-diagnose potential failure. This research and development effort is coupled with development of new propulsion technologies that use universal fuels and have less or no target signature emissions. Vehicles also will have lighter but tougher armor and will consume less fuel, thus reducing resupply requirements.

Strategic lift capabilities are also being improved. The C-17 is the latest addition to the Air Mobility Command's lift capability, and preliminary studies are under way to determine the feasibility of high-speed sealift capable of greater than 60 knots. The joint logistics over the shore (JLOTS) issue is also being thoroughly reviewed for off-loading in unimproved ports.

The military of the future will have a new array of technologies for better planning and execution, as well as a wide array of new equipment designed for easier deployment and support. Whereas throughput capabilities to load and off-load ships and aircraft at origin and destination are being improved, much remains to be done.

TRANSPORTATION PARTNERS

Current DoD policy is to transport personnel, equipment, and sustainment using commercial assets when practical and prudent. Even in contingency situations, commercial railroads, truck lines, ocean carriers, barge-towing industry, airlines, and bus companies play a critical role in projecting U.S. forces from CONUS and outside CONUS locations to the theater of operations. A major issue facing the commercial transportation industry and

DoD is the declining excess capacity of the system. Other issues include a shortage of seafarers and longshoremen in the ocean carrier industry. DoD responded to the airline industry problem by implementing the Civil Reserve Air Fleet (CRAF) Program and to the commercial ocean-shipping problem with the Voluntary Intermodal Sealift Agreement (VISA) program.

A readily available fleet of militarily useful merchant vessels and motor and rail carriers is a critical element of the Defense Transportation System (DTS). VISA and CRAF provide DoD with staged access to and payment procedures for commercial shipping and intermodal assets in the event of war or national emergency. The Ready Reserve Force and the Military Sealift Command (MSC) Surge Sealift Fleet provide DoD with an organic ability to move most of its unit equipment that is too large to fit in commercial containers.

Motor Carriers

Although sufficient motor carrier resources appear to be available to support surface transport, the availability of drivers and an appropriate mix of specialized transport is a potential problem for DoD. Trucking competition and deregulation have forced motor carriers to become more efficient, thereby removing the excess capacity on which DoD has relied for surge requirements. DoD may be able to recapture some of the lost capability by purchasing organic specialized fleets. However, a better answer appears to be in partnering with commercial carriers and offering incentives to ensure needed capacity.

Rail Carriers

Railroads are a primary means of transportation during deployment because of security, flexibility, and high capacity. Since 1976, U.S. railway accessibility and capability have steadily declined. As a last resort to combat the capacity erosion, DoD can purchase and maintain critical track sections when commercial ownership is not viable. Shortline railroads, formed as the larger railroads centralized, are now critical to maintaining a feeder network to and from the main rail lines. Today, only a limited surplus of rolling stock is available to serve during defense emergencies. As a result, DoD has purchased a fleet of more than 2,000 railcars.

Inland Waterway Carriers

In recent years, various entities have examined the U.S. inland waterway system as a resource to transport military cargo. Continued application of technology to barge operations and integration of the inland waterway system into the nation's intermodal system makes this an area ripe for additional development.

INFRASTRUCTURE

Port Readiness

More than 95 percent of DoD cargo moves by sea. To ensure the readiness of military and commercial seaports to support deployment of military personnel and cargoes in national defense contingencies, nine governmental agencies formed a Port Readiness Network for enhanced coordination and cooperation. Members of the network are MARAD, the U.S. Atlantic Command, the U.S. Forces Command, USTRANSCOM, MSC, the Military Traffic Management Command, the U.S. Army Corps of Engineers, the U.S. Coast Guard, and the Maritime Defense Zone. Port Readiness Network representatives work directly with commercial port authorities in coordinating and informing them of defense needs.

Currently, DoD designates 13 U.S. commercial ports as strategically important. Many of these ports, because of their location and physical characteristics, need more of their overall capability to serve commercial interests. Despite an overall patriotic attitude, some ports are telling DoD that they cannot make their facilities available in emergencies as soon as DoD would like. Although DoD can shift some operations to other ports, this generally results in a slower deployment. To ensure that future commercial port planning includes military needs, DoD should consider involving metropolitan planning organizations in the early stages of planning for contingency port operations.

Theater Infrastructure Limitations

Once in theater, units still face the challenge of moving tactically into the fight. Ships carrying military cargo must compete with normal commercial cargo for discharge capability. Further, channel depth and quality of Third World nation port facilities are serious potential problems. Techniques such as JLOTS that enable units to bypass choke points at the port give the operational CINC a tremendous advantage in denying the enemy a chance to dig in for the fight. Rapidly deployable causeway ferries allowing for JLOTS operations are in both the Navy and Army inventories, and DoD is evaluating systems for off-loading in higher seastates. The U.S. Marines are now considering using future ships as assembly areas and lines of departure rather than grounded infrastructure. Offshore bases are being evaluated for technical feasibility.

TECHNOLOGY

Future military transportation must continue to take advantage of advances in the field of logistics. This involves increased use of computers and real-time communications, as well as a systems approach to integrating suppliers and users. DoD is committed to adopting commercial practices in its transportation operations when feasible and to sharing technology it develops with the commercial sector consistent with security restrictions. Much effort is necessary to improve efficient use of resources for commercial land, air, domestic water, and sea transportation.

Agile Port System

CCDOTT's Agile Port System will improve marine terminal efficiency by processing and scheduling cargo at an inland facility. As envisioned, this inland facility could support several marine terminals, thereby improving overall system flexibility and efficiency.

Automated Identification Technology

DoD is also making extensive use of automated identification technology to track the movement of ammunition, equipment, and sustainment supplies through DTS. These applications are an adaptation of commercial technology to a military problem.

Intelligent Transportation Systems

The advent of intelligent transportation systems (ITS) has resulted in the rapid and widespread adoption of a wide range of technologies to aid transportation. They include the use of wireless communications, radar, sophisticated computer-aided video detectors, and on-board computer and vehicle navigation systems, all leading to the evolution of an integrated and multimodal transportation concept enabled by technology. ITS could affect military transportation in many ways.

The same technology being developed to support commercial vehicle operations, including the use of automatic vehicle location, automated maintenance monitoring, computer-aided dispatch, and improved scheduling and routing, could be applied to aid the military in fleet management. Traveler aid technologies could be used to manage operations of a base or port or to improve convoy operations. The use of ITS standards by the military has the potential of supporting interservice interoperability and ensuring compatibility with civilian traffic management and vehicle dispatch systems.

Future Airlift Platforms

Extensive research and development is under way by commercial industry to improve airlift capabilities. In addition to the new C-17s, airlift assets could be improved by the use of modular heavy lifters and ultraheavy lifters (UHLs). UHLs are a combination dirigible and airplane with a speed of 120 knots and a payload of 500 tons. If commercial demand justifies it, heavy lifters could be on the market in 2004 or 2005. DoD has not yet invested in this technology but is actively engaged in assessing its capabilities.

Future Sealift Platforms

Fast ships will be indispensable in delivering lethal ground combat power to theater. New sealift vessels being researched include high-speed sealift (HSS) ships with a speed of 50 knots and a payload of 10,000 tons, three of which could carry a future brigade. The first commercial HSS vessels could be under contract in 1999 if financing is available. These vessels will be U.S.-flag, will be in roll-on/roll-off (RO/RO) configuration after the installation of DoD-provided national defense features, and will carry approximately 10,000 tons at 38 knots. DoD has medium-speed RO/RO ships that are larger, but they travel at only 24 knots.

Future Ground Vehicles

DoD vehicles under development are taking advantage of advances emerging from various technologies including ITS. Such enabling technologies include advanced vehicle propulsion systems providing increased fuel efficiency and composite materials to lighten the force and reduce maintenance costs. Another potential application is the industry-developed data bus for ITS vehicles to permit plug-and-play connection and integrated operation of electronic devices.

DoD is reducing military vehicle specification requirements and developing interchangeable equipment with commercial infrastructure standards. To reduce procurement and operations and maintenance costs, DoD is adopting off-the-shelf commercial engines and spare parts to the greatest extent possible. DoD is increasing cargo in-transit visibility by improving communications with ground vehicles. Future communications capability will allow fleet managers to document the location and status of each vehicle and keep shippers and receivers aware of this information.

Command and Control

Capturing source data to ensure visibility of assets within the DTS has always been a challenge. USTRANSCOM is DoD's lead agency for establishing in-transit visibility (ITV) using the Global Transportation Network (GTN) as a central repository for transportation information. GTN is an automated command-and-control information system that provides an integrated system of ITV information and command-and-control capabilities. GTN collects and integrates transportation information from selected DoD and

commercial transportation systems. The system enables USTRANSCOM to collect information about cargo and passengers at their points of origin and to track their movement through each node of the transportation network to the final destination. USTRANSCOM is working to reduce the number of computer systems that process transportation information, to achieve data standardization between services, and to promote compatibility between systems.

Transportation Data Security

Increased dependence on automation has given birth to a new threat—information warfare. Most of DoD's transportation data are running open and uncoded on the Internet. In future wars, the huge demand for communications will result in 60 percent of military communications being unclassified. A Defense Advanced Research Projects Agency program is focusing on transportation data security. The challenge is to develop advanced technologies to safeguard information, yet provide the capability to allow seamless movement between classified and unclassified systems and networks.

EMERGING AUTOMATION

Advanced Concept Technology Demonstrations

Advanced concept technology demonstrations (ACTDs) exploit mature and maturing technologies to solve important military problems. An example is the Joint Logistics ACTD, which is developing and migrating interoperable web-based joint logistics decision support tools to the Global Combat Support System. Its principal goal is to revolutionize the logistics planning and execution process by providing specific domain capabilities through rapid application of emerging technologies.

Common Framework Architectures

These efforts will create an environment to integrate existing and new deployment modeling and simulation tools, standardize data items, and link with external systems. An example is the Advanced Logistic Program, which is an effort to design, develop, and demonstrate an end-to-end DoD prototype logistics system based on a distributed intelligent architecture. The prototype will manage the logistics pipeline for DoD to enable the war fighter to have the right material in the right place at the right time with reduced reliance on large DoD inventories.

Another emerging architecture is the Analysis of Mobility Platform/Force Projection Modeling system, which is an integrated simulation that captures movement through the DTS at the individual cargo item level of detail. It evaluates the interaction of infrastructure and transport systems with the detailed transportability characteristics of the deploying force. Underlying this system is a series of nodal models that simulate specific functions within the DTS. Most of these tools are time-stepped, discrete event, stochastic simulations of deployment operations that determine throughput, identify constraints, and calculate clearance times for deploying units at the line-item level. They will interface with a wide range of associated databases, which range from geographic information systems to live data feeds.

SUMMARY

In the new millennium, DoD must increasingly rely on the efficiencies and capabilities offered by transportation technologies available in the civilian sector. On the other hand,

military transportation requirements pose a unique set of problems that differ from those of the commercial world. The most important problem is the need for rapid planning and execution of a complex set of activities including coordination, assignment, and scheduling and routing of land, air, and sealift resources; effective use of crews and support resources; coordination with users; and the integrated use of both military and commercial resources. Effectiveness and efficiency are critical. As proposals are made to improve military transportation, TRB's Committee on Military Transportation must endeavor to promote a balance between effectiveness and efficiency.

In a world of decreasing military force structure and increasing commitments, DoD must maintain access to sufficient commercial transport capacity and take advantage of developing technology, especially automation. DoD has long recognized this need and has established partnering relationships with civilian carriers involving multiple modes of transportation. However, the reduction in civilian excess capacity increases the need for close coordination. Perhaps more important is that the military needs real-time access to commercial and research resources. The goal is to get more out of the existing transportation infrastructure. To use a military term, technology is emerging as a force multiplier with the potential of enhancing the lift asset capability available to the military.

Finally, the critical task of the Committee on Military Transportation is to provide a mechanism for bringing the military, commercial, and research communities together to provide solutions to both military and civilian transportation problems that ensure successful military deployments with only minimal effects on commercial operations.

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