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Industry Study**

**Final Report
*Transportation***



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TRANSPORTATION 2006

ABSTRACT: A flexible and productive transportation system is vital to America's economy and national security. The overarching trend of globalization continues to challenge America's transportation system; parenthetically, these demands may yield challenges that are still largely uncertain. The global economy is exponentially increasing demand on transportation infrastructure and the system must compensate by better integrating modalities (i.e., trains, ships, etc.) and maximizing intermodal efficiency. A healthy balance must be achieved between the flow of international commerce and security requirements regardless of transportation mode. The sector's voracious consumption of energy, particularly petroleum-based fuels, coupled with increased global demand will present intractable challenges in the foreseeable future. Transportation modes are expanding and evolving as a result of dramatic increases in demand for services throughout the industry. This study examines three significant crosscutting challenges to the overall transportation system: capacity and congestion, security, and energy. The 2006 Transportation Industry Study observed many areas of strength within the transportation network, and the potential for initiatives to enhance future national security and economic prosperity.

Mr. James Adams, Dept of Homeland Security
 CDR Ron Carr, US Navy

COL Maroun Chebl, Lebanese Army

Mr. Robert Coleman, Dept of Defense

Lt. Col. William Costantini, US Marine Corps
 CDR Robert Cox, US Navy

Mr. William Dial, National Geospatial-Intelligence Agency

COL Robert Jenkins, US Air Force

CDR James McGovern, US Navy

COL Peter Mueller, US Army

Mr. Raymond Rowley, Bureau of Alcohol, Tobacco, Firearms and Explosives

Mr. Thomas Simoes, Office of the Secretary of Defense

COL Mark Spindler, US Army

Ms. Dawn Thomas, US Agency for International Development

COL Leo Thrush, US Army

COL Tim Williams, US Air Force Reserve

Mr. Steven Ditmeyer, Dept of Transportation, Faculty

CAPT Brian Scott, US Navy, Faculty

Dr. James Browning, Faculty

PLACES VISITED

Domestic

Department of Transportation, Office of the Secretary and modal administrations,
 Washington, DC
 Association of American Railroads, Washington, DC
 American Short Line and Regional Railroad Association, Washington, DC
 American Trucking Associations, Washington, DC
 American Association of State Highway and Transportation Officials, Washington, DC
 National Industrial Transportation League, Washington, DC
 Military Sealift Command, USNS Seay and USNS Comfort, Baltimore, MD
 Federal Aviation Administration, Air Traffic Control System Command Center,
 Herndon, VA
 Surface Transportation Information Sharing and Analysis Center, Herndon, VA
 Department of Homeland Security
 Transportation Security Operations Center, Herndon, VA
 Federal Air Marshall Operations Center, Herndon, VA
 JetBlue, Queens, NY
 Port Authority of New York and New Jersey
 US Coast Guard, Sector New York
 New York Container Terminal, Staten Island, NY
 Military Surface Deployment and Distribution Command, Ft. Eustis, VA
 APM Container Terminal, Norfolk, VA
 Overnite Transportation Company, Richmond, VA
 BNSF Railway, Ft Worth, TX
 Hillwood Properties/Alliance Airport, Ft Worth, TX
 American Airlines Maintenance Base, Ft. Worth, TX
 Federal Express, Ft Worth, TX
 Federal Aviation Administration, Terminal Radar Approach Control and Tower, Houston, TX
 Port of Houston Authority, Houston, TX
 Continental Airlines, Houston, TX

International

British Airways, London, United Kingdom
 BAA, plc (formerly British Airports Authority), London, United Kingdom
 Transport for London, United Kingdom
 GE SEACO, London, United Kingdom
 Network Rail, London, United Kingdom
 European Conference of Ministers of Transport, Paris, France
 International Union of Railways, Paris, France
 French Ministry of Transport, Paris, France
 French National Railways, Paris, France

RATP (Paris Metro), Paris, France
Port of Rotterdam, Netherlands

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PLACES VISITED (Continued)

Netherlands Customs, Rotterdam, Netherlands
European Container Terminal, Rotterdam, Netherlands
Maersk Terminal, Rotterdam, Netherlands
Van der Vlist Special Trucking, Groot Ammers, Netherlands
598th Transportation Terminal Group – Military Surface Deployment and Distribution
Command, Rotterdam, Netherlands
Dutch Inland Waterways, Rotterdam, Netherlands
KLM/Northwest, Amstelveen, Netherlands



INTRODUCTION

A flexible and productive transportation system is vital to America's economy and national security. Unfortunately, the extensive transportation network is often taken for granted until catastrophic events, such as 9/11 and Hurricane Katrina, reaffirm the industry's importance. The nation's transportation system is a "network of networks" that defines our nation's supply chain and connects the populace with their families, employment, entertainment, education, and greater global economy. Globalization challenges America's transportation system both now and into the future.

The anticipated increase in demand throughout the transportation system will compound issues associated with the industry's limited capacity, and require greater intermodal emphasis to maximize efficiency. China, India, and Mexico have emerged as America's major trading partners; and estimates suggest that truck and containerized cargo will double by 2025. The globalized economy is dramatically increasing demand on transportation infrastructure and the system must compensate by better integrating modalities (i.e., trains, ships, etc.) and maximizing intermodal efficiency.

Achieving a healthy balance between the flow of international commerce and security requirements regardless of transportation mode is essential. Transportation infrastructure worldwide has become the most commonly targeted venue for terrorists, but the principal issue is securing the industry while promoting and enhancing the movement of people and commerce. The sector's heavy consumption of energy, particularly petroleum-based fuels, coupled with increased global demand for both transportation and energy, will present intractable challenges in the foreseeable future.

This document represents the collective efforts of an interagency task-force that analyzed the continuum of the transportation industry. The paper will identify the industry's key challenges and make recommendations within the context of its current conditions and future outlook. Furthermore, the study includes an assessment of the federal government's role and responsibilities as it applies to the industry.

THE INDUSTRY DEFINED

The transportation industry is vital to America's economy and national security. Often referred to as the "circulatory system" of our nation's economy, the transportation system is extensive and interdependent. For the purposes of this analysis, the industry is categorized into four sectors: trucking, maritime, rail, and aviation.

Trucking – The trucking sector includes both truckload carriers (TL) that deliver full truck loads for shippers, and less-than-truckload (LTL) carriers that deliver smaller loads for several shippers consolidated onto individual trucks. TL carriers generally deliver loads longer distances from point to point. Large LTL carriers employ a hub and spoke system to move freight, while smaller LTL carriers generally pick up and deliver loads within local areas. There are over 650,000 trucking firms in the United States, with a majority of companies owning fewer

than six trucks. Private trucking includes companies such as Walmart that have integrated this capability into their supply chain.

Maritime – For the purposes of this document, the maritime industry analysis focuses on two distinct but interdependent components: *Shipping* and *Seaports*. The shipping industry component focuses on transportation of goods by way of the seas and inland waterways. The transoceanic industry is dominated by Maersk which transports approximately 20 percent of containers worldwide. The seaport component generally focuses on municipal and state port authorities that own and lease the real estate, facilities and operations at seaports and ocean terminals to private operators. More than 95 percent of the nation’s overseas cargo moves through the 299 deep draft harbors.

Rail – The railroad sector encompasses both freight and passenger railroads and is characterized by private ownership of freight rail infrastructure and operations, and public ownership of passenger rail infrastructure and operations. Railroads are critical to the North American transportation network and collectively move more than 40 percent of all freight transported in the United States by weight. Freight railroads are often the only realistic method to move many bulk cargos such as coal or chemicals. The growth in international trade and road congestion has created huge growth in the intermodal shipment of containers via rail. Passenger rail is critical to relieve congestion in some large urban areas and along corridors on both coasts, but the sustainability of an integrated national passenger rail system under Amtrak remains in doubt.

Aviation – The aviation analysis focused on commercial passenger carriers consisting of legacy airlines (e.g. American and Continental) and low-cost carriers (LCCs) (e.g., JetBlue and Southwest). These carriers transport cargo as well, but concentrate their business decisions around passenger movement.

MODAL ANALYSIS

The most significant factor influencing the growth of the transportation industry is the state of the national economy. As the national economy grows and the production and sales of goods increases, there is an increase in the demand for transportation services to move goods through the supply chain. During economic downturns, the transportation industry is one of the first to slow down as orders for goods and shipments decline.

Currently, transportation modes are expanding and evolving as a result of dramatic increases in demand for services throughout the industry. This section will frame individual transportation industry sectors and describe current conditions and future outlooks. The analysis of individual sectors provides context to the greater transportation industry and identifies significant challenges and trends that transcend modes.

Trucking

Current Conditions – Competition in truck transportation is intense, particularly between trucking companies. Some long-haul truckload companies also compete against the railroad industry. Trucking companies are sensitive to increasing energy prices. However, thus far most firms successfully passed on increasing energy costs to consumers. Trucking accounts for the bulk of domestic freight transportation.

Outlook – Trucking remains a viable but slow growth industry. Additional growth will result from manufacturers' willingness to concentrate more on their core competencies – producing goods – while outsourcing their distribution functions to trucking companies, which can perform these tasks for less money. As firms in other industries increasingly employ the industry's logistical services, such as inventory management and just-in-time shipping, many new jobs will be created. Also, as more consumers and businesses make purchases over the internet, the expansion of electronic commerce will continue to increase demand for transportation and value-added services offered by the truck transportation industry.

Due to intense competition and a fragmented industry, profit margins will likely remain slim – averaging approximately two to four percent. Barriers to entry are low, resulting in numerous trucking company startups and failures every year. A continuing difficulty facing firms is a shortage of qualified drivers. A combination of market forces (low unemployment and low wages for drivers) and regulatory policy (age requirement for commercial driver's license) exacerbate the challenge.

Maritime

Current Conditions – The worldwide shipping industry and, as a result, U.S. seaports are experiencing traffic growth due to increased demand for low priced manufactured goods from overseas suppliers. Arguably, the most efficient way to transport these goods to U.S. markets is by transoceanic containerized cargo. The global leader in the shipping industry is Maersk Lines. In late 2005, Maersk acquired P&O Nedlloyd, raising their market share to 20 percent of the worldwide container volume. The industry is highly fragmented; with 56 percent of container volume shipped by the top ten shipping firms and 44 percent shipped by hundreds of small companies (Pentimonti, personal communication, April 11, 2006).

Contrary to trends in the worldwide shipping industry, the domestic industry is declining largely because of legacy protectionist measures from the Merchant Marine Act of 1920 (Section 27) or, as it is commonly referred to, the Jones Act. This law constrains American competitiveness in the industry by mandating that cargo in the U.S. bound for another domestic port must be carried on U.S. built, flagged, and crewed ships. This law results in higher cost to consumers and marginalizes American competitiveness in the industry.

Seaport operations in the U.S. include 299 deep-draft harbors, 14 Strategic Ports (as designated by DOD), and 627 shallow-draft harbors. By volume, ocean cargo accounts for 95 percent of U.S. international trade (Steinke, 2002, p.1). “North American port volumes have increased an average of 7 percent per year since 1990” (Maloni, 2005 Spring, p.16). One of the fastest growing sectors of seaport operations is the shipment of containers. In 2003, U.S. ports

handled more than 35 million twenty-foot TEU, an increase of over seven million containers in just three years (Maloni, 2005 Summer, p.2). Eight U.S. ports accounted for nearly 70 percent of all container movement in 2003.

Since 9/11, America's seaports have been undergoing a transformation as port authorities and port terminal operators endeavor to harden infrastructure to meet recently enacted government security regulations and mandates. Meanwhile, U.S. government agencies such as the U.S. Coast Guard (USCG) and the Customs and Border Protection (CBP) have implemented new and increasingly costly security regulations and programs designed to safeguard American ports from the threats posed by a smuggled nuclear weapon or radiological "dirty" bomb.

Outlook – While American seaports are able to effectively accommodate international maritime commerce, serious capacity challenges are emerging. Current predictions indicate that seaport volumes will double in the next twenty years, with some individual ports experiencing triple or quadruple their current volume. American seaports could have significant capacity deficits by 2010, and southeastern ports may reach throughput capacity within eight years (Maloni, 2005, p.16).

Port authorities, terminal operators, and transportation officials are clearly aware of the increasing demand and congestion at domestic ports. Congestion and capacity problems vary by region. However, transportation stakeholders are taking actions to mitigate the growing challenges. These measures include expanding terminals, constructing and enhancing inter-modal facilities, deepening harbor channels, and employing some innovative management techniques. Unfortunately, it is unlikely these actions alone will be sufficient to meet growing demand.

The security outlook for America's seaports is uncertain. The anticipated growth of seaport volume will undoubtedly bring new security challenges. While progress has been made in securing U.S. seaports since 9/11 more needs to be done. Of critical importance are closing gaps in the National Maritime Security Strategy and further developing effective coordination between the USCG, CBP, and other agencies with equity in transportation security. Better cooperation and coordination is needed between U.S. agencies and various partners, including port authorities and foreign governments.

Rail

Current Conditions – Four large railroads dominate freight traffic in the U.S.; i.e., the Union Pacific and Burlington Northern Santa Fe railroads in the western U.S., and CSX and Norfolk Southern railroads in the eastern half of the country. Three other railroads earn significant revenue within the U.S; i.e., Kansas City Southern in the south central U.S. and Canadian National and Canadian Pacific railroads, which have extensive infrastructure and operations in the U.S. amassed through mergers and acquisitions. Together these seven railroads earn 93 percent of the North American rail freight revenue and they are collectively referred to as Class-I railroads. Numerous regional and short-line railroads (called Class II and Class III railroads) connect with the major rail systems to complete the network. Amtrak provides nationwide inter-city passenger service while 18 public lines provide commuter rail service.

Traditionally, railroading was viewed as a low technology, large capital investment industry, with little growth potential. However, many of the goals of greater efficiency and profitability born from deregulation in the 1980s, and a host of mega-mergers in the 1990s, were reached. Today, the nation's largest railroads have great potential for growth and the ability to increase their market share of the burgeoning freight transportation business. Freight railroads are quite profitable and are beginning to invest in the development and integration of technologies that will increase efficiency, improve safety, and reduce personnel costs. However, passenger rail remains inefficient and unprofitable, but a necessary part of the U.S. transportation system, especially along the Atlantic and Pacific coasts, and in more densely populated urbanized regions.

Outlook – The future of the railroad industry looks bright. The desired efficiencies from deregulation, consolidation, and mergers, finally have occurred and the profitability of railroads has increased greatly. The trend of improved efficiency and increased profitability will likely continue, but the pace of revenue growth will likely moderate. In the future, private railroads will look for opportunities to partner with state and local governments for large infrastructure improvements to increase capacity and improve safety. Railroads reaching capacity will find that partnerships are necessary to raise capital for some mega-projects; for example, the Chicago Regional Environmental and Transportation Efficiency project (CREATE) designed to mitigate congestion.

An area of future concern for the railroads should include balancing increased profits with public perception of fair shipping rates. With the railroads' increased profits over the last few years, many shippers perceive the railroads are being exploitive by gouging customers. With this perception, shippers could use their elected representatives to increase pressure for more regulation of the industry – which would not be beneficial for the railroads or the nation's transportation network.

Another trend that may continue is additional mergers or partnerships, especially between one of the eastern railroads and one of the western railroads. Although the Surface Transportation Board may not allow such a merger, railroads will continue to collaborate to increase efficiency and provide increased capacity at the lowest possible infrastructure cost.

Finally, the technology explosion which has just barely reached the railroads will be unleashed in the near future. Integrating more advanced software dispatching and operating systems, using GPS for better efficiency and to increase capacity, and utilizing more remote control operations will provide better, faster, more reliable and more transparent service to customers throughout the nation.

Aviation

Current Conditions – Competition among airline carriers is fierce. The industry has not recorded a profit since 2000, but is losing less each year since 2003 as companies look for ways to decrease their Cost per Available Seat Mile (CASM) and increase their Revenue per Available Seat Mile (RASM). LCCs have some advantages over legacy carriers and have forced the legacies to match pricing on like routes.

LCCs reduce costs in several ways. First, by using secondary airports, LCCs avoid the higher fees associated with primary airports. Second, LCCs limit the types of aircraft they operate, streamlining operations, training and maintenance. Third, LCCs generally operate new aircraft, limiting maintenance costs. Lastly, LCCs generally have a newer and younger workforce which reduces wages and benefits as compared to their legacy counterparts.

The legacy carriers also are trying to reduce costs in several ways to better compete with the LCCs on ticket prices. First, many legacy carriers have renegotiated wage and benefit plans to overcome higher costs that are associated with a more senior work force. They also are reinvesting in newer, more fuel-efficient aircraft fleets to reduce maintenance costs and fuel consumption.

Since 2000, 19 U.S. carriers either filed for bankruptcy protection (e.g. Delta and Northwest) or liquidated (e.g., Legend and Independence Air). Start-up airlines, such as Independence Air, tended to expand too quickly with their aircraft purchases, which makes it difficult to cover their initial investments. The only major legacy carriers to avoid bankruptcy in that timeframe were American and Continental Airlines. They did so by cutting costs and reducing wages within management first. This made it more acceptable to its unions to make concessions in their labor contracts.

As fuel prices continue to rise, it has replaced labor as aviation's largest financial concern. Between 2000 and 2005, the airline industry consumed four percent less fuel and aircraft fuel efficiency increased by 18 percent. However, during the same time period the fuel bill more than doubled from \$16.4B to \$33B (Heimlich, 2006). According to Air Transportation Association (ATA), under current cost structures, it is extremely difficult for airlines to be profitable when the average price per gallon exceeds \$1.67 (Subcommittee, 2006). Unfortunately, the first quarter 2006 average price per gallon was \$1.93 (Heimlich, 2006). Therefore, some carriers incorporated fuel hedging as a strategy to reduce costs. However, carriers operating under chapter 11 bankruptcy are limited in using this strategy because of their hampered ability to borrow money.

Outlook – In 2006, the airline industry will continue to face high fuel costs. Additionally, LCCs and the possible addition of new services (e.g., air taxis) will continue to drive intense price competition. Nevertheless, the industry expects to return to profitability in 2007 through consolidations, international expansion, stabilized fuel prices and the use of innovative technologies.

Consolidation and international expansion is a means for carriers to cover more routes, stay competitive and increase their RASM. America West and US Airways joined forces to take advantage of America West's strong west coast presence and US Airways lucrative east coast markets. Alliances, such as Skyteam (among Continental, Northwest, KLM, Delta, and Air France), provide service on an international basis by giving the customer access to global routes through one ticketing avenue. Northwest and KLM also have a joint partnership, taking the alliance concept one step further by actually flying some of each other's more heavily traveled routes and sharing the costs and profits.

Technological advances will make it easier for customers to check-in and allow aircraft to operate more fuel efficiently. Computer advances will give the international airline industry the ability to achieve 100 percent ticket less travel by 2007. Further cost reductions can be

achieved through improved information technologies that provide a full range of services on the internet and through self-service kiosks at airports and other locations (IATA, 2006). Lastly, advances in aircraft structure and engine technology continue to make aircraft more fuel efficient.

INDUSTRY CHALLENGES

Analysis of individual transportation sectors provides common trends and challenges facing the interconnected industry. Challenges in one transportation mode will have cascading effects throughout the entire system. The transportation industry is of vital importance to the U.S. economy and national security, and requires an analysis of these challenges that transcend individual modes. The purpose of this section is to address the crosscutting challenges to the overall transportation system: *capacity and congestion, security, and energy*.

Capacity & Congestion

Most transportation professionals agree that increased congestion and limited capacity may be the most concerning challenges that face the nation's transportation network and the supply chains that utilize it. Increasingly congested facilities in all modes of transport have cascading effects throughout the U.S. economy. According to the Transportation Research Board's Critical Issues in Transportation (2005), "[c]ongestion occurs during longer portions of the day and delays more travelers and goods than ever before" (p. 2). The economy is affected because longer travel times increase transportation costs. Furthermore, the lack of reliable delivery requires businesses to maintain greater inventory, which is contrary to just-in-time logistics. Regardless, frustrations of increased congestion affect the entire economy, and greater investment and innovation is urgently necessary across the entire transportation system.

Trucking. As highways in almost every American city are reaching capacity, the trucking industry's ability to meet the demands of manufacturers and distributors is being seriously challenged. Growing congestion threatens the efficiency, speed, and reliability expected from truck deliveries. The impact of congestion on the trucking industry includes slow average speeds, unreliable travel and delivery times, increased driver frustration and low morale, higher fuel and maintenance costs, and an increased number of accidents and insurance costs. One suggestion by the Texas Transportation Commission was to designate certain highway lanes for the exclusive use of large trucks. Other options recommended by the American Trucking Associations include adding capacity on significant freight corridors and fixing major bottlenecks.

Maritime. To accommodate the increases in demand throughout the maritime sector, larger ships are being built to accommodate more containerized cargo. As cargo volumes increase, there is demand for larger, more efficient port facilities. Expanding infrastructure is expensive and time consuming, and there are physical limitations to this alternative. Competition for federal dollars to support channel projects is becoming more intense and local communities have fought port expansions based upon social and environmental concerns. While

different countries, states, and ports have different capabilities to deal with growing congestion; there are two key actions that the U.S. must better develop to deal with this issue. They include improving operational efficiencies through better use of IT and systems planning, and a more integrated approach to the planning and development of transportation networks. Moreover, governmental policies should be oriented toward achieving greater synergy throughout the entire transportation network. Unfortunately, the current modal emphasis within the Department of Transportation (DOT) and fragmented structure of Congressional oversight committees suggest the difficulties associated with implementing this recommendation.

Rail. The growth in containerized freight will require more rail capacity. The freight capacity shortfall has been growing steadily over the past few years, but mainly was the focus of shippers and transportation officials. Recently, that has changed. Now business leaders recognize the problem and are sounding the alarm about an oncoming freight railway capacity crisis. There are a number of ways railroad capacity is being improved, the most basic being an increase in the infrastructure – track, sidings, terminals, locomotives and rolling stock. Furthermore, the seven major railroads in North America have been spending tremendous amounts of capital over the past decade in order to increase capacity and fluidity within the rail enterprise. The railroads' financial struggle to fund infrastructure in an era of high capital costs resulted in a change from their traditional anti-government role to a more pragmatic view of a public-private partnership for selected projects. This strategic position ideally will achieve a balance between private ownership of railroads and the public need for more capacity on the rails. Although, congestion problems will continue to grow within America's transportation network, railroads offer a viable and cost-effective alternative for moving more freight and passengers off congested highways. Railroads must balance the need for additional capacity with the realities and cost efficiencies of a cyclical industry and a high cost of maintenance.

Aviation. Congestion due to air travel is felt well before takeoff and well after landing. Federal Aviation Administration (FAA) estimates that air traffic in the U.S. will triple in twenty years. Government administrations consider safety when addressing congestion issues which often hampers initiatives to decrease it.

The federal government affects congestion through the efforts of the Transportation Security Administration (TSA) and the FAA. TSA performs personal scans of everyone who sets off an alarm at security checkpoints, which backs up the lines of passengers and luggage. TSA is working, however, with the airports and airlines to schedule more screeners during peak travel times. The FAA has strict separation criteria ensuring safe distances between aircraft that can back up airways when the demand for a route is high. The FAA recently reduced the vertical separation from 2,000 to 1,000 feet on high-altitude jet routes, effectively doubling the airspace capacity.

Airport authorities are working hard to decrease congestion by linking airports with mass transit, and by expanding infrastructure, such as terminals and runways, to accommodate the increase in travelers. Airlines are always trying to decrease congestion to attract more passengers. Internet check-in at home and kiosk check-in at the airport has minimized ticket counter lines, while de-conflicting departure and arrival times has dispersed the amount of people in airports during layovers.

Security

Since 9/11, significant efforts were undertaken to prevent future acts of terrorism and reduce vulnerabilities. A natural tension exists between encouraging global commerce and travel and the need for security. Security is a shared responsibility among both public and private entities, but collectively, the nation is beginning to understand the need for a healthy balance between fostering trade in a globalized world and the requirement for security.

Trucking. The challenge facing the trucking industry is the security of cargo as it enters and transits the U.S. This industry has addressed many security challenges to protect against potential terrorist attacks within their sector. In addition, the federal government has taken significant steps to enhance security measures within the trucking industry. As a result, many improvements were made to ensure better trailer and container security, safer border crossings with Canada and Mexico, and stronger regulations to control the transportation of hazardous material. The trucking industry continues to work closely with the federal government to ensure the economic strength of the nation through the safe and secure transportation of goods. The federal government must also continue to recognize the importance of the trucking industry to the national economy and ensure security measures are fair and cost effective.

Maritime. Among the key security challenges to America's maritime industry is identifying the threat with some degree of certainty, and implementing protective measures that minimize vulnerabilities – while ensuring the free flow of cargo vital to our nation's economy. Many security experts believe that it is only a matter of time before terrorists exploit the existing vulnerabilities in the maritime sector. However, experts are divided regarding the appropriate response. Most agree that the greatest critical maritime vulnerability is the introduction of a nuclear device concealed in a shipping container. The challenge lies in the improvement of the existing multi-layered security response, of which key components include: the hardening of port infrastructure, security programs such as the Container Security Initiative (CSI) and the Customs-Trade Partnerships Against Terrorism (C-TPAT), an incipient Transportation Worker Identification Card (TWIC), and the development and employment of non-intrusive screening equipment.

Rail. Security remains an evolving challenge as railroads face the formidable task of securing a dynamic freight system over long distances. It is vital to U.S. economic prosperity and national security to ensure the rail industry is protected to the greatest extent possible from attacks and sabotage, and continues to transport the supplies, goods, and workforce unimpeded. The rail system, both passenger and freight, is an open-system, highly vulnerable to attack throughout its infrastructure. Ironically, the open nature of the railroad is both its greatest vulnerability – and its greatest appeal. Recognizing the impracticality of hardening the security of an open transportation system (not to mention the huge economic cost), the railroad industry adopted a *consequence management* security strategy – a strategy centered on minimizing the harm of an attack, as opposed to a prevention strategy (CRS, 2006, p. 5). Towards this end, significant security improvements by both public and government agencies were made; namely in intelligence gathering and communication, improved screening of “high-risk” cargo, formalizing vulnerability assessments throughout the industry, increased security training for employees, incorporating new technological developments into the security architecture, and increased funding toward security infrastructure upgrades, and hiring of more security personnel.

The railroad industry understands that its security strategy requires continuous improvements and coordination with federal agencies to integrate and accomplish its security objectives. Actions are ongoing to improve: positive train control, positive identification of passengers and employees, vulnerability assessments as it pertains to the movement of hazardous cargo, and strong leadership to shape public expectations, protect its own infrastructure, and minimize harm to this vital industry.

Aviation. Since 9/11, airline security is a top national priority. There continue to be numerous debates concerning the most effective and proper amount of airline security. A tenuous balance exists between safety, convenience, civil liberties, and the cost of increased security. Airline security can be divided into two main areas: *airport* and *airplane*. Airport security was assigned to the TSA. TSA has made significant improvements in screening, such as creating watch lists, utilizing improved explosive detection devices, and upgrading commercial cargo screening. Aircraft security was improved through FAA-mandated use of reinforced cockpit doors, increased Federal Air Marshal presence, the ability of the cockpit crew to carry firearms, and crew operating procedures to prevent access to the cockpit.

Energy

The U.S. economy relies heavily on the most energy-intensive modes of transportation – trucking and aviation. The transportation network’s abundant consumption of petroleum-based energy makes the U.S. highly dependent on foreign energy sources. This dependency has renewed interest in alternative fuels and increased domestic production. The commercial transportation sector represents approximately 30 percent of fossil fuel consumption, and projected increases in transportation demand will cause that share to rise (Transportation Research Board, p. 5).

Trucking. A major challenge for the trucking industry is the new fuel requirement for diesel trucks. In an effort to dramatically reduce air pollution, the EPA mandated that by October 15, 2006, 80 percent of the diesel fuel sold in America for on-road use must contain ultra-low sulfur diesel (ULSD). The new fuel will have no more than 15 parts per million (ppm) of sulfur. By 2010, all diesel fuel sold in the U.S. for vehicle use must meet this standard. This is a change from the current 500 ppm of sulfur found in today’s diesel fuel. There are two major issues that will emerge from this change: the first will be the dramatic improvement in air quality resulting from the use of lower sulfur fuel, and the second will be the economic effect that every American consumer will feel due to the higher cost of ULSD fuel and the diesel trucks that will run on it.

Aviation. The high cost of fuel has become the number one issue for the airline industry. Since airlines can not control jet fuel prices, they continue to take aggressive measures to conserve fuel. Fuel conservation measures range from: optimizing flight planning for minimum fuel-burn routes and altitudes, cruising longer at higher altitudes, reducing onboard weight, employing single-engine taxi when able, and fleet modernization for more fuel-efficient airplanes.

GOVERNMENT GOALS AND ROLES

Throughout the nation's history, the federal government has played a significant role influencing the direction and development of the transportation industry. Congress influences through laws authorizing regulations and appropriations, while the executive branch oversees the implementation of these laws through policy, writing of regulations, and disbursement of appropriated funds. Governmental influence is necessary, but has produced both positive and negative impacts on the industry. An assessment of these impacts provides the context for evaluating the future role required by the federal government.

The government's actions provided positive influence in a number of broad categories. These actions include deregulation of the trucking, rail and aviation sectors; establishing safety standards along modes; actions to enhance environmental protection; funding infrastructure development for waterways, roads, highways and airports; and most recently establishing security requirements that directly affect our national security and the efficiency of the transportation system.

The government's deregulation of the railroad, trucking, and airline industries was productive. This allowed market forces to take hold and produced advancements in both industries. Deregulation of the railroads provided the flexibility that allowed them to rationalize and upgrade their systems, reinvest in productive rail infrastructure, generate higher levels of service and greater volumes of traffic, company mergers, increase productivity, improve profitability, and improve safety and lower rates for shippers. Deregulation of the airline industry allowed market forces to drive industry decisions considering routes, price, frequency of flights, and amenities. It has, thereby, facilitated efficiency in the airline industry. Deregulation shows the value of competitive pressure on the marketplace as the best vehicle to shape the economic environment of this industry rather than strict governmental regulation.

Trucking. Recent federal actions are negatively impacting the trucking industry. The DOT's Commercial Drivers License program, which set a minimum age of 21, eliminated the ability of truckers to attract a younger workforce to a sector that is significantly short of truck drivers. A 2005 regulation by the Federal Motor Carrier Safety Administration mandates that dual drivers using sleeper cabs must spend eight consecutive hours in the sleeper, plus two additional consecutive hours off duty. This could lead to longer transit times for long-haul truckers, which could reduce industry efficiency. The National Highway Traffic Safety Administration requirements for trucks to improve their braking distance by 20 to 30 percent in the next two years; and new EPA regulations mandating the use of ultra-low sulfur diesel fuel by October 15, 2006 will result in additional costs that will be passed on to the consumer.

Maritime. There are also examples of governmental intervention that are not working as intended in the maritime sector. The domestic shipping industry is in decline due in part to protectionist measures remaining from the Merchant Marine Act (Jones Act) of 1920. Additionally, U.S. critical waterway infrastructure is not receiving adequate funding, even though the Harbor Maintenance Trust Fund was established to generate funds for this specific purpose. The balance of this trust fund is expected to reach \$3.96 billion by the end of 2007. However, rather than investing these funds in needed infrastructure, the federal government is using this trust fund balance to help offset the huge federal budget deficit.

Aviation. Today, the FAA remains a government agency. This agency continues to struggle for funds and authorization to obtain the most modern technology that could enhance its ability to more efficiently and effectively manage the growing capacity challenges in the national airspace. Many countries around the world privatized this function in an effort to use market forces to incentivize their air traffic systems to keep pace with modern times.

These criticisms of the federal role over strictly modal issues lead to a concern over the governments ability address more complicated, crosscutting, and intermodal or network issues such as congestion, security, or energy challenges. While both the DOT and Congress have identified these challenges, they continue to organize and operate in inefficient modal stovepipes.

DOT operates through twelve modal administrations with little coordination or synergy between sectors. Additionally, DOT does not address security issues. Security matters, which today can have far reaching consequences for this industry, were consolidated in the Department of Homeland Security (DHS) – where decisions are made with limited input from transportation experts.

A similar parochialism is seen in Congressional oversight. Transportation appropriations are generally managed by two different subcommittees; Energy and Water, and Transportation in both the House and Senate. The Authorization committees operate in strict stovepipes, six in the House and three separate full committees in the Senate (Banking, Housing, and Urban Affairs, Commerce, Science and Transportation, Environment and Public Works). The discordant Congressional structure relative to homeland security encompasses roughly 85 committees and subcommittees which also impact the transportation sector. This fractionalized structure often lacks coordination and produces inefficient allocation of resources.

The stovepipe structure results in significant fights for funding by mode rather than a coordinated, integrated allocation of resources to support transportation network priorities. These funding battles typically lack impartial assessments or prioritization based upon overriding benefits to the nation. Congressional earmarks are another inefficient practice. Appropriations for specific “pet” projects siphon critical funds away from more valuable uses. A recent example in the 2006 Transportation Bill was a \$2.5 billion loan guarantee for new rail for the small Dakota & Eastern Railroad by a South Dakota Senator. While, “[t]his earmark dwarfs most pork projects...it remains part of a skyrocketing trend. From 1994-2005 the number of earmarks more than tripled, while their cost shot up from \$30 billion to \$47 billion” (Knight, 2006, p.27).

The government’s actions will influence how congestion, security and energy challenges are addressed in the nation. The federal government must learn from past decisions that have enhanced or hurt this industry. It must develop processes that encourage efficiency and synergy between modes, and an organizational structure that is better postured to provide integrated network solutions, rather than costly, inefficient, independent, single mode answers. There needs to be a better alignment of both executive and legislative functions to address the intermodal network rather than modal stovepipes. There needs to be better coordination between DHS and DOT on security matters. Finally, the government must better leverage the free market economy by encouraging public private partnerships or private industry investments to produce a more modern and efficient transportation network and additional resources to fund infrastructure needs.

CONCLUSIONS AND RECOMMENDATIONS

The 2006 Transportation Industry Study observed areas of strength and weakness in both the public and private sector areas of the industry. There were good and bad examples of initiatives to improve the performance of the industry, leading to some recommendations on how to enhance national security and economic prosperity.

The first conclusion is the transportation industry should be viewed as an interconnected “network of networks.” Each individual mode is inextricably linked to the other modes. Solving a problem associated with a single mode often has negative, and sometimes unforeseen, consequences in another mode. To resolve this issue, the Industry Study recommends that Executive and Legislative branch functions be aligned to reflect an intermodal approach. In the Executive branch, DOT should adopt an intermodal matrix-structured organization to facilitate integrated solutions to critical issues. Instead of the current structure of agencies within DOT being responsible for a single mode or function (e.g., Federal Highway Administration, Federal Aviation Administration) leading to stove piped planning and execution, the DOT should include all modes in approaching its responsibilities. Realigning the Legislative branch would require a reorganization of Congress’ committees and subcommittees. Congress would be forced to allocate funds and conduct oversight with the entire network in mind. Aligning the Federal government in this manner most likely would have the effect of forcing state and local governments to follow suit.

The second conclusion is infrastructure in each mode is approaching or at capacity, and expanding the physical infrastructure is a capital intensive endeavor. Congestion of the current infrastructure was a common theme of public and private sector officials the Industry Study encountered. Each had concerns that current plans will not meet forecasted infrastructure demands caused by increasing traffic growth.

To address this requirement, the Industry Study offers the following recommendations. First, DOT should take the lead to expand and promote public-private partnerships in intermodal infrastructure development. Neither the public nor private sector has demonstrated the ability to unilaterally make the investments required to expand the infrastructure to meet future needs. The Industry Study witnessed several public-private ventures that hold promise in resolving the dilemma. Examples include private companies paying long-term leases to operate toll roads; private companies operating air traffic control systems; public-private partnerships expanding port facilities; and private railroads operating on public rail infrastructure. Combining the private profit motive with government responsibilities to serve constituents will produce synergy toward integrated development.

DOT should develop and expand a center of excellence for the use of technology on current infrastructure. DOT should encourage the investment and conduct the research and development that produces technologies that can more efficiently use the current infrastructure and survive a business case analysis. This technology could then be passed to the private sector for implementation and operation. Leveraging technology to increase capacity could provide some congestion relief. For example, this might take the form of a smart highway that positively controls vehicles, allowing for greater density. GPS combined with positive train control could reduce the distances maintained between trains, thereby increasing capacity. Any tax dollars

devoted to such research would be recouped by greater revenue associated with the increased economic activity generated by more efficient infrastructure use.

Another conclusion is that security is an industry imperative. Transportation assets and networks are the target or venue of choice for terrorists. The 9/11 attacks, Madrid train bombing, and London subway attacks are all examples of how terrorists use the transportation industry to pursue their objectives. Each private and public sector official that the Industry Study met with discussed security issues and the affect that these issues have on their particular responsibilities.

The current U.S. Government structure places federal responsibilities for security primarily with DHS. DOT is fundamentally responsible for strategic planning, policy, safety, and management of the transportation system. An underlying theme throughout the study was the natural tension that exists between the need to maintain commerce and the requirement for security. Indicators suggest that as DHS organizationally matures; those with equities in transportation security achieve a greater understanding of the need for a healthy balance between the two. Debates exist whether TSA, and others with transportation security responsibilities, should reside in DHS or DOT. The Transportation Study recommends that coordination between the two cabinet departments be expanded. This could take the form of formal structures being developed, and informal meetings or other activities between agencies.

A final recommendation regarding security is that DOT implement the TWIC program. Conducting the necessary background checks and issuing a federally recognized credential will eliminate some redundant security efforts, create a single standard, and provide additional security for the entire network.

ESSAYS ON MAJOR ISSUES

Challenges in one transportation mode will have cascading effects throughout the entire system. For this reason, detailed essays relative to the industry's crosscutting challenges are included as appendices.

1. Appendix A: U.S. Seaport Congestion: The Need for Capacity and Capability Improvements
2. Appendix B: Examination of U.S. Railroad Security Challenges: Post 9/11
3. Appendix C: The Greening of Commercial Trucking

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APPENDIX A: UNITED STATES SEAPORT CONGESTION: THE NEED FOR CAPACITY AND CAPABILITY IMPROVEMENTS

INTRODUCTION

The Honorable Jeffrey N. Shane, Under Secretary for Transportation Policy at the U.S. Department of Transportation (DOT) stated in March 2006 that transportation congestion was one of the most significant issues facing this Nation (2006). While United States seaports are able to effectively provide for the entry of foreign imports and exit of U.S. goods, serious capacity challenges are emerging. Recent studies predict North American ports could have significant capacity deficits by 2010 and southeastern ports may reach throughput capacity within eight years (Maloni, 2005 Spring, p.16). Today, port authorities, terminal operators and government entities are all pursuing actions to mitigate the pending capacity crisis. A critical question is whether these actions are well coordinated and sufficient to meet growing needs. This paper presents the growing demand and congestion challenges facing the nation's seaport infrastructure and operations; current actions being taken to increase capacity in an attempt to keep up with demand; and finally, additional actions necessary to meet future needs and better posture U.S. ports to handle the goods that fuel the nation's economy.

U.S. SEAPORTS – GROWING DEMAND FOR INCREASED CAPACITY

U.S. seaports play an absolutely vital role in our national economy. In 2004, the U.S. exported about \$800 billion in goods and imported \$1,470 billion in goods with \$719 billion of the imports, or 49 percent, entering through the nation's seaports (Arnold, 2006, p.4). By volume, ocean cargo accounts for 95 percent of U.S. international trade (Steinke, 2002, p.1). The U.S. has come to rely heavily on the imports of cheaper, low cost goods from overseas. WALMART, for example, relies on imports for 90% of the items it sells in the U.S. (Breskin, 2005, p.36).

A recent analysis reported that "North American port volumes have increased an average of 7 percent per year since 1990 [and predicted] that container port volumes will at least double by 2020, with some individual ports seeing triple or quadruple growth" (Maloni, 2005 Spring, p.16). In 2003 the nation's ports handled more than 35 million twenty-foot equivalent units (TEUs) of containers. This was an increase over previous years which saw 32 million TEUs in 2002, 30 million in 2001 and 2000, and 28 million in 1999 (Maloni, 2005 Summer, p.2). Eight U.S. ports accounted for nearly 70percent of all container movement in 2003. These ports are Los Angeles/Long Beach (LA/LB) with 11.9 million TEUs or 33.2 percent of the throughput, the port of New York/New Jersey handled 4.1 million or 11.4 percent, Oakland 1.9 million or 5.4 percent, Tacoma, WA at 1.7 million or 4.9 percent, Charleston, SC 1.7 million or 4.8 percent, Hampton, VA 1.6 million or 4.6 percent, and Savannah, GA with 1.5 million TEUs and 4.3 percent of the container handling (Maloni, 2005 Summer, p.5).

The Port of Los Angeles/Long Beach, has experienced significant stress over the past four years. It saw a substantial crisis in 2002 caused by a ten-day longshoremen strike. But in 2004, a crisis was due to lack of capacity. "During the 2004 holiday season backups at the

Nation's busiest port complex, Los Angeles-Long Beach, California, required more than 100 container vessels to be diverted to other ports" (TRB, 2005, p.2). The Transportation Research Board (TRB) forecasts that west coast ports may not be capable of handling the anticipated growth of trade that is coming over the next 20 years. This is due not only to physical land constraints, but also to intermodal limitations of railroads and highways (TRB, 2005, p.2).

Developments at overseas ports with large export volumes destined for the U.S. signal the growing nature of this business. The Port of Singapore (PSA) was ranked as largest in the world in 2003 – based upon total cargo tonnage, and second in the world based upon container traffic – handling over 18.4 million TEUs (AAPA, 2006, Rankings). The port provides transit to 600 ports in 123 countries (Field, 2002, p.1). PSA is currently expanding its 41 berths with 131 cranes to 52 berths, increasing capacity to 31 million TEUs by 2011 (DPG, 2006, p.3).

Likewise, the Port of Rotterdam in the Netherlands was ranked as the second busiest port – based upon cargo tonnage, and eighth in the world – based upon handling 7.1 million TEUs in 2003 (AAPA, 2006, Rankings). The Port is currently constructing new facilities that will increase its capacity by 3.2 million TEUs by 2007 (Port of Rotterdam, 2004, p. 23), to a total of 12 million TEUs by 2012 (DPC, 2006, Jan, p.8). It is also planning to begin construction of an entirely new port facility called Maasvlakte 2 in 2008. This project will triple the port's capacity for handling containers (Chemical Week, 2005, p.28). As the world's largest importer, the U.S. can fully expect to be affected by this heavy growth in the seaport industry.

The increase in vessel size is another stress factor. "Given the significant capital and operating expenses of container vessels, ocean carriers have found efficiencies in increasing ship size" (Maloni, 2005 Summer, p.23). The capacity of vessels able to transit the Panama Canal (Panamax ships) is about 4,500 TEU's (Morton 2005, p.12). These typically require channel depths of 35 to 40 feet. Today, post-Panamax vessels in use have reached 8,000 TEUs and require 45 to 53 foot depths (Maloni, 2005 Summer, p.23). In 2005 a 9,200 TEU vessel, the MSC Pamela, became the world's largest containership (DPC, 2006 Mar, p.3). Increases in the number and size of ships are placing new demands on ports to maintain or increase channel depth, require larger berthing areas, cranes and container yards.

Another new trend is the use of all-water routes from Asia to the U.S. east coast. Shippers are finding it effective to bypass the west coast by transiting the Suez or Panama Canals in order to reach east coast ports. "For the first time in 2003, all-water Asia originated cargo overtook European shipments as a primary source of inbound cargo for ports in New York and Virginia" (Breskin, 2005, p.35). Recent estimates state the Panama Canal is operating at about 93% of capacity and 2004 traffic through the Suez Canal increased 16% (Morton, 2005, p.1). Generally, all-water routes take an estimated four to seven days longer to reach the east coast from Asia. But, shippers are finding this more reliable and efficient based upon ship improvements and the ability to avoid port and land transport delays on the west coast (Breskin, 2005, p.36).

There are additional issues that are adding to U.S. port congestion. The U.S. military is increasingly relying on U.S. seaports for deployments, as the Pentagon has shifted many Army units from forward bases in Europe and Korea to expanding bases in the continental U.S. The expeditionary nature of this new strategy and 12 month rotations of U.S.-based units to Iraq and Afghanistan have increased demands on U.S. Ports. These deployments require sizeable staging areas and port yards for configuring and loading equipment. Also, the imbalance in U.S. imports

and exports creates an imbalance in empty container usage which stresses port container yards. Finally, huge security issues that emerged with the ongoing Global War on Terrorism have produced additional pressure on the efficiency of already stressed port operations.

U.S. SEAPORTS - CURRENT TRENDS FOR INCREASING CAPACITY

U.S. port authorities, terminal operators, transportation officials and government leaders are clearly aware of the increasing demand and congestion experienced at the Nation's seaports. Key stakeholders are taking actions to mitigate these trends. Congestion and capacity problems vary by region, as have actions to mitigate the growing challenges. A current literature search indicates that efforts to increase U.S. capacity focused on expanding terminals, construction of intermodal rail facilities, campaigns to deepen harbor channels and some innovative management techniques. In the current environment, it is unlikely these actions alone will be sufficient to meet growing seaport demands.

Infrastructure expansion is a trend on the east coast where ports experienced a 5-10 percent increase in container traffic in the past year. The Port of New York/New Jersey is pursuing a \$1 billion, five-year expansion plan to double capacity by the year 2007 (Breskin, 2005, p.37). This includes revitalizing the Howland Hook terminal after ten years of dormancy. They are building a new intermodal rail facility there and planning new ship- to-rail facilities at each of their existing terminals as well (Trunick, 2004, p.13). The Virginia Ports Authority will see the private expansion by Maersk Sealand through their construction of a new, state-of-the-art, 250 acre container terminal at a price tag of \$450 million (Breskin 2005, p.38). The Virginia Authority itself is funding a \$300 million project to enhance the Norfolk International Terminal increasing capacity by 30 percent (Breskin, 2005, p.38). The South Carolina State Ports Authority is working permitting for a new 280 acre terminal at the former naval base and also pursuing the acquisition of property along the Savannah River for the possible expansion of that port on the undeveloped South Carolina river bank (SCSPA, 2006). The Port of Savannah initiated a \$100 million project to expand its Garden City Terminal from 2.5 Million TEU capacity to 4.35 million by 2014 (Breskin, 2005, p.37).

Capacity challenges are the most severe on the west coast. Oakland is pursuing a \$1.2 billion plan to expand their port operations over the next ten years (Colman, 2005, p.39). The Port of Tacoma opened a new 171 acre, \$210 million, container terminal in January of this year (Bartholomew, 2005, p. 49). But, U.S. capacity issues are impacting international neighbors. The Canadian government is assisting with financing for a new container terminal in the Port of Saint Rupert, BC with the initial goal of handling 500,000 TEU (Coleman, 2005, p.40). Mexico also adjusted tax policies to attract new demand. In 2004 that Government ended the practice of charging a \$90,000 bond on each arriving seaport container. It now permits free transit of shipping containers from their western ports, if transported by rail directly to the U.S. (Mireles, 2005, p.1).

Many ports are pursuing deeper harbors to handle the largest new vessels. One of the largest deepening projects is underway for the Port Authority of New York/New Jersey. A \$1.6 billion, ten-year project to achieve 50 foot channels in sections of the harbor is being cost shared by the authority and the Federal Government through the U.S. Army Corps of Engineers (Breskin, 2005, p. 35). The Philadelphia Regional Port Authority received congressional

authorization for a 45 foot deepening project back in 1991. However, the five-year, \$264 million project was delayed (Trunick, 2004 Dec, p.13). The Virginia Port Authority 50 foot project was completed last fall and is authorized to 55 feet (Morton, 2005, p.13). The Charleston Harbor deepening project brought inner harbor depths to 45 feet and was completed in 2004 at a cost of \$150 million (SCSPA, 2006, p.1). The Port of Savannah anticipates deepening its channel from 42 to 48 feet by 2011 (Breskin, 2005, p.37). The Port of Miami is hoping to gain some all-water traffic from the Panama Canal and is also currently constructing its 50 foot channel (Morton, 2005, p.14).

The Nations busiest Port, LA/LB, has experienced severe congestion issues. Following the unanticipated congestion in 2004, the port added a second shift of longshoremen and extended operations to Saturdays. In 2005, the authority instituted PierPASS, an operation that charges shippers an additional fee for operations during weekday peak hours of 8 a.m. to 5 p.m. Reports indicate the additional \$20 per TEU charge successfully shifted 30 percent of container traffic to off-peak hours at nights and on Saturdays (Trunick, 2005 Sep, p.1). The port is considering increasing container stacking levels, which requires larger wheeled cranes and better technology to manage shipping and cargo (Trunick, 2004 Oct, p.42).

U.S. SEAPORTS – ADDITIONAL CAPACITY AND CAPABILITY IMPROVEMENTS

The industry's reaction to congestion and capacity issues noted above, vary with the degree of the challenges. In July 2005, Mr. Doug Tilden, CEO of Marine Terminals Corporation stated, "On a national level we need to create around 3.3 million TEUs per year in additional system capacity over the near term to support an 8 percent compound trade growth rate. To put in the context of port size; a 3.3 million-TEU port would be the third largest port in North America. And we need to create one every year!" (2005, p.8). As addressed in the previous section, many ports have focused on expanding infrastructure. This is expensive, time consuming, and there are physical limitations to this alternative. Competition for federal dollars to support channel projects is becoming more intense and local communities have fought port expansions based upon social and environmental concerns – as seen in a recent, failed terminal expansion plan in the Charleston Harbor in 2000.

In order to continue to address growing requirements, there are many other actions that must be pursued as well. Three key actions must include operational efficiencies, a systems approach to the planning and development of transportation networks, and thorough preparation for possible manmade and natural disasters through consequence management.

"North American ports tend to be significantly less efficient than their foreign counterparts. So ports have relied heavily on costly, time-consuming facility and labor expansion to meet volume increases, but this expansion has generally lagged behind volume growth" (Maloni, 2005 Summer, p.1). The U.S. can look to the Port of Singapore for a case study in port efficiency, "Its calling card is efficiency; its backbone is IT" (Field, 2002, p.1). The port uses information technology (IT) in all aspects of its port operations. Their use of IT began in 1972. Today, the Computer Integrated Terminal Operating System (CITOS) "integrates every asset from prime movers, yard cranes and quay cranes to containers and drivers" (PSA, 2005, para 5). The system assists with berthing systems, ship and yard load planning and allocation of their resources. Portnet is an internet based link between shippers, the port terminals, freight

companies, and even government agencies. This system allows shippers to order berth space or pilot services as well as track container status (PSA, Para. 15). The port also employs a fully automated freight system. Flow-Through Gate System manages traffic flow in and out of the landside terminals. IT is so pervasive in Singapore that they have working remote-controlled overhead bridge cranes. Singapore exhibits both efficiencies and technology that U.S. ports need to embrace to improve operations.

A second critical area for improvement is the need to address the transportation challenges in the context of a community of stakeholders and fully integrated network. Waterside expansions cannot solve all the current and future problems without a coordinated effort, considering the important linkage of all modes of transportation. The TRB specifically noted institutional problems, "Fragmented authorities and structures for decision making and regulation inhibit the ability to address problems in highways, waterways, public transit, railroads, air transportation, and pipelines from a systems perspective" (TRB, 2005, p.9).

The Federal Government recognizes this problem. In its 2005 report to Congress, DOT's Maritime Administration (MARAD) noted "...there are 17 Federal agencies in six cabinet-level departments currently responsible for maritime decision-making. In the past, this has led to a patchwork of inefficient laws, policies and programs" (USDOT, 2005, p.vi). National leadership must continue to take steps to build organizations and processes to address these challenges, moving away from modal stove-pipes. The U.S. needs a more integrated, synergistic program to help solve transportation and port capacity problems with industry stakeholders.

Further evidence of the lack of an integrated network approach to solving these capacity issues was revealed in another analysis of the container port operations. A recent study surveyed 33 key North American ports regarding capacity issues and received 24 responses. The five most important port capacity factors the operators identified were: local roads, terminal space, local rail, long shore efficiency, and local trucking (Maloni, 2005 Summer, p.15). The report states that these results "...imply that ports believe their own future capacity mostly extends beyond their authority, indicating they must rely on the cooperation of external stakeholders to enhance current capacity" (p.18). This advances the need for the government, along with industry stakeholders, to provide a much more collaborative network that ensures coordinated planning and prioritization as the nation moves forward and addresses capacity challenges and solutions.

A third critical area requiring national attention is the area of consequence management, the ability to effectively respond to potential natural or manmade disasters at our critical ports. The impact of hurricane Katrina on port operations in the Gulf of Mexico and New Orleans and the 2002 longshoremen strike in LA/LB were significant events causing widespread disruption. With 35 million TEUs moving through the nations ports each year, it seems unrealistic to believe terrorists will not target and at some point succeed in attacking this critical infrastructure.

A recent Congressional Budget Office (CBO) report to Congress addressed the economic costs of potential disruptions to container shipments based upon short-term and long-term closure of U.S. ports. It estimated the impact of a three year closure of the Port of LA/LB would be low, only reducing the Gross Domestic Product (GDP) by 0.35 to 0.55 percent or \$45 to \$70 billion, per year (CBO, 2006, p.19). This estimation seems very unrealistic as key optimistic assumptions included a lower consumer demand for more expensive imports, construction of additional port infrastructure in the U.S. and absorption of imports at other ports. It assumed that

other U.S. ports would increase container handling each of the three years by 25 percent, 35 percent, and finally 50 percent by the third year (Arnold, 2006, p19). This seems to ignore the physical limitations of ports' capabilities, depths, infrastructure, as well as the need to service high population concentrations in areas such as Southern California, where they rely on bulk deliveries through their ports. It gives a false sense of security and does not take into account the capacity challenges addressed in this paper. The nation must be prepared for a port disaster as it is clearly imperative to return any damaged port back into operation expeditiously.

SUMMARY/CONCLUSION

During an Industry Study visit to the U.S. Department of Transportation in March 2006, Secretary Norman Y. Mineta described the U.S. transportation system as the circulatory system of our Nation (2006). If this is true, the nation's seaports supply the critical oxygen to fuel this system. Today, the nation's seaports face a substantial challenge to efficiently and effectively handle our growing national cargo. Current estimates indicate the port capacities could be exceeded as early as 2010. This industry is struggling to keep up with these demands through expanding terminals, construction of intermodal rail facilities, campaigns to deepen harbor channels and some innovative management techniques. In the current environment, it is unlikely these actions will be sufficient to meet growing seaport demands. Stakeholders must ensure other actions are taken. This paper identifies three including operational efficiencies, a systems approach to the planning and development of transportation networks, and a thorough preparation for possible manmade and natural disasters through consequence management. Clearly, a coordinated, comprehensive strategy is required to tackle the challenges facing the nation's seaport operations and this is vital to U.S. economic viability and prosperity.

AUTHOR: Colonel Peter Mueller, United States Army

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The logo for the International Chamber of Commerce (ICC) is visible in the background, featuring a circular emblem with a scale of justice and a sword, surrounded by the text 'INTERNATIONAL CHAMBER OF COMMERCE' and 'DEFE SSIO INSURABILIS'. Below the emblem, the letters 'ICAF' are printed in a large, bold, sans-serif font.

APPENDIX B: EXAMINATION OF U.S. RAILROAD SECURITY CHALLENGES - POST 9/11

BACKGROUND

The rail system, both passenger and freight, is an open-aired system, generally characterized by security experts and transit officials as “inherently vulnerable, and thus *virtually impossible* [my emphasis] to defend against attack, due to the very nature of their design and operations” (GAO, 2006, p.4). Ironically, the openness of the rail infrastructure is not only its greatest security vulnerability – but also it is its greatest appeal (especially in the area of passenger transport). Complicating the problem, the railroad is part of an intermodal transportation system that too often finds itself at the mercy of other modes of transportation security initiatives. In other words, there is some degree of assumed trust by the railroad industry that security checks by other transportation modes have been conducted – and sufficiently.

The ability to move a great volume of freight over long distances quickly, and under minimal security constraint is vital in meeting industry demands – thus vital to the national security at large. Likewise, the ability to board passenger rails and move the work force with minimal delay is not only an appealing and desirable, but again, vital to maintaining the economic prosperity of the United States. This point simply cannot be overstated! “A key challenge facing the Congress (Federal Government) is balancing the desire for and cost of increased rail security with the impacts of security measures on the operating efficiency. Attempting to defend against all threat possibilities would cost billions of dollars, and the security measures may not only be of unproved effectiveness but may also interfere with the way these institutions operate, imposing many indirect costs on society. Recognizing the impracticality (if not impossibility) of hardening the security of a desired open transportation system (not to mention the huge economic cost), the railroad industry has adopted a *consequence management* strategy – a strategy centered on minimizing the harm of an attack, as opposed to a prevention strategy” (CRS1, Gov Document, p. 5, 2006). Such a strategy seems too conciliatory; but by doing so, railroad leaders believe they are able to preserve the desired “openness” (ease of movement) of rail, as well as enhance the overall security posture.

DISCUSSION / KEY POINTS

Though many improvements were made (i.e., expansion of the use of vulnerability and risk assessments, increased local emergency exercises, hardening of yards / stations, increased police and security officials, increased use of canine for explosive checks, etc), there is arguably much room for improvement. Some changes and initiatives have been better than others, and many critical areas are still problematic. To name just a few:

- a) As discovered on our visit to the Association of American Railroads (AAR), the AAR using the Surface Transportation Information Sharing and Analysis center (ST-ISAC) is

quite unsatisfied with the level of cooperation with the federal government in regards to intelligence sharing; vehemently arguing that it gives much more information than it receives, thereby handicapping their ability to maximize internal security measures.

- b) Despite information technology and communication improvements, the railroad industry today has still not incorporated positive train control measures – to include real-time control over hazardous freight.
- c) Passengers can board commuter rail relatively easy with little to no proof of identification or routine search of carry on baggage. Access to freight, though a bit more restrictive, certainly eases as the trains travel along isolated and unguarded track – dramatically increasing vulnerability to attack.

The heightened security posture within the United States (post 9/11) now requires that security of the nation’s rail system be shared among private and public institutions. Primarily, the Department of Homeland Security (DHS), Department of Transportation (DOT), and the railroad companies themselves in a private / public cooperative spirit are the major players in rail and transit security. In broad terms, these improvements include: improved intelligence gathering and communication (albeit argued by the AAR as not a significant improvement), improved screening of “high-risk” cargo entering the U.S., formalizing vulnerability assessments throughout the industry, increased security training (both preventative and emergency response) for employees, incorporating new technological developments into the security architecture, and increased funding (\$150 million in FY2006) towards security infrastructure upgrades and the hiring of more security personnel. According to the Association of American Railroads, “[The railroads]working closely with local, state and federal authorities and utilizing their own police forces, railroads increased inspections and patrols, restricted access to key facilities, briefly suspended the movement of freight in the New York area and changed certain operational practices as anti-terrorist measures. The plan establishes alert levels and describes progressive series of actions to thwart terrorist threats to railroad personnel and facilities. It also includes additional countermeasures that will be applied in the areas of operations; information technology and communications; and police” (AAR, 2006). But is this enough? Absolutely not!

RECOMMENDATIONS

The Department of Homeland Security, in concert with the Department of Transportation, Federal Railroad Administration, and U.S. Congress are actively engaged in the security upgrade of the railroad’s overall security posture. The following are strategic security initiatives currently under consideration by public and private leaders in regards to rail security that I endorse and recommend to be implemented:

- Positive Train Control
- Positive Identification
- Re-Routing of Hazardous Cargo
- Expectation Management

The following is a brief discussion on each of these initiatives, highlighting the challenges faced by the railroads and the federal government. Likewise, a recommendation and explanation is offered regarding each of these critical initiatives:

a) **Positive Train Control.**

Recommendation: *Institute Federal Train Control Technology / Measures on all trains. Consider duplicate or backup measures for passenger trains and freight trains transporting HAZMAT.*

Conceived as a safety initiative, Positive Train Control (PTC) easily serves as a security enhancement as well. “PTC utilizes state-of-the-art microprocessors, global positioning satellite technology, data radio networks, and sophisticated train control and train dispatching computer software that allows for centralized monitoring and control of the movement and speed of trains across an entire railroad line or network. With PTC, a centralized dispatching center would know the exact location of every train on the system and could, with a few key strokes, identify each and every hazardous materials shipment on any train” (FRA, 2004). Recall in our earlier discussion that the railroad has embraced a security strategy of *consequence management*, which centers on minimizing rather than preventing the harms from attack. Achieving the objectives of this strategy requires knowing where the trains (especially passenger and hazardous cargo) are at all times in order for emergency response to respond swiftly and appropriately – to minimize harm.

b) **Positive Identification.**

Recommendation: *Establish positive identification measures for passenger rail – random or permanent. Link to a National Identification?*

In regards to passenger rail, one of the significant drawbacks to an *open* transportation system is that the system is incapable of positively identifying the passengers on board its trains – at any given time. Select stations have initiated passenger identification security measures, which include baggage X-Ray and metal detectors, but not uniformly across the U.S. – and not continuously. Admittedly, this is a difficult task to do, especially as officials painstakingly try to minimize passenger wait times to access the track areas (again, part of the security strategy – preserve operational efficiency) – but nevertheless, an absolute security imperative. The remedy in my mind either lies in the creation of a national ID, or in refiguring rail access points requiring positive ID at all of the checkpoints. The danger in this case is that it may be counterproductive to security objectives if the ease of travel and operational efficiency are impaired or negatively affected. Of course, the notion of a national ID, though contemplated, doesn’t even exist today, and it remains controversial in many private and public circles. Whether or not either of these ideas is feasible, the point here is that positive identification is a critical security measure that properly compliments other measures, and I believe necessary to support the tenets of a consequence management security strategy.

c) **Re-Routing of Hazardous Cargo.**

Recommendation: Through thorough risk assessment, re-route select HAZMAT rail traffic around populated areas and ensure HAZMAT movement is properly tracked and that emergency response is prepared and capable of responding – if/when necessary.

The movement of Hazardous Material (HAZMAT) on rail through populated areas has once again headlined in the news; bringing into question the safety of such practice during a heightened level of national security and the Global War on Terrorism. This, like so many of the other security initiatives is complicated and difficult to implement because risk assessments identify countless ways that terrorists could attack or sabotage HAZMAT cars – rendering defense measures almost futile. The railroad industry doesn't agree, and certainly opposes the authorization for state and local governments to halt any HAZMAT movements during time of emergency (as authorized by the Surface Transportation Safety Reauthorization Act of 2003). Edward Hamberger, President and CEO of the Association of American Railroads in a 2004 address to Congress warned that "railroads operate as part of an integrated national network and regulatory constraints on operations can have a ripple effect throughout the rail system. The effect is not circumscribed by state or local boundaries. Because rail transportation is inherently interstate in nature, the safe rail transport of any commodity, including hazardous materials, requires a uniform set of standards that apply nationwide. This uniformity would be severely jeopardized if states or localities sought to force rerouting by prohibiting the transportation of hazardous materials within their jurisdictions" (Hamberger).

Additionally, there is argument as to who would absorb the re-routing costs, and what would be the actual "bang-for-the-buck," considering the chance of defending against a planned attack against a HAZMAT car is realistically slim. All solid arguments, but not, in my opinion strong enough to forego re-routing simply because the odds of it working are high. Through the proper use of formal risk / vulnerability assessments, I think it possible to identify select areas in which re-routing can and should be done. The argument that risk of incident is just too low to justify the enormous cost is, in my mind failed logic. If the possibility is real, and the risk assessment reveals enough indicators to support the need for a heightened security posture, then serious thought and planning by government and private industry should be given to re-routing – as appropriate.

d) Expectation Management.

Recommendation: An Information Campaign. Government and Private industry should prepare themselves and their constituents for the possibility and reality that a terrorist strike is possible, that all cannot be defended, and that the strategy is to minimize harm.

Implementing a consequence management security strategy requires stakeholder buy-in in order to maximize effectiveness. How will the American people and government officials respond if the rail system is attacked or sabotaged? If the response is to shut down the rails until an accepted prevention strategy can be implemented, the affects could (and I submit will) be devastating to the industry as a whole and to the national economy. If however, the response is not over reactive, then there is a real possibility that consequence management, as a security strategy, will prove formidable, and continue to meet the demands of the economy with minimal interruption. Preventing overreaction requires sufficient preparation of government officials and

the populace to be ready and accepting (as difficult as that may be) of the inherent vulnerabilities of the railroad industry. Overreaction could potentially be more devastating to rail operations and efficiency than the actual attack itself. Developing such patience will require continuous dialogue with the public by both the rail industry and the government in a joint information campaign effort that levels with the people, and accurately depicts the security environment, the potential risks involved, and articulates why the security strategy is centered on minimizing harm – rather than preventing. A difficult task, but none-the-less a critical one to meet the objectives of the strategy.

Economics / Cost

These recommendations are nothing more than good ideas if they are not able to be financed. As discussed, several needed improvements like re-routing could be enormously expensive, and realistically could lose consideration if the cost is forbidding. Since deregulation, the railroads have invested heavily in increased capital, capacity, and efficiency upgrades. Though this investment has significantly improved profit margins, reinvestment into capital has reduced available revenues to pay for increased security improvements to support their strategy. Federal funding is limited, much in part because the railroad is not a public utility, but rather a private enterprise. Opponents of federal funding argue that public funds cannot and should not be used for private gain (CRS2, Government Document, 2004, p10). Nevertheless, the overwhelmingly accepted need and desire to secure the railways is causing congress to re-look many of the current restrictions and policies and determine what options are possible, specifically; the use of a federal trust fund (as with other surface transportation modes), possible legislative changes to better incorporate national security needs, and increased latitude in private-public partnership in paying for the security of rail infrastructure.

SUMMARY/CONCLUSION

It is vital to U.S. economic prosperity and national security to ensure the rail industry is protected to the greatest extent possible from attacks and sabotage, and continues to transport the supplies, goods, and workforce unimpeded. The industry has adopted what I believe a very realistic security strategy, centered on consequence management rather than prevention in order to properly balance security needs with operational efficiency. But as discussed, this strategy requires continuous improvements and initiatives to accomplish its goals. Action to improve positive train control, positive identification of passengers and employees, vulnerability assessments as it pertains to the movement of hazardous cargo, and strong leadership to shape expectations and minimize harm are just a very few of the needed improvements to strengthen the overall rail security posture. Many of these initiatives require re-evaluation of the government's role in the rail industry, possibly even resulting in greater regulatory policies (possible limited re-regulation?). Finally, it is important to note that any rail security strategy must be interconnected with the security schemes of other modes of transportation (intermodal) to ensure a unity of effort, foster mutual support, and demonstrate proper use of valuable resources in the form of people and money to maximize security efforts.

AUTHOR: Colonel Mark Spindler, United States Army

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APPENDIX C: THE GREENING OF COMMERCIAL TRUCKING

INTRODUCTION

The next hot topic in the commercial trucking industry is a surprising one. While subjects like road congestion, the need for increased security, and trucking technology upgrades have been getting all the headlines, the real trucking story for 2006 will be diesel fuel. Yes, that smelly, air polluting fuel that has kept the trucking industry rolling and the American economy booming is getting a major overhaul later this year. The American public (and the media that feeds them!) has not viewed this impending change with any degree of interest. Very rarely has the subject even been mentioned in the “mainstream media.” Sometime between now and the 15 October 2006 implementation date of the new Environmental Protection Agency (EPA) regulation, the story will move from professional publications and government web sites to the hometown newspaper.

What is the change and what will be the impacts of the change? In an effort to dramatically reduce air pollution, the EPA has mandated that by 15 October 80 percent of the diesel fuel sold in America for on-road use must contain no more than 15 parts per million (ppm) of sulfur. (By 2010, all diesel fuel sold in the United States for vehicle use must meet this standard.) This is a change from the current 500 ppm of sulfur found in today’s diesel fuel. The new generation of diesel is called ultra-low sulfur diesel (ULSD) and the ramifications (both positive and negative) of its introduction later this year will be felt far and wide. The EPA regulation sets very strict limits on the emissions of particulate matter, nitrogen oxide, and hydrocarbons that can only be reached if ULSD is used in new or retrofitted engines.

Directly effected by the EPA rules will be the commercial trucking industry, oil refineries, pipeline operators, and diesel engine manufacturers. There are two areas, however, that will grab the real headlines. The first will be the dramatic improvement in air quality resulting from the use of lower sulfur fuel used in conjunction with new diesel engine technology. The second will be the economic effect that every American consumer will feel due to the higher cost of ULSD fuel and the diesel trucks that will run on it.

ULTRA-LOW SULFUR DIESEL

Let’s start with the ultra-low sulfur diesel fuel itself – what is it and how is it produced? According to the Diesel Technology Forum [DTF] (2005), “Ultra-low sulfur diesel fuel (ULSD) is a refined diesel fuel that has dramatically low sulfur content compared to regular on-highway diesel and can be used in any diesel engine.” As noted earlier, the new EPA regulation mandated a 15 ppm sulfur content. To get to this level, refiners use what’s called “a two-stage deep desulfurization process” (Energy Information Administration [EIA], 2001). The second stage of the process requires the use of high reactor pressure to bring the diesel down to ultra-low levels of sulfur.

While the technology exists to produce such low sulfur content fuel, refiners have had to spend a great deal of money to build capacity and high pressure units to meet the upcoming demand. The EPA has estimated that the average cost per refiner for facility upgrades to

produce ULSD has been \$50 million. The total cost to the refining industry has been estimated to be between \$3 billion to \$13 billion (EIA, 2001).

Although there has been universal agreement that ULSD use will translate into cleaner air, concerns initially were raised by the commercial trucking industry. These concerns about using ULSD centered around increased fuel costs, limited fuel availability, decreased fuel economy, and engine damage. Studies by the Department of Energy and the American Petroleum Institute have shown that ULSD should cost between 5 cents to 13 cents per gallon more than today's 500 ppm diesel fuel (American Trucking Associations [ATA], 2006). With diesel fuel approaching \$3 per gallon, this minor additional cost at the pump should have very little impact on freight rates or on trucking company bottom lines.

Where there might be some pain come October has to do with the availability of ULSD throughout the country. In January of this year the Heavy Duty Manufacturers Association heard from speakers who, "warned that ULSD supplies may not make it into all corners of the nation by the time the new regulations are in effect" (Anonymous, 2006). However, both the EPA and the DTF have written recently that availability of ULSD will be able to meet all demand by this fall (DTF, 2005).

Early concerns about loss of fuel economy seem now to have been overstated. EPA has estimated that there will be only a 0.5 percent decrease in fuel mileage. The estimate by the National Petrochemical and Refining Association put the decrease in mileage at between 1 percent to 4 percent (ATA, 2006). Under actual road conditions, a Houston beer distributor that has been using ULSD for a few years in its fleet of 155 tractor-trailer rigs has seen less than a 1 percent decrease in fuel mileage (Kilcarr, 2003).

Finally, there has been the concern that the use of ULSD will damage diesel engine components. Again, this proves to be more "urban legend" than fact. Since it's the sulfur in diesel fuel that causes engine corrosion, using ULSD actually increases the time between oil changes (Kilcarr, 2003). ULSD does, however, appear to have lower lubricating properties that are needed to keep diesel engine fuel injectors working properly. To solve this problem, refiners will put in a fuel additive or, better yet, will add biodiesel to the ULSD.

Biodiesel is a renewable fuel derived mainly from soybeans (DTF, 2005). When blended using 5 percent biodiesel and 95 percent ULSD, this fuel mixture provides excellent lubrication for the injectors without any loss of fuel efficiency. As an added benefit to using biodiesel rather than a petroleum-based additive to improve lubricity, refiners will receive a tax credit for using a renewable fuel (Metz, 2004). Although they were late in endorsing the use of a biodiesel blend, the ATA has recently come out as an advocate of its use. In supporting a 5 percent biodiesel blend, ATA President and CEO Bill Graves stated, "Biodiesel represents an important part of a long-term energy plan designed to increase the nation's fuel supply and reduce our dependence on foreign oil" (ATA, 2006).

ENGINE TECHNOLOGY

Let's now look at the new diesel engines that will run on the ULSD. The EPA air quality standards cannot be met with simply changing to ULSD fuel. Therefore, manufacturers have been developing new clean engine technology for introduction with the 2007 model year and on ways to retrofit clean engine technology to the thousands of tractor rigs currently on America's

highways. The diesel engine patented in 1892 by German Rudolf Diesel has evolved into a clean burning machine that powers 94 percent of America's trucking (Schulz, 2000). The 2007 models will be the cleanest yet.

Compared to the diesel engines of the 1988 model year, the new engines coming on line in a few months will emit 98 percent less particulate matter and nitrogen oxide (DTF, 2005). How are such huge reductions possible? An array of technology will be employed to work in conjunction with ULSD to realize these dramatic pollutant reductions. These include the addition of:

- 1) exhaust gas recirculation, which lowers nitrogen oxide emissions by returning exhaust gas back to the engine;
- 2) common-rail fuel injection, which uses extremely high pressure to better vaporize the diesel fuel prior to combustion resulting in almost no exhaust;
- 3) advanced turbochargers, which improves engine efficiency while reducing exhaust gas; and
- 4) onboard computers, used to maximize engine performance (Clean Air Fleets, 2006).

Advanced emissions filters will treat what little exhaust gas there is coming out of the new diesel engines before anything leaves the tailpipe. First comes a particulate trap that will collect 80 - 90 percent of the remaining particulate matter. A catalytic converter will then reduce the remaining nitrogen oxide by 25 - 50 percent (DTF, 2005).

Will all this new technology add to the cost of the 2007 model engines? Estimates vary, with the EPA on the low end stating that over its lifetime the new engine will add only \$7,000. Other estimates, however, range up to \$26,000 over the life of the engine (Bass, 2004). The President and CEO of FedEx, Doug Duncan, said it best when he stated, "Yes, the new diesel fuel costs will be higher and the engines will cost us more. But I think people in the industry may be using the costs as an excuse hoping they won't have to do it. The fact is the environmental improvements are here to stay. We as a society are behind those and we all in business have to accept that fact and play our role for the greater good" (Hannon, 2005).

And what can commercial trucking firms that own pre-2007 model tractors do to contribute to this "greater good?" They can retrofit their existing diesel engines so that they can take full advantage of the ULSD and clean engine technology. To make the program to retrofit their engines less of a financial burden, Congress authorized \$1 billion to be spent over five years as grants and loans to truckers. The EPA will manage 70 percent of the program while the states will receive 30 percent of the funds (Union of Concerned Scientists, 2006). The EPA is using its Smart Way Transport Partnership program as a way to reach out to the trucking industry to encourage their adoption of the diesel retrofit initiative (EPA, 2006).

According to the Diesel Technology Forum (2005), there are currently 11 million diesel trucks on America's roads today. They estimate that these older engines can realize a 90 percent emissions reduction when they use ULSD and are retrofitted with the anti-pollution devices described earlier. The major engine manufacturers have been working on the most cost-effective ways to upgrade existing diesel engines.

PIPELINE SHIPMENT

The final piece to the clean air puzzle is to efficiently transport the new ULSD. Unlike in Europe where fuel is mainly moved via tanker truck, in the United States fuel is shipped over long distances via pipeline. The same pipeline is used to transport gasoline, diesel fuel, and jet airplane fuel. The fuels are shipped sequentially without any barriers in between. The trick is to keep them flowing at a constant rate so there is as little cross-contamination as possible. The small amount of fuel at the interfaces does become contaminated and is usually blended into a lower grade (EIA, 2001).

Pipeline operators are currently working on ways to best ship ULSD without it becoming contaminated. With the sulfur content at 15 ppm, there is very little margin for error when shipping ULSD. The sequencing of fuel types will be very important so that as little ULSD as possible will have to be downgraded due to contamination. After consulting with pipeline operators, EPA has estimated that as much as 4.4 percent of the ULSD will be contaminated during shipment (EIA, 2001). Conoco Phillips raised this issue by stating, "Contamination of ULSD with higher sulfur content fuels is a critical issue. Higher sulfur diesel, gasoline, jet fuel, or heating oil can contaminate ULSD, such that sulfur levels exceed allowable limits for advanced emission treatment systems" (Gelinas, 2005). To stay at or below the 15 ppm limit, refiners may be forced to produce ULSD with a lower sulfur content knowing that the sulfur content will rise during pipeline shipment. Until we get closer to the October 2006 date for the full introduction of ULSD, the industry is unable to fully gauge the level and impact that contamination during pipeline shipment will have.

CONCLUSION

This paper has examined the pros and cons, the impacts and the opportunities, and the knowns and unknowns of the EPA's most recent effort to improve air quality. For years, Americans have looked with disgust as diesel trucks belched out huge plumes of black exhaust smoke. Those days are drawing to a close. The commercial trucking industry will soon be added to those who are active stewards of our environment. We'll all breathe easier in the coming months and years.

AUTHOR: Mr. Robert Coleman, Department of Defense

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