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Can America's Supply Lines Hold? Evaluating the Transportation and Logistics Industry's Readiness for Global Power Projection

Transportation and Logistics Industry Study

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Acronyms[i]

AAR	Association of American Railroads	**GDP**	Gross Domestic Product
ADAS	Advanced Driver-assistance Systems	**GSE**	Ground support equipment
AI	Artificial intelligence	**IMO**	International Maritime Organization
ATI	Autonomous Track Inspection	**LOE**	Line of effort
Atrucks	Autonomous Trucks	**MARAD**	U.S. Department of Transportation Maritime Administration
BET	Battery electric truck	**MMA**	Merchant Marine Act
BRI	Belt and Road Initiative	**NATO**	North Atlantic Treaty Organization
CBP	U.S. Customs and Border Protrection	**NDRF**	National Defense Reserve Fleet
CL I	Class I Railroad	**NEPA**	National Environmental Protection Act
CONUS	Continental United States	**NPRN**	National Port Readiness Network
CMMC	Cybersecurity Maturity Model Certification	**NRSC**	National Rail Strategy Council
CRAF	Civil Reserve Air Fleet	**NSC**	National Security Council
CRRF	Civil Reserve Rail Fleet	**OCONUS**	Outside the Continental United States
DFAR	Defense Federal Acquisition Regulation Supplement	**ONM**	Office of National Mobilization
DHS	U.S. Department of Homeland Security	**PIDP**	Port Infrastructure Development Program
DIB	U.S. defense industrial base	**PSGF**	Port Security Grant Program
DLA	Defense Logistics Agency	**PSR**	Precision Scheduled Railroading
DOC	U.S. Department of Commerce	**RLA**	Railway Labor Act
DOD	U.S. Department of Defense	**ROI**	Return on investment
DOL	U.S. Department of Labor	**RRF**	Ready Reserve Force
DOS	U.S. Department of State	**SDDC**	Surface Deployment Distribution Command
DOT	U.S. Department of Transportation	**STB**	Surface Transportation Board
EV	Electric vehicles	**STRACNET**	Strategic Rail Corridor Network
FAA	Federal Aviation Administration	**TRANSCOM**	U.S. Transportation Command
FAR	Federal Acquisition Regulation	**TTX**	Tabletop Exercise
FEMA	Federal Emergency Management Agency	**USACE**	U.S. Army Corps of Engineers
FHA	Federal Highway Administration	**USCG**	U.S. Coast Guard
FRA	Federal Railroad Administration	**USINDOPACOM**	United States Indo-Pacific Command
FTE	Full-time Employee	**YoY**	Year-over-year

[i] Please see Annex E for a glossary of terms.

Executive Summary

This report provides a comprehensive analysis of the U.S. transportation and logistics industry, examining its integral role in both the national economy and defense mobilization. Through industry research, expert interviews, and field studies, the study evaluates six key sectors—air freight, deep-sea shipping, ports and harbors, railroads, trucking, and warehousing—identifying strengths and systemic vulnerabilities. The research study's analysis seeks to ascertain specific focus areas that can help to preserve strengths while mitigating short- and long-term vulnerabilities across the industry. The study first analyzes the transportation industry and its sub-sectors, and then examines the industry's role in the U.S. economy and national security and mobilization. Next, the study identifies industry issues and concerns for consideration, and finally, provides policy recommendations for potential implementation.

While the United States possesses considerable capacity in air, rail, and trucking, its competitive advantage is narrowing due to fragmented coordination, aging infrastructure, workforce shortages, and increasing competition from global challengers, particularly the People's Republic of China. These issues pose significant risks to economic stability and the nation's ability to project military power in future conflicts, and yet, a common refrain during engagements across industry sectors was that it would take a catastrophe to generate a catalyst for action.

Problem Statement

To strengthen the U.S. transportation and logistics industry's resilience, national security leaders should examine the industry as a whole, including intermodal connection points, to consider ways to maximize throughput across entire transportation corridors rather than stove-piped sectors.

The report emphasizes the need to integrate emerging technologies and wargaming into national logistics planning. Advanced tools like artificial intelligence (AI), automation, and digital twins are transformative tools, offering predictive capabilities, efficiency gains, and enhanced situational awareness. However, technological solutions alone are insufficient, and adoption remains uneven across sectors and often lacks strategic alignment with defense needs.

The report derives six key policy recommendations: increase coordination across stakeholders—whole-of-government, industry, allies and partners, and academia—invest strategically in infrastructure; integrate logistics into national-level planning and wargaming; incentivize technological innovation; strengthen the transportation workforce; and modernize regulatory frameworks. Together, these measures aim to shift the transportation and logistics industry from a reactive system to a proactive, integrated framework capable of supporting both commercial needs and rapid defense mobilization.

Transportation and Logistics in the Strategic Environment

The U.S. transportation and logistics industry remains globally competitive, but its lead is eroding amid accelerating investments and central planning by strategic competitors. Comparative analysis among the United States, China, and the Russian Federation [see ***Annex A***] reveals that the United States maintains enduring strengths in air, rail, and trucking capacity—sectors underpinned by a robust industrial base and legacy infrastructure. However, these advantages are increasingly undermined by labor shortages, aging infrastructure, and fragmented public-private coordination. In contrast, China has made dramatic gains in ports, warehousing, and deep-sea shipping through sustained government investment, centralized logistics integration, and its Belt and Road Initiative (BRI). While Russia shows limited competitiveness due to sanctions, its ongoing efforts prosecuting the war in Ukraine, underinvestment, and systemic inefficiencies, China's scale and momentum pose the most substantial long-term challenge to U.S. dominance. There is a shifting balance in global logistics competitiveness, with the United States maintaining critical strengths but facing growing challenges from a rapidly advancing Chinese logistics apparatus. Concurrently, U.S. defense planners are faced with a credible potential for armed conflict with China during the next 20 years: Chinese President Xi Jinping has publicly reiterated the importance of China's unification with Taiwan, saying most recently in May 2025, that "Taiwan's restoration to China is…an integral part of the postwar international order."[1]

The United States faces vulnerabilities across its transportation and logistics industries that jeopardize Washington's ability to project power overseas, sustain operations globally, and ensure domestic economic resilience in times of crisis. A conflict in the Indo-Pacific would exacerbate these vulnerabilities, delaying mobilization and hampering ongoing logistical support during protracted military operations. The following section seeks to better understand the U.S. transportation industry's position in the strategic environment by examining the characteristics and role of the industry's various sectors.

Industry Overview

The U.S. transportation and logistics industry comprises a network of more than 160,000 miles of national highways, 155,000 miles of railways, 360 ports, 523 large commercial airports and 47,800 warehouses.[2] This study addresses six core industry sectors, including air freight, deep-sea shipping, ports and harbors, rail freight, trucking, and warehousing. The industry enables the movement of goods across the country and around the world, supporting every major sector of the U.S. economy, such as manufacturing, agriculture, retail, and energy. An efficient logistics system reduces costs, improves delivery times, and strengthens the competitiveness of U.S. businesses globally.

Transportation is also essential for national security. The military depends on commercial transportation networks—ports, rail, highways, air, and sea—to move equipment and personnel during peacetime and conflict. Critical supply chains for fuel, food, medicine, and other strategic goods run through this system, making its resilience a national priority. Key infrastructure is dual-use and must be protected, not just from physical threats, but also from increasingly common cyberattacks.

This section of the study provides an overview of the key determining characteristics of the transportation sectors. Where possible, the study provides relevant statistical data to better enable comparisons across the industry but acknowledges overlapping data and a degree of "double counting" among sectors due to the dual-use and intermodal nature of the transportation industry. Figures *I* and *II* in *Annex D* provide a sense of relative sector contributions to international trade by weight and by value.

Air Freight

The U.S. air transport industry is a cornerstone of U.S. global power projection and a foundational driver of global economic activity, integrating military and commercial assets.[3] The industry functions as a dual-use market supporting commercial and defense needs and includes air transportation (moving passengers and cargo) and air freight (shipping goods).[4] The industry sector functions as an oligopoly with high barriers to entry and intense internal competition among dominant firms. The market is characterized by limited product and cost differentiation, although prices are influenced by location and proximity to hubs.[5] Air transport plays a crucial role in enabling efficient supply chains. Prominent aviation analyst Joachim Schafer identified three criteria for determining whether a product moves around the globe by air: "[t]hey are either particularly valuable, particularly urgent, or particularly perishable."[6]

Market stakeholders include shippers, forwarders, and carriers, the latter including integrated express carriers, dedicated freighter airlines, passenger airlines using belly cargo space, and regional carriers.[7] Industry-adjacent manufacturers also influence the market and include large firms that dominate aircraft manufacturing globally.[8] Definitions of air cargo and air freight vary and are sometimes used interchangeably, but the position taken in this evaluation is that air freight operations refer to the wider logistical actions and costs required to move material by air, of which air cargo is a subset (referring to property moved on an aircraft separate from its owner).[9]

Deep-sea Shipping

Deep-sea shipping involves the maritime transportation of goods between continents or across large ocean distances. The industry is defined domestically by the Occupational Safety and Health Administration as operating vessels for freight transport on the deep seas between U.S. ports and certain territories, and along the coasts of Alaska, Hawaii, or Puerto Rico.[10] This mode of transportation is vital, with more than four-fifths of world trade flowing through the high seas, and international shipping carrying about 90 percent of world merchandise trade by volume, including food, energy, and essential goods.[11] Deep-sea shipping is a strategic pillar supporting diplomatic and informational influence, military power projection, and economic prosperity for Western global engagement.

Despite deep-sea shipping's critical importance to Western power and security, the United States has experienced a dramatic erosion of its maritime power.[12] Once a dominant seafaring nation with a large, American-flagged and operated merchant fleet, the United States now relies heavily on foreign, predominantly Asian, ownership and labor to transport its goods. Today, China operates a merchant fleet almost 40 times larger than that of the United States, leading the world in shipbuilding, vessel ownership, and accounting for nearly 50 percent of global production in 2024.[13] In contrast, the United States' lack of focus on deep-sea shipping has decreased its competitiveness globally: the country does not appear on the notable list of top merchant fleet owners.[14]

The domestic U.S. deep-sea shipping industry consists of around 230 firms, employing approximately 7,000 workers and generating $9.3 billion annually, with the top 50 firms controlling more than 97 percent of the market.[15] In 2024, the U.S. merchant fleet generated $47.7 billion in total revenue, with deep-sea freight transportation accounting for $9.9 billion, which equates to just 0.1 percent of the U.S.' $29 trillion gross domestic product (GDP).[16] However, the relatively small size of the U.S.' approximately 185-vessel fleet raises concerns and could jeopardize economic prosperity.

Ports and Harbors

The U.S. port industry consists of 360 commercial ports nationwide, including 150 deep-draft ports serving ocean-going ships.[17,18] Ports across the United States typically display unique profiles tailored to regional cargo and require extensive infrastructure and specialized equipment for handling, such as cranes and vehicles.[19,20] These factors contribute to high market entry barriers and present challenges in developing a uniform national strategy for port modernization. In addition, ports are inherently intermodal, facilitating transshipment of goods from ships to other transportation modes for final delivery. This means that the industry includes many stakeholders, each with their own equity in operations [*See Figure I: Port Stakeholders*].

A key advantage of the ports and harbors industry is that it facilitates domestic trade by offering a low-cost means to move bulk products compared to other methods of transportation. The largest share of port annual revenue ($1.8 billion) is derived from tankers for energy products, followed by container ships and dry bulk.[21]

The economic outlook for ports is mixed. Future port growth is tied closely to exogenous economic factors, such as volatility in consumer demand for traded goods and the price of oil. This means that the market is also sensitive to government policies that affect the flow of international trade, such as tariffs. Concurrently, long-term performance improvements are tied to efforts to bolster efficiency and increase throughput.

Rail Freight

The U.S. rail freight industry is characterized by a concentrated market dominated by six Class I (CL I) freight railroads, operating a vast privately-owned rail network exceeding 160,000 miles. These large carriers, such as Burlington Northern Santa Fe and Union Pacific, operate in distinct geographical regions. More than 600 short-line and regional railroads complement the CL I freight railroads and provide crucial first- and last-mile connections.[22] Unlike the United States' publicly funded highway network, the rail industry is largely responsible for maintaining its own infrastructure. The Federal Railroad Administration (FRA) and Surface Transportation Board (STB) regulate the industry, which employs around 170,000 workers, more than 80 percent of whom are union members.[23,24]

The U.S. freight rail system is widely regarded as the most extensive, safest, and most cost-efficient in the world.[25] The industry has significantly improved safety since 2000, reducing employee injury and fatality rates by over 60 percent, and it leads in fuel efficiency for land transport, moving one ton of freight nearly 500 miles per gallon of fuel. [26,27]

The current health of the rail freight industry is moderate. Intermodal services continue to perform well, yielding strong financial results. However, the CL I carriers are dependent on the economic performance of the commodities they transport and external factors affecting the domestic and global economy.

Trucking

The U.S. trucking industry is an essential component of the national transportation system and logistics infrastructure, functioning as an economic engine for the U.S. economy and an indispensable asset for defense mobility. As the primary pillar for domestic freight movement, trucking provides the critical first and last mile connectivity, linking modes of strategic transportation to final destinations. The industry structure includes 577,000 motor carriers that operate an estimated 14 million trucks and employ 3.5 million professional truck drivers.[28] The trucking industry forms the central link between manufacturers, producers, retailers, and customers by ensuring the rapid and efficient distribution of commercial goods and military cargo, transporting approximately 72 percent of domestic freight, totaling more than 11 billion tons annually.[29] The U.S. Department of Defense (DOD) also relies heavily on commercial trucking capacity for domestic movement of stores and equipment in support of global power projection operations.[30]

The trucking industry features distinct segments defined by carrier type, transported commodities, cargo load characteristics, and operating distance. Each segment is tailored to different shipment and service requirements. Long-haul trucking, which moves goods over long distances using large commercial trucks, is a vital connective tissue within the broader transportation industry.[31] Conversely, trucking operations function within a specific geographic region. Drayage trucking—the short-distance transport of goods, often shipping containers—is a small but essential component of the short-haul segment that facilitates international trade flow at ports. Drayage trucking acts as the central link for the intermodal supply chain by ensuring that cargo transits rapidly to its destination.[32]

Currently, the health of the trucking industry is strained. Trucking is characterized by economic uncertainty, increased operational costs, deteriorating infrastructure, increased regulatory measures, and a workforce shortage. There is optimism for improvement, but not in the immediate future. Navigating these headwinds will require substantial coordination from government and industry stakeholders.

Warehousing

The general warehousing and storage industry provides essential services that bridge production and consumption. The sector is defined by third-party logistics providers offering storage, inventory management, and distribution services to clients across manufacturing, retail, and government sectors. Specialized storage such as refrigeration or self-storage is excluded from this category. Yet, the general warehousing industry remains the broadest and most integral industry to day-to-day commercial and military logistics.

As of 2025, the U.S. warehousing and storage industry included approximately 38,000 businesses managing more than 47,799 warehouses. These entities collectively employ more than 1.3 million people and generate upwards of $43.1 billion in annual revenue. However, the industry’s low average profit margin of 4.9 percent suggests thin operational buffers and high sensitivity to disruptions.[33]

Driven by the explosion of e-commerce, companies are increasingly relocating warehouses closer to urban centers to facilitate faster deliveries and streamline last-mile logistics.[34] Major players like Ryder Systems and CMA CGM are investing in cutting-edge warehouse automation—such as robotic retrieval systems, AI-based inventory optimization, and sensor-integrated infrastructure—that minimize human intervention and maximize throughput.[35] This wave of innovation is helping the industry address long-standing challenges, particularly labor shortages and high turnover. While the warehousing sector continues to improve automation and urban adaptation, it does so in concert with the transportation and logistics ecosystem that carries these efficiencies to the national and global marketplace.

Industry Support to the U.S. and Global Economy

Collectively, these sectors directly support the U.S. and global economy. Transportation and logistics provide pathways for goods to transit from producers to consumers, accounting for more than 9 percent of GDP and directly or indirectly employing more than 16 million people, more than 10 percent of the domestic labor force.[36] In 2024, U.S. consumers imported more than $3.3 trillion and exported more than $2.1 trillion of goods.[37] As the following section illustrates, each sector plays a unique, but important and interconnected, economic role:

Air Freight

The air transport industry is a foundational driver of global economic activity, contributing approximately 5 percent of global GDP.[38] In 2023, the United States' aviation industry directly accounted for $433 billion in economic output and 2.3 million jobs.[39] The industry contributes substantially to economic vitality by transporting high-value cargo, constituting 35 percent of global trade by value and 1 percent by volume.[40] Aerospace manufacturing generates high-wage jobs, fuels innovation, and is a top U.S. export. Due to overlapping supply chains, the military aviation sector relies heavily on the commercial market for revenue and innovation. While the U.S. market historically has consisted of multiple large aircraft manufacturers, today Boeing is the sole U.S.-based producer of large commercial aircraft.[41] The U.S. Department of Transportation (DOT) characterizes efficient freight transportation as essential to the country's economic strength due to its economic importance.[42]

Deep-sea Shipping

Deep-sea shipping is the backbone of international trade, moving approximately 90 percent of overseas cargo by volume.[43] The industry is vital to global trade, enabling the United States to import and export goods that drive economic growth. Deep-sea shipping relies on U.S. ports, which serve as important gateways connecting domestic producers and consumers to the global economy. In 2023, vessels moved more than $2.1 trillion in goods to and from the United States.[44] The broader marine industry significantly contributes to the domestic economy, with port and maritime sectors generating $476 billion annually, nearly 2 percent of U.S. GDP.[45]

Ports and Harbors

As of 2024, the American Association of Port Authorities estimated that ports contribute $2.9 trillion to U.S. GDP.[46] This includes the economic activity facilitated by port operations and the value of goods that pass through ports. U.S. ports handle approximately 90 percent of U.S. goods shipments by volume and 42 percent by value.[47,48] Of these shipments, 65 percent are imports and 35 percent are exports supporting the global economy and international trade, which is consistent with the U.S. economy's "net importer" status.[49] The decline of U.S. manufacturing means more finished goods are imported from overseas, and U.S. ports are a critical conduit for American consumers to receive goods from international sellers.

East Coast ports are vital in executing trade with European markets, while ports on the West Coast process nearly all traffic to and from critical markets in Asia. Inland ports are more specialized and serve important niche markets on a smaller scale. Each of these ports provides food and energy security for Americans.

American ports support 21.8 million jobs, including terminal operators, stevedoring and marine cargo handlers, drayage truckers, warehousing, and rail operators and associated support services.[50,51] A large share of U.S. port workers are members of unions such as the International Longshore and Warehouse Union and the International Longshoremen's Association. These unions have a substantial influence on port operations across the country.

Rail Freight

In 2023, the rail industry generated more than $233 billion in total economic output and contributed more than $50 billion directly to GDP.[52] Railroads support nearly 749,000 jobs across various sectors, with each direct rail job supporting approximately 3.9 additional jobs.[53]

Rail is the primary mode for transporting bulk commodities due to its cost-efficiency. While coal transport has decreased, the rail industry remains crucial for transporting agricultural products, chemicals, construction materials, and crude oil.[54] Intermodal freight, which entails moving shipping containers and truck chassis via rail, has become increasingly relevant to the industry, especially with the rise of e-commerce. Intermodal volume saw significant growth entering 2025, highlighting strong consumer demand and port activity.[55] Approximately 38 percent of U.S. rail traffic is tied to international trade, connecting domestic producers to global markets. This reliance on international trade markets makes the industry sensitive to evolving U.S. trade policies.[56]

Trucking

The trucking industry's performance closely mirrors U.S. economic activity, making it a valuable indicator of economic trends.[57] As of 2022, the Bureau of Transportation Statistics reported that the trucking industry's contribution to U.S. GDP constituted the largest share among all freight transportation modes, accounting for $588 billion or 2.2 percent of U.S. GDP.[58]

Beyond this direct impact on GDP, the industry's broader network encompasses over 682,000 distinct businesses providing trucking-related employment for more than 8.5 million workers across the economy and generating $987 billion in gross annual revenue with a 3 percent profit margin.[59] Without trucking's continuous operation, supply chains supporting the U.S. economy and its connection to world trade would stall.

Warehousing

Warehousing is more than a support function for e-commerce: it is the foundation of modern supply chains. Inbound logistics, receiving, order picking, and outbound distribution all flow through warehouses that serve as pivotal hubs for domestic consumption and international trade. The warehouse, therefore, acts not only as a physical storage facility but as a control node in a dynamic and often volatile global economy.[60] According to *IBISWorld*, the warehousing section contributed approximately $43 billion to U.S. GDP.[61]

During periods of disruption—whether caused by pandemics, labor strikes, or geopolitical events—warehouses serve as a stabilizing force. For instance, during the COVID-19 pandemic, warehouses absorbed excess inventory, allowing manufacturers to continue operations even as harbor operations were delayed.[62] Similarly, when Hurricane Harvey flooded supply routes, decentralized warehouse networks enabled companies to maintain operations by shifting fulfillment centers to unaffected areas.[63]

These examples demonstrate that the warehousing industry can play a significant role in the United States and global economies and is not merely a logistical necessity—it is a strategic economic infrastructure that plays a role in stabilizing the global economy in the face of supply chain disruptions. In addition, the warehousing industry serves as a platform for advanced analytics, allowing firms to track goods, predict demand, and respond to disruptions with agility.

In addition to supporting the U.S. economy, the transportation industry's infrastructure and capabilities collectively contribute to the U.S. military's ability to move materiel around the globe and enable U.S. power projection in support of national security objectives.

Support to National Security and Mobilization

U.S. transportation and logistics infrastructure is inherently dual-use in support of commercial and military objectives. The U.S. transportation industry's resilience—or potentially, lack thereof—directly supports U.S. economic stability and national security. In addition, according to United States Transportation Command (USTRANSCOM) regulations, the transportation industry is the principal facilitator of mobilization, employing "intra-Continental United States (CONUS) air, rail, highway, pipeline, port facilities, and inland waterway assets of commercial firms."[64] The industry's ability to facilitate rapid cargo embarkation and debarkation during conflict is a critical component of national mobilization. The remainder of this section examines the role of each transportation sector in national security and mobilization.

Air Freight

Air transport is a cornerstone of U.S. global power projection, offering unmatched speed and flexibility for rapid crisis response and force deployment. In regions such as the Indo-Pacific, where distances are vast and timelines compressed, airlift provides the crucial ability to move troops, equipment, and supplies within hours or days.[65] While sealift remains the primary mover of large volumes, only airlift can meet the demands of time-sensitive or high-priority missions. The United States operates the world's largest military airlift fleet—including C-17s and C-130s—and demonstrated this airlift capability during the 2021 Afghanistan evacuation, which transported more than 120,000 individuals in 2 weeks, doubling the amount that many experts considered possible.[66] However, the military's organic airlift resources are limited and often overtasked, prompting reliance on the Civil Reserve Air Fleet (CRAF) to provide scalable surge capability through commercial partnerships.[67]

Established as a voluntary program, CRAF enables DOD to access commercial aircraft during national emergencies.[68] As of August 2021, CRAF included 450 aircraft from 24 carriers that could be activated in phases within 24 to 48 hours.[69] It has been used only three times, most notably during the Gulf War, when commercial airlines carried 60 percent of personnel and 25 percent of cargo.[70] This partnership allows military aircraft to prioritize contested environments while leveraging commercial infrastructure to maintain throughput.[71] As overseas demand for military airlift increases, especially in high-intensity or prolonged conflicts at reach, CONUS-based commercial carriers will be essential for relieving pressure on organic military assets. However, currently, domestic CRAF participation is restricted by caps on participant numbers and types of carriers. Expanding the program to include integrated logistics providers like Amazon, which now operates an extensive cargo fleet, could offer additional surge options.

Deep-sea Shipping

Strategic sealift, considered the militarized version of deep-sea shipping, focuses on moving military equipment, supplies, and personnel during conflict, enabling the projection and sustainment of U.S. military forces. The U.S. Merchant Marine, often called the "fourth arm of defense," supports combat operations and provides expertise for operating strategic sealift vessels.[72] The Military Sealift Command leverages government-owned and commercially chartered vessels, many with dual-use functionality.[73] This integration is foundational to any sustained U.S. military engagement abroad.

The United States maintains a National Defense Reserve Fleet (NDRF), established after World War II, to provide a pool of merchant ships for national emergencies.[74] The Ready

Reserve Force (RRF), a high-readiness subset of the NDRF created in 1976, is designed to be activated within 5 to 10 days to rapidly deploy heavy military equipment.[75]

Key laws related to deep-sea shipping that support national security include the Jones Act of 1920, which requires goods transported between U.S. ports to be carried on U.S.-built, -owned, and -crewed vessels, primarily for national defense and commercial sovereignty.[76] The Merchant Marine Act (MMA) of 1936 aimed to maintain a merchant marine for foreign trade and as a naval auxiliary in time of war or emergency.[77] The Military Cargo Preference Act of 1904 restricts the transport of military equipment and supplies primarily to U.S.-flagged vessels, with few exceptions.[78] These laws are controversial because a U.S. vessel is roughly three times more expensive to operate than a foreign ship.[79] Although the Jones Act was intended to preserve a strong U.S. merchant fleet, the active domestic deep-sea fleet today consists of fewer than 100 large cargo ships, less capable than the fleet in 1950, making the country highly dependent on foreign shippers. U.S. regulations constrain the domestic shipping and shipbuilding industries.[80] While these laws are critical for national security, they also restrict competitiveness and workforce flexibility, contributing to high operational costs and limiting profit margins.[81]

Ports and Harbors

During peacetime, ports and harbors support national security indirectly and directly. Indirectly, the industry contributes substantially to U.S. prosperity and, thereby, national security. Raw products and finished goods move through ports to provide goods to the $440-billion defense industrial base.[82] Ports also play a direct role in supporting national security objectives, including military transportation. The U.S. Army's Surface Deployment Distribution Command (SDDC) coordinates U.S.-flagged commercial ships to carry the majority of peacetime DOD ship cargo (except for dry cargo and ammunition), with commercial terminal operators handling ship loading and unloading.[83] During any major conflict scenario, U.S. ports are critical nodes for deployment, sustainment, and redeployment.

Seaports also play a key role in U.S. border security. The U.S. Coast Guard (USCG) uses its authorities to protect ports and waterways through a range of law enforcement operations.[84] U.S. Customs and Border Protection (CBP) provides routine cargo and regulatory inspections at ports and harbors, ensuring compliance with international trade laws and security protocols.[85] These operations protect U.S. agriculture, health, intellectual property, and physical security.

According to industry estimates, nearly 90 percent of cargo transported during a major military mobilization depends on the commercial maritime sector.[86] The SDDC has designated 18 Commercial Strategic Ports [*See Figure 3: Strategic Seaports*] "to support the deployment of U.S. Armed Forces assets in the event of war, contingency, or other national defense emergency or disaster."[87] These ports are owned and operated by local or state port authorities and form a key component of the National Port Readiness Network (NPRN) to ensure readiness to support potential force deployments.[88] Maintaining contracts, such as standing labor agreements for terminal-related services, can decrease the amount of time required for mobilization during a contingency. The NPRN also plays an important role in bringing together interagency stakeholders to address individual equities related to mobilization.

The SDDC owns and operates six Military Strategic Seaports to support seaport capacity demand surges for military cargo deployments in response to national security contingencies.[89] These ports provide unique services that would be difficult for DOD to acquire at Commercial Strategic Seaports, such as support for submarines and munitions storage and handling.[90]

Rail Freight

Today, DOD uses the Strategic Rail Corridor Network (STRACNET), a 41,000-mile network connecting key defense installations to strategic seaports, managed in coordination with the FRA and Military SDDC.[91] While the SDDC maintains some DOD-owned railcars, successful mass mobilization at scale requires coordination with CL I carriers to use their commercial fleets. Providing commercial carriers with predictability is crucial for ensuring national security objectives are met without degrading these firms' ability to support the domestic economy.

The U.S. rail freight sector plays a critical role in supporting the nation's commitments to North Atlantic Treaty Organization (NATO) by enabling strategic mobility, infrastructure resilience, and rapid force projection. Through the STRACNET, DOD can efficiently move heavy equipment, vehicles, and supplies from inland installations to coastal ports for transatlantic deployment in support of NATO missions. This dual-use infrastructure not only enhances national economic productivity but also aligns with NATO's Military Mobility Initiative, which emphasizes the removal of logistical barriers to rapid troop and equipment movement across allied territories.[92] In addition, the integration of freight rail capabilities into military exercises and wargaming scenarios, such as those led by USTRANSCOM, identifies gaps in interoperability and prepares the alliance for coordinated crisis response. By sustaining and modernizing its freight rail system, the United States reinforces its strategic credibility and enhances collective defense with its allies.

Trucking

The U.S. trucking industry is an integral component of the nation's defense logistics infrastructure, providing essential support for the movement of military personnel, equipment, and supplies. The trucking enterprise's two main defense customers include the Defense Logistics Agency (DLA) and USTRANSCOM.

DLA manages the global defense supply chain for the military services and combatant commands. DLA relies heavily on commercial trucking to ensure the flow of defense materiel through its global network of distribution centers.[93] USTRANSCOM, through the SDDC, depends on the trucking industry to provide global surface deployment and distribution transportation services in support of national security objectives. SDDC leverages the commercial trucking industry's capacity to enable force movements and deployments to transport assets to sea and aerial ports for global power projection.[94] In addition, trucking facilitates domestic operations for unit relocations, military exercises, and the sustainment of military installations. Any disruption to commercial trucking capacity directly affects military readiness and the nation's ability to respond effectively to foreign and domestic contingencies.

The trucking industry's role in transporting military cargo and supporting force deployment and sustainment is vital to national mobilization efforts. Current DOD policy is to "transport personnel, equipment, and sustainment using commercial assets when practical and prudent. Even during contingency situations, commercial truck lines are critical in projecting U.S. forces from CONUS locations to the theater of operations."[95]

Partnered with commercial trucking, SDDC can provide timely and effective transportation solutions to meet DOD requirements and defense mobilization efforts.[96] A March 2025 conversation with SDDC leaders clarified: "We have over 1,000 trucking companies registered in our DOD commercial carrier program, granting us access to sufficient trucking capacity in a time of mobilization."[97] Therefore, the commercial trucking sector is well-positioned to provide sufficient transport during defense mobilization and will continue to operate as the essential "fourth component" for projecting DOD forces. However, maintaining this advantage and logistical depth could prove challenging if the sector faces future capacity constraints due to labor shortfalls, aging infrastructure, and or hastily implemented technology adaptation.

Warehousing

Warehouses contribute to national security by sustaining operational readiness. The U.S. military relies on a network of storage and distribution facilities to ensure that mission essential equipment and supplies—ranging from major platforms, ammunition and food to spare parts and fuel—are available where and when they are needed. This need is particularly acute in contested and congested theaters like USINDOPACOM, where lines of communication are vulnerable to disruption.

DLA plays a central role in this ecosystem. With 24 global distribution centers managing more than 2.2 million unique line items, DLA integrates warehousing into broader military logistics, supporting both domestic operations and overseas missions.[98] These facilities support rapid deployment, disaster relief, and sustained combat operations. For example, DLA Indo-Pacific enables direct resupply to forward-deployed units, minimizing the need to rely on extended, vulnerable supply chains from CONUS, with the exception of munitions warehousing and distribution, and equipment maintenance.[99]

Domestically, agencies like the Federal Emergency Management Agency (FEMA) maintain stockpiles of emergency supplies in regional warehouses, ensuring that relief can be dispatched swiftly after disasters.[100] This dual-use infrastructure exemplifies how warehousing supports both national defense and civil preparedness.

If the U.S. industrial base cannot produce, stage, and distribute defense materiel swiftly, the nation's deterrence posture and readiness will be compromised.[101] Warehousing serves as a crucial enabler in this process. A vast network of general-purpose and specialized defense depots supports rapid reconfiguration from peacetime operations to wartime logistics. For instance, during the Cold War, the United States maintained dispersed stockpiles of equipment to shorten deployment timelines. Today, the warehousing network could again serve as the backbone for such surge capacity, provided it receives sustained investment.

The creation of the Strategic and Critical Materials Board in 2025 under the Stockpiling Act is a step in the right direction, signaling institutional recognition of the storage requirements for mobilization.[102] Yet a modern mobilization effort would also require digital integration, predictive logistics, and AI-driven assessments to map production needs against warehouse locations and supply routes. Without these upgrades, the nation risks repeating past shortcomings, where defense production outpaced logistics capacity, leaving essential goods stranded in depots or delayed at ports. As industrial strategist Jerry McGinn warned in 2025 Senate testimony, "mobilization cannot succeed in isolation from warehousing and distribution networks."[103]

Overall, the transportation and logistics industry's criticality to national and defense mobilization is widely recognized, but this implicitly means that industry issues and concerns may inherently cause impediments to U.S. global power projection. The next section explores these concerns in detail.

Industry Issues, Concerns, and Opportunities

While there are common threads and areas of latency throughout the transportation and logistics industry, each segment faces unique challenges in maintaining a competitive edge and preparing to facilitate potential military mobilization. The following section provides an overview of industry-specific concerns.

Air Freight

The air transport industry faces significant challenges that constrain its full potential during mobilization. Key issues include:

- **Ground Integration.** Mobilization efforts are often slowed by the logistical complexity of servicing a wide variety of commercial and military aircraft, each requiring different types of ground support equipment (GSE). During the 2021 Afghanistan evacuation, the need to source and coordinate multiple GSE types at short notice created delays and operational friction.[104] Improving standardization and pre-coordination of ground handling requirements is essential to accelerating joint airlift operations.
- **Airport Infrastructure.** U.S. air infrastructure is rated "D+" due to aging facilities, underinvestment, and substantial workforce shortages, including maintenance technicians and air traffic controllers.[105] The Federal Aviation Administration (FAA) has estimated that an additional $68 billion in development projects are needed for airport infrastructure investments through 2029, while the Airports Council International – North America estimates $151 billion. Projects include surface area improvements, terminal safety, security, and others.[106]
- **Vulnerability to Cyber Attack.** Increasing digital connectivity creates vulnerabilities to cyber threats, particularly for legacy systems and interdependent networks.[107]
- **Small Industrial Capacity.** The domestic industrial base for large aircraft manufacturing has shrunk significantly, with only Boeing remaining, degrading capacity to produce and maintain essential aircraft.[108]
- **Cargo Capacity Constraints**. U.S. commercial air cargo capacity growth worldwide is constrained by an aging fleet, insufficient investment in new freighters, and delivery delays on aircraft orders. Usage rates are at their highest point in 5 years, leaving little flexibility for operational surges or market disruption, and the number of dedicated freighters remains insufficient to support market volatility and anticipated consumer e-commerce demand growth.[109] These market conditions leave DOD with three options for moving cargo by air: it can pay premium prices, divert additional military assets, or exercise wartime legal authorities.

Deep-sea Shipping

The global shipping industry faces growing pressure from geopolitical tension, environmental mandates, increasing costs, and a worsening shortage of skilled labor. These challenges impact Western democracies like the United States.

- **Geopolitical Tension.** Conflicts in regions like the Middle East—particularly Houthi threats near the Red Sea—and disruptions at chokepoints such as the Suez and Panama Canals are forcing vessels to reroute, driving up costs, increasing risks to crew safety, and straining already fragile global supply chains.[110,111]
- **Environmental Challenges.** Regulations to reduce greenhouse gas emissions require the industry to invest in new, expensive technologies. The International Maritime Organization's (IMO's) goal is to become net-zero by 2050.[112] While companies are investing in sustainable solutions, green fuels are currently expensive. Nevertheless, the opportunities within technological development are substantial and can provide the United States with alternative ways to leverage its maritime strength.
- **Workforce Shortages.** Shortfalls in human labor affect both deep-sea shipping and related industries like shipbuilding. A lack of qualified sea personnel, specifically merchant mariners, drives shipowners to use foreign registries. "The shortage of merchant mariners is one of the biggest obstacles…to quickly expand the current fleet of fewer than 200 vehicle carriers, oil tankers and containerships that can be called upon in wartime to carry American vehicles, fuel and food."[113] In Western societies, people prefer jobs with regular hours and better work-life balance, making seafaring less appealing absent significant wage increases.[114] The commercial shipbuilding workforce in the United States is aging and declining. Recruitment and retention struggles are exacerbated by competition from other sectors and low national unemployment. U.S. labor costs are significantly higher than in competitor nations.[115] Maritime academies are also experiencing declining enrollment.
- **Aging Fleet and Shipbuilding Decline.** The U.S. deep-sea fleet is aging and shrinking. The average age of a Jones Act-compliant vessel exceeds 30 years, making them less efficient and more costly to maintain.[116] The United States has fewer than 100 active large cargo deep-sea ships. The domestic shipbuilding base is in a perilous state, with few commercial shipyards capable of building large ocean-going cargo ships. High labor and material costs make U.S. domestic shipbuilding uncompetitive. The U.S. commercial shipbuilding workforce currently has an estimated shortage of 140,000 skilled workers.[117]

  Both the Trump and Biden administrations have acknowledged the strategic decline of the U.S. maritime sector and responded with executive orders—issued on April 9, 2025, and April 9, 2024, respectively—laying out parallel strategies to rebuild shipbuilding capacity. These directives call for sustained federal investment, targeted incentives to drive private sector engagement, modernization of domestic shipyards, and closer collaboration with allies.

Ports and Harbors

As of 2023, no U.S. port ranked in the top 50 of port operations worldwide.[118,119] U.S. ports and harbors face several impediments to remaining globally competitive and maintaining the ability to support rapid mobilization:

- **Congestion.** COVID-19 exposed congestion as an industry vulnerability.[120] U.S. ports are not yet optimized (whether by infrastructure expansion and development or implementing new technology) to maximize throughput.
- **Lack of Incentive.** The Commercial Strategic Seaport designation requires ports to conduct voluntary planning and provide periodic readiness reports without tangible benefits and at a risk of considerable cost (in lost revenue) during potential mobilization.
- **Large number of Stakeholders.** Among the port stakeholders consulted for this study in 2025, several highlighted the complex nature of inter-stakeholder communications at ports, including with the government.[121,122,123] This contributes to the industry's reactive, rather than proactive, atmosphere and leads to years-long wait times and negotiations for project approval. Stakeholder proliferation can also be problematic when trying to surge or shift capacity, synchronize operations, or create resilience.
- **Principal-Agent Dilemma.** Dockworker trade unions drive up labor costs and are incentivized to negotiate to maintain the status quo at the expense of port modernization, wherein automation tools are perceived as an impediment to union livelihood.[124]
- **Susceptibility to Market Volatility.** The industry thrives in an environment of global commerce but is particularly vulnerable to trade wars or other exogenous factors that affect consumer demand.

Rail Freight

Despite significant private investments in infrastructure and modernization in recent years (including $26.8 billion in 2023), the industry faces numerous systemic challenges:[125]

- **Infrastructure and Modernization**. Substantial portions of the U.S. rail network still require modernization. The implementation of precision scheduled railroading (PSR), an operating philosophy aimed at increasing efficiency and reducing costs, has been a notable development. While PSR has improved scheduling, reduced costs, and increased responsiveness, its implementation has led to other challenges such as longer trains, which increase safety concerns and can exacerbate traffic congestion.[126]
- **Public Opposition.** Addressing public concern regarding the safe transportation of hazardous materials, particularly after recent high-profile crashes, requires significant financial investment.
- **Trade Policies.** Evolving U.S. trade policies and infrastructure bottlenecks further constrain the industry's adaptability and performance.
- **Workforce Shortages.** CL I rail freight employment is projected to increase 2 percent over the next 10 years, slower than average for all occupations.[127] There are looming challenges with retention within the industry with the implementation of PSR, as carriers downsized by 30 percent from 2011 to 2021, with notable reductions in train and crew operators and maintenance personnel.[128]

- **Environmental compliance costs.** Specific environmental regulations, such as those proposed by the California Air Resources Board, mandate a transition to zero-emission locomotives.[129] The rail industry estimates compliance could cost approximately $16 billion over 25 years, not including additional infrastructure upgrades like electric grid and hydrogen pipeline development.

Trucking

From a national security perspective, the U.S. trucking industry faces significant challenges that directly impact supply chain resilience, economic stability, and defense logistics. Information derived from research and engagement with trucking, defense, and academic experts points to the following enduring issues:

- **Workforce Shortages.** The industry faces a deficit of over 80,000 drivers, with projections suggesting this number could double by 2030 if current trends continue.[130] Reports indicate U.S. truck drivers earn approximately 40 percent less today than their counterparts in the 1970s.[131]
- **Inadequate Infrastructure.** Aging infrastructure increases transportation delays and maintenance costs for the trucking industry.[132] There is not enough parking or access to safe areas for truckers during periods of rest. Developing charging infrastructure for electric trucks is becoming increasingly important and must be appropriately established before any transition from diesel tractors.[133]
- **Responsible Technology Adaptation.** Current zero-emission trucking regulations pushing the expansion of electric trucks are myopic. A realistic transition timeline must be established to achieve key operational milestones, such as demonstrated improvements in vehicle range, charging speed, truck weights, and the widespread build-out of a reliable national charging and fueling network. These milestones must be set collaboratively with industry and technology experts and become established proactively before shifting the industry to electric trucks.

Warehousing

Although the warehousing industry is expanding, it faces several entrenched challenges that threaten its long-term viability:

- **Workforce Shortages.** Multiple factors contribute to workforce shortages and lead firms to rely on temporary labor. The physical demands of warehouse work, combined with low wages, limited benefits, and increasing automation all contribute to recruitment and retention issues across the country.[134]

- **Technology Driving the Need to Upskill Workers.** Although technologies such as AI-driven inventory systems and robotic pickers can improve throughput and reduce costs, they also demand a more technically skilled workforce. As automation becomes more prevalent, this transition necessitates investment in tailored workforce development programs to upskill existing employees.
- **Uneven Technology Adoption.** While large industry firms are pioneering smart warehouses, smaller businesses lag behind due to cost barriers.
- **"Just-in-time" Is Efficient but Insufficient.** While economically efficient, the COVID-19 pandemic revealed that recent reliance on "just-in-time" logistics is vulnerable during global disruptions. Shifting to "just-in-case" strategies, supported by domestic warehousing expansion, would enhance national resilience but require upfront capital investments and potential regulatory reform.
- **Limited Capacity Overseas to Support Mobilization.** Warehousing infrastructure in strategic locations like Guam and Hawaii is at capacity and requires modernization. Current inventory strategies emphasize efficiency over effectiveness, storing most material in CONUS rather than at forward positions—an approach that may prove inadequate during a high-end conflict.

Although technology cannot solve all the industry's issues and concerns, technological advancement is playing a determining role in shaping the future of the industry. The following section examines technology's effect on the industry in detail.

Emerging Technology and AI

AI is transforming the transportation and logistics industry by boosting efficiency, cutting costs, and improving resilience. Each sector is using technology to solve unique challenges, although the pace of adoption and implementation varies. Despite gains such as optimizing schedules and routes, autonomous systems, and predictive analysis, all sectors must address how new technologies pose vulnerabilities through cybersecurity exposure, infrastructure, workforce adaptation, and regulations. The following sections detail key impacts and trends across each transportation sector.

Air Freight

Emerging technologies, particularly AI, are poised to transform the air transport industry across commercial and military applications. AI can optimize operations through predictive maintenance, improved flight planning, logistics routing, and resource allocation.[135] The current industry model is based on time, achieving promised delivery windows rather than maximizing aircraft fill efficiency. For defense logistics, AI offers the potential to streamline supply chain visibility, improve coordination with allies and partners, and bridge the planning gap between commercial and military sectors. AI simulations and digital twins provide cost-effective methods to model mobilization scenarios and forecast constraints, enhancing flexibility and decision-making. While autonomous flight adoption is slow due to safety concerns, technologies like drones and swarm technology present the potential for delivery to hard-to-access locations where traditional aircraft are unsuitable.[136] Other relevant technologies include automation, augmented reality, robotics, and connected cargo.[137]

Deep-sea Shipping

Artificial intelligence, digitalization, and automation are reshaping the deep-sea shipping industry. AI technologies enable real-time route optimization, predictive maintenance, and smarter cargo handling, leveraging sensor data to reduce fuel use, minimize downtime, and enhance safety.[138] Wind-assisted propulsion, like the Oceanbird concept, aims to significantly lower emissions.[139] Predictive maintenance solutions, using condition monitoring and machine learning, reduce costs and enhance fleet availability. These technologies stem from U.S.-based companies, although the United States' deep-sea shipping industry itself is not a significant consumer of these technologies. The environmental challenges and regulations may serve as an opportunity for developing new technology for the future.

Ports and Harbors

A 2024 Government Accountability Office study noted that among the 10 largest U.S. container ports, technological improvements, including the use of AI, have focused more on process automation improvements—applied to port operations through predictive data analytics, proactive port call scheduling, and labor requirement forecasting—rather than automated cargo handling equipment.[140,141] Process automation does improve throughput by moving goods through the port more quickly, reducing congestion and increasing turnover.

U.S. port automation innovation is low compared to international ports, partly due to the domestic influence of labor unions that seek to protect jobs by limiting automation.[142] Top-performing international ports have embraced technology and innovation to a greater degree, including tools such as the Vessel Management System, Automated Identification System, and digital twins.

Rail Freight

The U.S. rail industry is increasingly leveraging technology to improve safety, efficiency, and sustainability. Key technologies include the Internet of Things for real-time monitoring, big data analytics for improved decision-making, and AI for automation and predictive maintenance.[143] AI has significant implications for national security by fortifying the resilience and adaptability of critical infrastructure, with potential use cases ranging from predictive maintenance to network resilience modeling. Federal funding, particularly from the Infrastructure Investment and Jobs Act of 2021, is supporting rail modernization and safety improvements.[144]

Trucking

The U.S. trucking industry is experiencing a significant transformation driven by emerging technologies that are enabling increased operational efficiency, safety, environmental sustainability, and in some cases, such as autonomous trucks, are changing the very nature of the profession.

Trucking automation encompasses advanced driver-assistance systems (ADAS) and the development of fully autonomous trucks (Atrucks). Research suggests Atrucks may lead to significant shifts in U.S. trade patterns by reducing per ton-mile trucking costs and making the industry more competitive with rail transportation, particularly for distances less than 3,000 miles.[145] The same research anticipates that human-driven trucks will continue to dominate shorter-distance freight movements, with Atrucks becoming more prevalent for distances over 500 miles.[146]

The industry also faces increasing pressure to reduce greenhouse gas emissions and adopt clean energy, driving interest in electrification and alternative fuels.[147,148] However, challenges remain in the widespread adoption of electric trucks, including the need for significant expansion of utility infrastructure to generate and distribute more electricity and concerns regarding the availability of raw materials for battery electric vehicle suppliers.[149] Stringent greenhouse gas standards for new tractors beginning in 2028 also pose significant cost implications for the industry, with costs to build the zero-emission infrastructure potentially exceeding $620 billion.[150] While these technological advancements offer the potential for increased efficiency and reduced and improved environmental performance, they also require significant investment, adaptation, and workforce upskilling.

Warehousing

Emerging technologies—particularly AI and digital twins—are transforming warehousing from a reactive to a predictive discipline. AI applications optimize everything from material handling to route planning. For example, AI-driven warehouse management systems can forecast demand spikes, recommend space allocations, and optimize inventory holdings.[151] Digital twins—a virtual replica of a warehouse and or supply chain—allow operators to simulate scenarios, test logistics decisions, and assess bottlenecks before they occur.[152] These simulations can model real-time variables such as workforce availability, natural disasters, or military contingencies. As a result, logistics planners can rehearse responses, allocate inventory more efficiently, and improve resilience against various scenarios.

This evolution is particularly valuable for military planners. Combatant commands can align logistics capabilities with strategic objectives by integrating AI and digital twins into wargaming and force posture analysis. These tools help identify vulnerabilities and enable pre-positioning of critical supplies based on scenario-specific demand signals.

Still, technological transformation across the industry remains uneven, with smaller firms struggling to adopt advanced systems at scale. Consequently, while the warehousing industry has modernized rapidly in certain areas, the industry as a whole remains labor-intensive and fragmented, posing challenges and opportunities for strategic national planning.

Overall, technology is driving efficiency gains in the transportation and logistics industry, tailored to the unique characteristics of each sector. This enables the faster delivery of a greater number of goods. Regardless of the sector, any firm's willingness to invest in capabilities will be determined by the expected return on investment.

Policy Recommendations

Market forces will continue to press commercial firms to seek efficiencies to increase profit margins, for instance, through the transportation and logistics industry's embrace of process automation. Therefore, the study recommends that the federal government focus its efforts on areas where stakeholder interests may not organically align with the industry to support the United States' ability to project power globally during mobilization. The transportation industry will likely benefit from recent legislation designed to reinvigorate the U.S. industrial base and infrastructure, but these measures will be insufficient independently to position the industry to remain competitive and prepared to execute rapid national mobilization.

National security leaders should examine the industry as a whole, including intermodal connection points, to consider ways to maximize throughput across entire transportation corridors rather than stove-piped sectors. This industry study identified six key areas for concentrated government effort across all the sectors. These include: 1) increasing government and industry planning and coordination; 2) facilitating infrastructure improvements and research; 3) enhancing integrated wargaming; 4) incentivizing technology improvements; 5) alleviating labor shortages; and 6) refining regulations and policy. The government can take action at both the strategic and tactical levels to shift from a reactive to a more proactive approach to addressing concerns. These cross-cutting recommendations are listed in priority order, reflecting areas of assessed greatest need across the industry as a whole and criticality to mobilization. The added benefit of these initiatives is that they can alleviate market inefficiencies, support continued economic growth, and improve the industry's readiness to support national mobilization. The study acknowledges that in prioritizing cross-cutting recommendations, there is an inherent potential to lose sight of priority needs within industry sectors. For instance, the authors consider deep-sea shipping and ports and harbors as the U.S. transportation and logistics industry's greatest areas of need. Therefore, additional industry-specific recommendations can be found in *Annex C*, below.

1) Increasing Government and Industry Planning and Coordination

Nearly every transportation and logistics industry sector studied would benefit from increased coordination with the government. During discussions in the spring of 2025, multiple industry stakeholders expressed that commercial-government engagements were limited by a lack of government bandwidth and personnel. The industry would benefit from a comprehensive strategy that promotes interagency coordination to streamline commercial-government interactions, prioritizes industry improvements by sector, and identifies areas to better integrate commercial transportation and logistics infrastructure into national security and defense logistics strategies. Such a strategy could help commercial entities in navigating diverse government stakeholder requirements, saving valuable time, but will necessitate additional funding to alleviate already-stretched personnel across the country. A holistic strategy should also consider ways to build capacity and integration with allies and partners. One potential avenue for uniting stakeholders and providing a comprehensive strategy includes re-establishing an Office of National Mobilization:[ii]

[ii] From the Secord Word War through 1973, national-level mobilization responsibilities shifted through a succession of specialized offices—including the Office of War Mobilization (later Office of War Mobilization and Reconversion), the National Security Resources Board, the Office of Defense Mobilization, and the Office of Emergency Preparedness—each with varying degrees of authority, executive access, and focus on military-industrial readiness. Previous national-level mobilization offices were closed in 1973, and their responsibilities transferred to the FEMA due to a government reorganization driven by a declining postwar threat perception, bureaucratic inefficiencies, and a shift toward an all-hazards approach that prioritized disaster response over specialized mobilization planning. Over time, various mobilization offices were moved away from direct reporting to the executive branch and folded into broader bureaucracies to streamline operations, reduce redundancy, and reflect the evolving focus from wartime readiness to general emergency management. However, FEMA has proven ineffective in coordinating and planning mobilization because of its limited authority, fragmented interagency role, insufficient resources, and lack of high-level influence within the federal government.

Re-Establish an Office of National Mobilization

Description	The Office of National Mobilization (ONM) would function under the executive branch as a centralized agency responsible for planning, coordinating, integrating, and overseeing national mobilization preparedness and industrial mobilization during national security emergencies. Key roles include developing mobilization plans and coordinating across federal departments, serving as an advisor to the National Security Council (NSC) on Defense Production Act (DPA) authorities and resource preparedness, and developing planning guidance and procedures to ensure readiness.[153] ONM would resolve issues related to DPA priorities and allocations and facilitate interagency collaboration to maintain institutional memory and agility.[154] The ONM would synchronize transportation and logistics efforts across the military, industry, and allied and partner nations, ensuring seamless integration of supply chains and mobilization activities critical for rapid and efficient wartime scaling. ONM would coordinate with domestic industry bodies and government departments such as Treasury, Commerce, and Labor to ensure whole-of-government preparedness. During crises, would expand staffing by activating its Executive Reserve to support mobilization and resource management under NSC guidance. ONM would bridge military, industrial, civilian, and international sectors to provide authoritative leadership, ensuring coherence and efficiency in mobilization efforts during peacetime and emergencies.
Objective	To provide a central entity to spearhead national mobilization, unifying logistics and transportation with industrial capacity and governmental authority for decisive, rapid, and sustained crisis response.
Key Stakeholders	• Executive Office of the President • NSC • DOD • Department of State (DOS) • Department of Commerce (DOC) • Department of Treasury • Department of Labor (DOL) • Department of Energy • DOT • FEMA • Industry bodies/associations and academia • Trusted allies and partners **Note**: The ONM will also identity key stakeholders for the National Defense Executive Reserve, a volunteer body of industry executives and experts from the private sector and government, established under the DPA, who are trained to be activated in national security emergencies to provide executive support and improve mobilization and industrial productivity.
Timelines	**12 months:** Initial operating capability **24-30 months:** Final operating capability
Legislation/ Regulations	**Statutory Authorization and Mandate.** ONM would require explicit legislative authorization defining its mission to coordinate, integrate, and oversee national mobilization preparedness and industrial mobilization efforts across federal departments and agencies. Enact as a new statute or as a provision to existing laws such as the DPA. **Interagency Coordination and Reporting.** ONM would require statutory or regulatory authority to coordinate interagency groups, federal departments and other stakeholders to ensure whole-of-government preparedness for mobilization and national emergencies.
Costs	**Personnel**. ONM would require 200 dedicated, trained staff with logistics, industrial (Including industry associations), and interagency coordination expertise. ONM acts as a skeletal organization that expands in time of crisis. **Financial**. Moderate annual cost (tens of millions of dollars). Full-time employee (FTE) costs can be mitigated with inter-agency joint duty assignments (JDAs) to share expertise while reducing the need for dedicated personnel. Must-fill JDAs would also bolster inter-agency coordination.
Risks & Mitigation	**Interagency coordination**. Overlapping jurisdictions and parochial interests could impede effective cooperation or delay decision-making.[155] Placing ONM under the executive branch and requiring accountability to the NSC (quarterly) and Congress (annually), may mitigate this issue. **Disbandment between administrations.** ONM could become a political targeted for disbandment because mobilization planning functions are often deprioritized or marginalized during peacetime. Routine reporting to the NSC and Congress, and industry coordination can mitigate this concern by ensuring ONM's relevance during peacetime and crisis is understood.

2) Facilitating Infrastructure Improvements and Research

Increased proactive and strategic government engagement can ensure that mobilization requirements are addressed in the design phase of infrastructure development plans across the country. Government funds and grants are available for private firms, but a key challenge is ensuring that funding allocation, which is heavily regulated to ensure fairness, meets strategic priorities. Infrastructure modernization is underway but is uneven across and within transportation sectors depending on firm size and available capital, which is often inaccessible for small firms. Focus areas for infrastructure improvements should include alleviating top congestion bottlenecks—including in the Indo-Pacific—investing in intermodal connections, and rebuilding transportation-related manufacturing capacity. In some sectors, such as air freight, deep-sea shipping, and warehousing, the government should seek to offer incentives for expanding capacity that otherwise would be insufficient to support mobilization at current levels. One potential avenue to best capitalize on recent infrastructure improvement legislation is a DOD-led effort to align transportation and logistics-related infrastructure modernization to mobilization needs:

National Intermodal Infrastructure Modernization Program (NIIMP)		
Description	A DOD-led, interagency infrastructure initiative to modernize and expand dual-use intermodal infrastructure across ports, air cargo terminals, rail nodes, and truck corridors. The project funds and guides enhancements at Commercial Strategic Ports, CRAF-designated air hubs, key STRACNET railheads, and high-throughput trucking chokepoints to ensure synchronized and efficient military and commercial logistics operations. It will also establish a distributed network of warehouses in the Indo-Pacific with trusted allies and partners.	
Objective	Enhance national security and logistics resilience by modernizing critical intermodal nodes with infrastructure that enables rapid and scalable cargo transfer during national mobilization. Improve throughput, reduce bottlenecks, dispersion and align civilian infrastructure with military requirements.	
Lead Actor(s)	DOD, supported by USTRANSCOM, SDDC, and DLA in coordination with DOT and DOT's Maritime Administration (MARAD).	
Key Stakeholders	• MARAD • FAA • FRA • STB • Trusted allies and partners	• Port and airport authorities • Commercial rail operators • Trucking industry associations • Labor unions • State and local governments

	• USACE
Timelines	**6–12 months:** Policy launch and node assessment **12–24 months:** Prioritization and project design **2–7 years:** Construction and modernization (phased by criticality and feasibility)
Legislation/ Regulations	• Integrate MARAD's Port Infrastructure Development Program (PIDP), the FAA's Airport Improvement Program, and FRA discretionary grant programs under one intermodal mobilization infrastructure umbrella. • Enable DOD sponsorship under the National Environmental Policy Act (NEPA) for dual-use military-civilian infrastructure to expedite project approvals. • Require periodic NPRN-led readiness assessments of all intermodal nodes (not just ports). • Amend DPA and related authorities to designate key intermodal nodes as Defense Critical Infrastructure.
Cost	$12–18 billion over 10 years, covering 18+ commercial strategic ports, 20+ CRAF-aligned air cargo hubs, key rail interchanges along STRACNET, and trucking chokepoints across major deployment corridors.
Risks & Mitigation	• **Jurisdictional Complexity:** Overlapping authorities among DOT, FAA, DOD, and local agencies can reduce effective decision-making. This can be mitigated by establishing a National Intermodal Mobilization Working Group under the NPRN. • **Labor Disputes:** Union resistance to automation and modernization may delay and impede development project. This can be mitigated by tying funding to pre-approved labor agreements and readiness metrics. • **Infrastructure Downtime:** Construction may cause temporary operational bottlenecks. Can minimize downtime using spiral development by prioritizing high-return on investment (ROI) upgrades. • **Funding Gaps:** Existing grant processes may not align to high-priority defense upgrades. This can be addressed by include defense readiness-based scoring in grant evaluations. • **Regulatory Delays:** Environmental policy requirements may stall timelines. This can be mitigated by providing pre-clearance pathways under NEPA for DOD-aligned projects.

3) Logistics-Focused Wargaming

Incorporating the transportation and logistics industry into DOD wargaming is essential, especially given the tendency by military officials to "assume away" any logistical or sustainment problems as they plan operations.[156] For any U.S. military strategy to be useful and successful, it must include realistic logistical considerations. This is especially relevant given the tyranny of distance in the Indo-Pacific theater. Meetings and site visits in the spring of 2025 revealed that tabletop exercises are being conducted on an ad-hoc basis in some sectors of the transportation industry. These tabletop exercises (TTXs) help to mitigate crises and identify vulnerabilities. However, there is a substantial untapped opportunity to scale up wargaming as a part of a coordinated approach across the industry. These opportunities include taking advantage of emerging technologies such as digital twin architecture to minimize the disruption that wargaming might have on industry operations. Effective wargaming would not only improve national readiness for wartime but would also demonstrate U.S. capability to mobilize quickly and sustain a protracted war, resulting in stronger deterrence against near-peer adversaries. Industry-specific recommendations can be found in *Annex B*, below.

4) Incentivizing Technology Improvements

Technology presents an opportunity to increase efficiency across the transportation industry. While automation technology requires high capital investments, firms are already starting to integrate AI-driven process improvements. Tax incentives, subsidies, and grants can target elements of the transportation industry to reduce latencies for potential mobilization, while promoting responsible technology adaptation. AI models can also be integrated into wartime mobilization planning scenarios to better predict capacity requirements and potential bottlenecks. A potential DOD-related AI optimization project includes:

AI Optimization coupled with Blockchain Technology		
Description	This initiative proposes modernizing DOD's logistics infrastructure and acquisition planning and execution using AI for predictive optimization and blockchain for secure, transparent supply chain tracking. These technologies are intended to reduce inefficiencies, counteract disruptions (geopolitical, cyber, or natural), increase interoperability with trusted allies and partners, and secure mission-critical assets across global DOD operations.	
Objective	Apply AI and blockchain technologies to improve auditability and enhance supply chain forecasting, inventory optimization, traceability, and vendor validation, ensuring uninterrupted and secure traceability and delivery of assets.	
Lead Actor(s)	DLA and the Joint Staff J4	
Key Stakeholders	• USTRANSCOM • Defense Information Systems Agency • National Security Agency • Department of Homeland Security's Cybersecurity and Infrastructure Security Agency	• General Services Administration • Office of the Secretary of Defense for Acquisition and Sustainment • Industry partners and academia • Trusted allies and partners
Timelines	**6-9 months:** Requirements analysis and cybersecurity assessment **24-36 months:*** Development, backward integration, and testing **36+ months:*** Deployment, integration, and training ***Note**: spiral development would deliver initial capabilities earlier in timeline and iteratively deliver broader capabilities across whole-of-government enterprise	
Legislation/ Regulations	• Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFAR): **amend** FAR Part 4 and DFAR Part 204 to explicitly authorize the use	

	of distributed ledger technology and AI-based tools for acquisition, logistics tracking, and vendor verification. • DODI 5000.87 (Software Acquisition Pathway): **amend** to include AI-model lifecycle management and blockchain infrastructure under acceptable architectures for software-based logistics programs. • Cybersecurity Maturity Model Certification (CMMC 2.0): **amend** to clarify how CMMC Level 3 and above applies to blockchain nodes and AI training pipelines involving Controlled Unclassified Information. • Clinger-Cohen Act (1996): **amend/clarify** language to accommodate decentralized and autonomous system governance in IT investments. • 10 USC §2222 (Defense Business Systems): **amend** to remove restrictions on business system modernization to allow for non-traditional vendors and allow for usage of emerging technologies. • DOD 4000.25 V2: **amend/rescind** directives associated with the use of legacy systems that may conflict with real-time, autonomous logistics enabled by AI.
Cost	**3-yr estimate:** **Category:** — **Cost Estimate:** R&D/prototyping — $150M System design and deployment — $500M Cyber compliance and training — $100M Annual operating expense (Yr3 Only) — $50M **Total 3-yr Estimate** — **$800M**
Risks	**Cybersecurity Threats:** AI and blockchain systems may become attack vectors if not hardened per DOD/National Institute of Standards and Technology standards. **Interoperability:** Integrating modern systems with legacy logistics platforms (e.g., the Defense Priorities & Allocations System Program) is complex. **Adoption Resistance:** Cultural and training gaps within DOD logistics communities could delay implementation. **High Capital Costs:** Upfront investment without near-term ROI may challenge budgeting **Policy Ambiguity:** Blockchain-specific acquisition and regulatory frameworks are still evolving. **Data Classification Concerns:** Supply chain ledgers must ensure classified or International Traffic in Arms Regulations-controlled items are protected.

5) Alleviating Labor Shortages

Transportation and logistics labor provides a valuable positive externality for national security but faces difficulties in attracting talent due to difficult working conditions. The government should consider expanding and revitalizing vocational training programs that serve as pipelines in the industry. Areas of opportunity include scholarships, apprenticeship programs, partnerships with technical colleges, and exploring creative solutions for enhancing access to training. The government also might consider building a program that provides upskilling and or reskilling training to enable workers who have lost jobs to technology improvements to be competitive in other jobs within the industry. One potential policy option is establishing a nationwide program oriented toward the transportation and logistics workforce:

National Workforce Revitalization Program for Transportation and Logistics	
Description	Launch a federally funded initiative: **Developing Resources for Infrastructure & Vocational Employment (DRIVE)** to expand vocational training, apprenticeships, and upskilling/reskilling pathways for transportation and logistics jobs. The program would prioritize partnerships with technical colleges, labor unions, and private sector employers to build career pipelines, particularly targeting underserved and displaced worker populations.
Objective	Increase the supply of qualified U.S. workers for critical logistics and transportation roles, strengthen national security through domestic labor resiliency, and help workers transition into sustainable careers amid industry automation and evolving skill demands.
Lead Actor(s)	• **DOD:** key program sponsor and national security coordinator • **DOT:** lead agency for strategic planning and coordination. • **DOL:** administer training grants, apprenticeships, certification programs, and coordination with local labor markets. • **Congress:** authorize funding and create the legislative foundation. • **State workforce agencies and community colleges:** local implementation.
Key Stakeholders	• Technical and community colleges • Labor unions and industry associations • State and local workforce development boards • Employers in logistics and transport • Automation-displaced workers and younger entrants to the labor market • Military veteran transition programs
Timelines	**0–18 months:** Federal budget appropriation and program design with stakeholder input. Launch pilot with selected partner states or regions (e.g. major port cities/freight corridors). **18–24 months:** Full program rollout with scholarship disbursements, apprenticeships, and curriculum deployment. **2–5 years:** Ongoing scaling and evaluation; integration with broader workforce and infrastructure investments.
Legislation/ Regulations	• Requires Congressional authorization and appropriations, possibly as part of a broader infrastructure or workforce bill. • DOL would need to develop program guidance, compliance rules, and performance metrics. • State governments may need to align licensing and credential recognition standards.
Cost	• **Federal investment:** \$1–3 billion over 5 years, including grants, scholarships, and infrastructure upgrades at technical institutions. • **Offsetting funds:** Cost-sharing with state and private partners; potential for ROI via reduced unemployment and increased tax revenues.
Risks & Mitigation	• **Low enrollment or participation:** Mitigate through stipends, job placement support, and targeted outreach in partnership with employers. • **Complex implementation across agencies and regions:** Address with ready-to-launch regional partnerships and coordination via a federal-state council including key intermediaries. • **Mismatch between training and employer needs:** Use real-time labor data and mandate employer input to align training with industry demands.

6) Refining Regulations and Policy

There is no regulatory panacea across the transportation and logistics industry, and recommendations vary: in some instances, sectors may benefit from the removal of confining regulations, such as grant requirements that implicitly exclude small firms through up-front capital-intensive investments. In other areas, such as the increasing vulnerability of transportation infrastructure to cyberattacks, regulations need to be added to include risk assessments, mitigation measures, and incident response plans to address uneven standards across the industry. Separately, there are opportunities to preemptively address potential mobilization latencies by better aligning military and commercial standards to promote interoperability. One viable policy approach to addressing regulatory issues in the transportation and logistics industry is to establish an interagency policy group (potentially under the proposed Office of National Mobilization) to recommend adjustments to regulations across the industry to promote overall industry health and mobilization capabilities:

Inter-Agency Transportation and Logistics Policy Working Group	
Description	Establish an interagency policy working group to refine existing laws and regulations to increase interoperability, reduce vulnerabilities, address mobilization latencies, and enable inclusion of select allies across the transportation industries within the U.S. ecosystem.
Objective	Increase national transportation and logistics interoperability and readiness across the sectors in the United States and with trusted allies and partners.
Lead Actor(s)	DOT: Lead office (or, if approved, Office of National Mobilization) DOD: Supporting office, ensuring military readiness DOS: Supporting office, ensuring allied cooperation and integration DOC: Supporting office, ensuring national interests within commerce DOL: Supporting office, ensuring labor interests and regulations are met Congress: Authorize necessary funding and finalizing the legislative change NSC: Supporting and advisory role in national security issues concerning allied integration and legislative change
Key Stakeholders	• The above-listed agencies • Industry bodies and Associations: advisory and supporting roles to ensure industry interests are incorporated • FEMA – advisory role • Academia – advisory role • Trusted allies and partners
Timelines	**2-4 months:** Establish project group **6-8 months:** Draft regulations, laws, and policy changes **12-18 months:** Final regulations and laws ready to be enacted
Legislation/ Regulations	**Legislative:** Address vulnerabilities of transportations infrastructure across the sectors, mandating mitigating measures, and incident response plans to prevent cyber-attacks. Revise specific acts, like the Jones Act, to enable interoperability within shipping and the shipbuilding industry with select allies. **Regulatory:** Address mobilizations latencies by aligning military and commercial standards to promote interoperability across national sectors. Amend regulations to enable small firms to better benefit from infrastructure grants.

Cost	Project group cost: Personnel can be drawn from existing departments, mitigating expenses. New laws and regulations will create a change in expenses for the industry (expenses unknown), however, the aim is to leverage U.S. transportation industry and competition against adversaries through better interoperability which might reduce cost over time.
Risks & Mitigation	**Increased initial costs to industry**: Long-term costs are likely to reduce as cross-sector and allied cooperation will increase interoperability and reduce individual and costly solutions. Allied integration challenge national security but will increase interoperability and strengthen industry capability overall.

The above policy recommendations are a starting point for improving the resilience of the U.S. transportation industry and its support to national mobilization. The ideal solution might include implementing each of these recommendations in concert, although the government will face tradeoffs in the current resource-constrained fiscal environment. Regardless of the policy path taken, the degree to which the inter-agency can improve coordination with industry partners and align industry developments with mobilization will determine the United States' future ability to project power abroad.

Conclusion

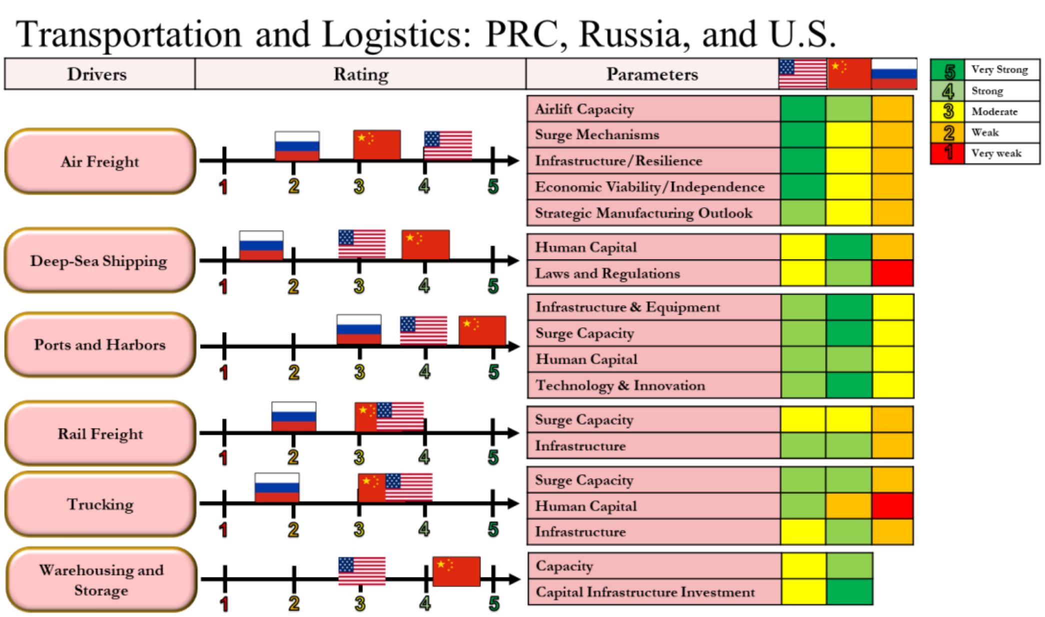
The U.S. transportation and logistics ecosystem is central to the U.S. economy and our military cannot mobilize for (and sustain) conflict without it. Transportation connects U.S. consumers to global markets, and in many areas, we have fallen behind industry standards, relative to our competitors. While most public discourse gravitates toward the poor state of U.S. transportation infrastructure as experienced by civilian consumers, it is critical that U.S. policymakers avoid neglecting key additional areas for improvement across the industry including 1) increasing government and industry planning and coordination; 2) facilitating infrastructure improvements and research; 3) enhancing logistics-based integrated wargaming and deployment exercises; 4) incentivizing technology improvements; 5) alleviating labor shortages; and 6) refining regulations and policy.

Concurrently, the United States cannot forget that even as Americans build resilience at home, the country will need to work with allies and partners to ensure the ability to sustain operations abroad. Invariably, this will include the need for prioritization in theaters that are congested and contested. Transportation and logistics are not just a supporting function—they are the vital connective tissue that binds together our nation's industry, our military strength, and our national security, ensuring our ability to turn economic potential into decisive action on the battlefield.

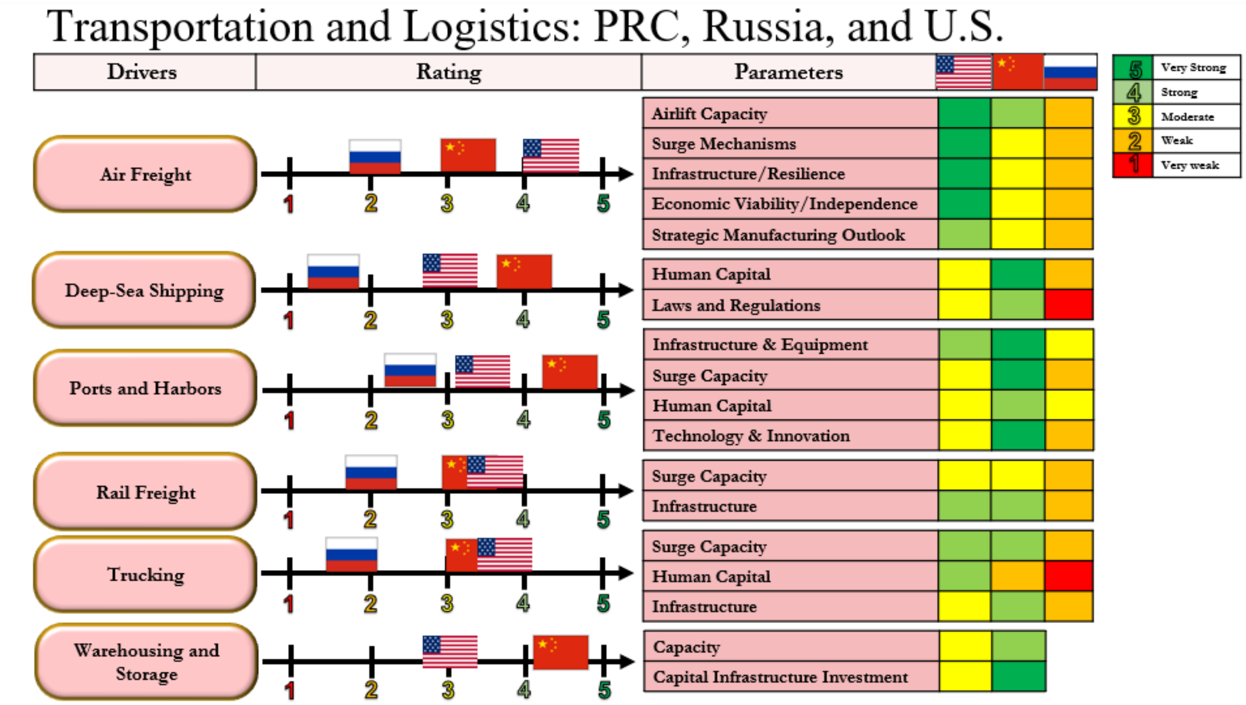
Annex A: Line of Effort Analysis

This annex offers a comprehensive comparative assessment of the United States, China, and Russia across critical transportation and logistics sectors essential to national mobilization and strategic resilience. Using a Line of Effort (LOE) methodology, it evaluates sectoral performance in trucking, rail freight, air transport, ports and harbors, deep-sea shipping, and warehousing. Each LOE addresses key drivers such as surge capacity, infrastructure, human capital, and regulatory policy to determine each nation's ability to support sustained logistics operations during a national crisis. The analysis concludes that while the United States maintains a diminishing lead in air, trucking, and rail segments—primarily due to legacy scale and strategic frameworks—it is falling behind China in ports, deep-sea shipping, and warehousing, where centralized investment and planning have accelerated Chinese dominance. Russia, meanwhile, is significantly constrained in all sectors due to sanctions, labor shortages, and aging infrastructure, limiting its overall logistics capability.

Industry Overview



Air Freight



Five LOEs were used to evaluate the U.S. commercial air transport industry's readiness for national mobilization: fleet capacity, surge mechanisms, infrastructure and operational resilience, economic viability/strategic independence, and strategic large aircraft manufacturing outlook. These criteria provide a structured lens for comparing U.S. capabilities against those of China and Russia. Each LOE incorporates measurable parameters, ranging from fleet size and modernization to contractual surge frameworks and industry profitability. The figure above summarizes this comparative analysis. Altogether, the U.S. maintains a commanding lead in the air industry, but China is actively working to develop its industry to compete with the United States and Europe.

Airlift Capacity is the baseline metric of a nation's ability to respond to mobilization demands. The United States possesses the world's largest commercial air fleet, with over 7,500 passenger aircraft and 960 cargo aircraft, most of which are under 15 years old.[157] This scale enables broad operational flexibility and long-range support capacity. While rapidly expanding, China still lags with 4,300 aircraft and 260 cargo planes. However, its fleet is more modern and projected to rival the United States by

2043.[158] Russia maintains a much smaller and older fleet of 1,100 aircraft, more than 70 percent of which are of foreign manufacture—a significant risk given current sanctions and spare part shortages.[159] This gives the United States a distinct competitive edge in quantitative and qualitative terms.

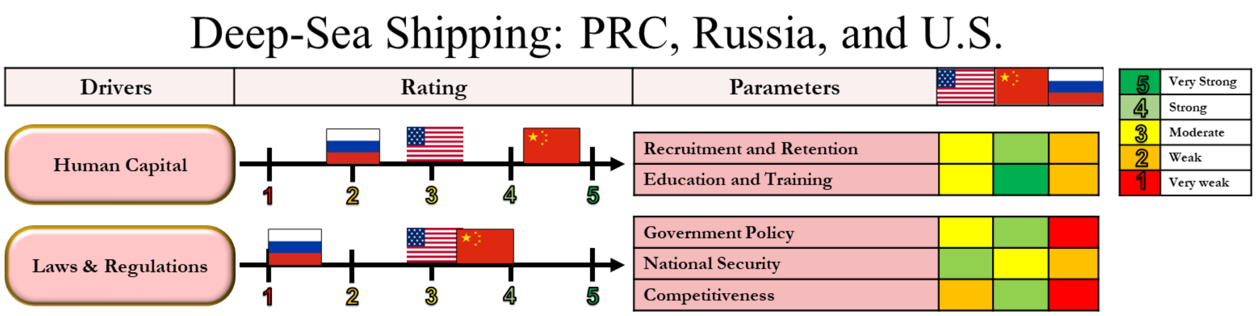
Surge Mechanisms measure how effectively a country can transition commercial capacity into defense mobilization. The United States leads through its CRAF, which provides access to 450 aircraft and is backed by robust contracts and regular coordination.[160] China lacks a formal CRAF-equivalent, but its centralized control of state-owned airlines provides theoretical surge potential, which is limited by its smaller cargo fleet and lack of stress-testing. Russia also lacks a formal mechanism and, due to sanctions, has struggled with operational reliability.[161]

Infrastructure and Operational Resilience assess a nation's ability to scale air operations during a crisis. While U.S. infrastructure is aging and earned a "D+" in a 2025 report, it still outperforms its Russian and Chinese counterparts in scope and capability.[162] The United States has nearly 500 commercial airports. Although China is rapidly expanding, with over 250 new and modernized airports, its network remains concentrated, with only modest redundancy. Russia has more than 300 airports, but many suffer from deferred maintenance.[163]

Economic Viability and Strategic Independence evaluate long-term sustainability and resilience to supply chain disruptions. The United States remains the most profitable and dominant air transport market. Its industrial base supports strategic autonomy in aircraft production and maintenance.[164] China's industry benefits from significant state subsidies and is growing steadily, but remains dependent on Western engines, avionics, and certification. Russia's industry has been severely degraded by sanctions, forcing reliance on Chinese and Iranian support.[165]

Strategic Outlook for Large Aircraft Manufacturing highlights the relative effort placed by each nation on competing within the air industry. While the United States maintains a commanding lead, its lack of government investment and dearth of domestic competition provides an opportunity for China to capture market share and erode U.S. dominance over the long term. It is projected Chinese capability could rival U.S. and European industry leaders by 2043.[166] Russia is unlikely to improve its position as obstacles stemming from sanctions, technological development, market access, and Chinese competition will impede its advancement.

Deep-Sea Shipping



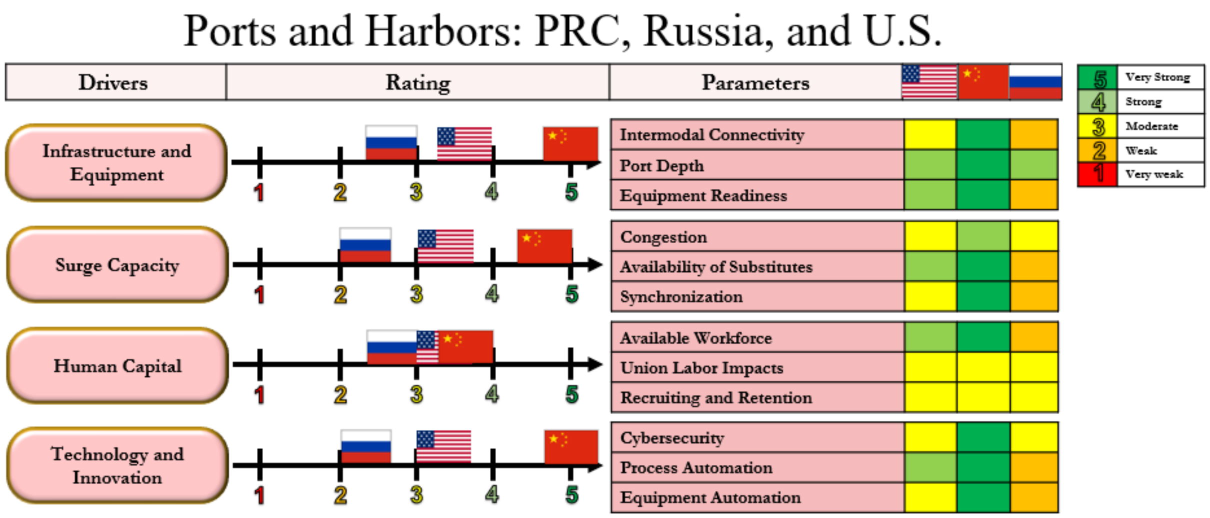
To assess the readiness and strategic posture of the ocean shipping and shipbuilding industries, two LOEs were examined: human capital and legal and regulatory environment. This structured analysis highlights how workforce development and government policies affect competitiveness, national security, and long-term sustainability in the maritime sector. Overall, China's scale and centralized coordination enable it to secure a commanding position. While the United States leads in legal protections for sovereignty, it faces significant workforce and cost challenges. Russia remains limited by sanctions and systemic inefficiencies.

Human Capital evaluates workforce availability, training infrastructure, labor dynamics, and recruitment and retention. The global maritime workforce is governed by IMO standards, particularly the STCW model courses. However, national implementation and labor conditions vary widely.[167] The U.S. faces acute workforce shortages due to an aging population, high labor costs, and a shift in worker preferences toward land-based employment offering better work-life balance.[168] Declining enrollment in maritime academies further exacerbates the issue.[169] Legislative responses such as the SHIPS for America Act aim to reverse this trend by offering incentives and modernizing training.[170] China, in contrast, benefits from a large, low-cost labor pool and a robust state-backed training pipeline, though structural challenges like the hukou registration system and growing disinterest among youth in seafaring careers pose long-term risks.[171] Nonetheless, China leads the global merchant mariner workforce through sustained investment and integrated political oversight.[172] Russia's recruitment is strained by broader labor market constraints, competition from other transport sectors, and diminished workforce size due to the war in Ukraine.[173] While Russia maintains maritime training institutions, its overall output and global competitiveness are in decline. Consequently, China holds a dominant position in global maritime labor readiness.[174]

Legal and Regulatory Environment analyzes the impact of national laws, economic models, and strategic integration between civilian and military maritime sectors. The United States operates within a free-market legal framework reinforced by key legislation such as the Jones Act (1920) and the Merchant Marine Act (1936)**.** These laws are foundational for ensuring national defense and maritime sovereignty by requiring domestic ownership, construction, and manning of vessels for intracoastal trade.[175] However, they also drive up operational costs, restrict labor flexibility, and reduce competitiveness on the global stage.[176]

China adopts a directive and centralized regulatory model, with ministries tightly managing maritime strategy. China's emphasis on military-civil fusion enables seamless dual-use integration between commercial shipping and national defense, significantly enhancing China's global maritime influence.[177] However, this alignment poses security concerns for foreign stakeholders due to blurred lines between civilian and military operations.[178] Russia mirrors China's centralized approach but is hampered by bureaucratic inefficiency and heavy sanctions.[179] These external constraints severely impair trade and regulatory effectiveness. Russia has increasingly turned to a shadow fleet to circumvent international laws, challenging maritime norms and reducing transparency.[180] Overall, national approaches to maritime regulation diverge sharply—free-market models like the U.S. prioritize sovereignty and defense but at economic cost, while state-controlled systems like China's emphasize integration and efficiency, though often at the expense of international trust.

Ports and Harbors



To assess the comparative readiness of the ports and harbors sector for national mobilization, four LOEs were analyzed: infrastructure and equipment, surge capacity, human capital, and technology and innovation. Each LOE includes measurable parameters, enabling structured comparison between the United States, China, and Russia. The figure above summarizes this comparative analysis. Overall, China leads in several categories due to heavy investment and centralized control, while the United States maintains strengths in process innovation and clear emergency authorities. Russia lags significantly due to war-driven workforce reduction, underinvestment, and limited technological advancement.

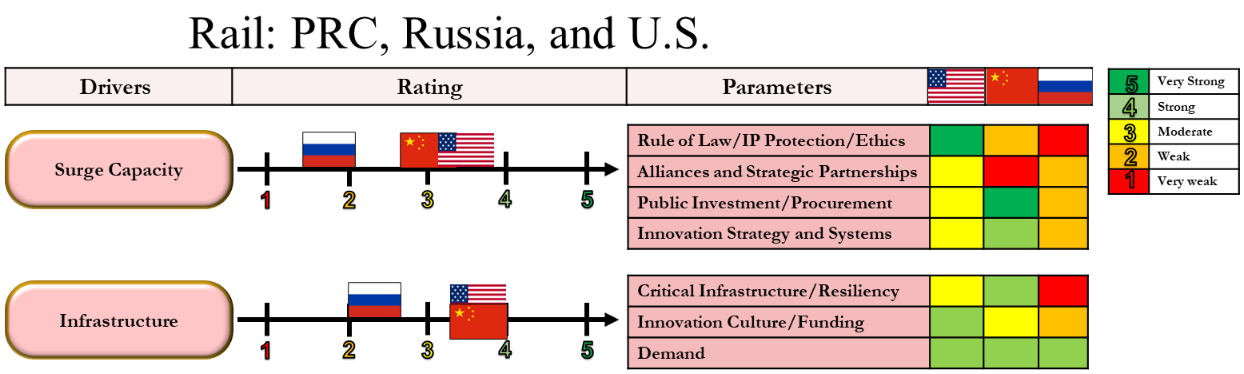
Infrastructure and Equipment evaluates intermodal connectivity, port depth, and equipment readiness. China holds a distinct edge, operating the world's most efficient container ports, with superior intermodal connectivity driven by extensive on-dock rail terminals and initiatives like the China-Europe Express Rail. All three nations possess multiple deepwater ports exceeding 45 feet (14 meters), but China's sheer number of such facilities grants it a competitive advantage. Additionally, China is the industry leader in equipment readiness due to sustained, large-scale investment. In contrast, U.S. and Russian investments in port infrastructure and equipment are comparatively lower, with modernization lagging Chinese benchmarks.

Surge Capacity assesses congestion, availability of substitute ports, and operational synchronization. Both China and the U.S. face congestion challenges—China with export volumes, and the United States with import-driven demand and aging infrastructure, the latter experiencing more severe operational strain. Russia's congestion stems primarily from limited infrastructure capacity rather than throughput volume. China benefits from over 2,000 ports, offering extensive redundancy and substitute options. The United States' 360 ports demonstrated some flexibility and the ability to reroute congested traffic during COVID, but overall substitute capacity is limited. Synchronization of port operations is more readily achievable in China due to centralized, state-owned enterprise control. In contrast, while the United States has clear lines of authority during national emergencies, coordination outside crisis scenarios remains difficult.

Human Capital includes workforce availability, union impact, and recruiting and retention dynamics. China leads with a workforce exceeding 730 million, offering deep labor reserves. The U.S. workforce stands at approximately 170 million, while Russia's has been sharply reduced due to its ongoing conflict in Ukraine. U.S. unions wield significant influence at U.S. ports, sometimes hindering operational efficiency and technological advancement. China's state-controlled All-China Federation of Trade Unions aligns with government goals, offering more predictable labor outcomes. Russian unions exist but have minimal operational impact.

Technology and Innovation examines cybersecurity, process automation, and equipment automation. Cybersecurity is a universal concern, but global reliance on Chinese-manufactured port technologies adds additional risk. The United States emphasizes process automation, including artificial intelligence applications, over equipment automation. Russia aims to develop its port backbone through heavy investment in process automation during the next 5 years. However, China remains the clear leader, with large-scale, ongoing investments in both process and equipment automation outpacing both U.S. and Russian efforts.

Rail Freight

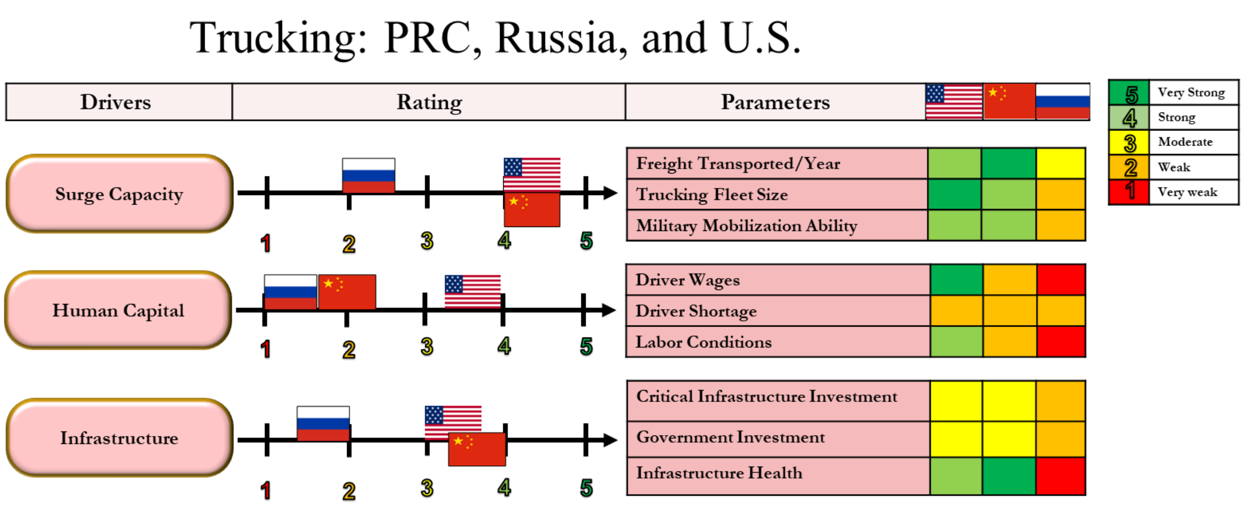


The U.S. railroad freight industry has operated successfully during the past century, providing significant value to the domestic and global economy and supporting national security requirements: today its industry maintains a slight advantage over China and a significant advantage over Russia. The United States maintains the largest rail network in the world, exceeding 140,000 miles, with a system optimized primarily for freight transport.[181] This freight-centric orientation contrasts sharply with China and Russia, where rail systems are more balanced between passenger and cargo operations. However, China and Russia are making substantial investments in their rail freight industries, challenging the United States' comparative advantage. To evaluate the U.S. railroad freight industry's readiness for national mobilization and its standing relative to strategic competitors, two LOEs are considered: surge capacity and infrastructure. These criteria provide a structured lens for comparing the capability and effective utility of each nation's industry.

Surge capacity measures how effectively a country can transition commercial capacity into national mobilization. The rail freight industry is vital to national security and mass mobilization efforts. In the United States, it enables the effective movement of military equipment, ammunition, and supplies across the continent. Historically, American railroads transported nearly 44 million service members from late 1941 to June 1945, averaging 2,500 troop trains monthly in the war's final years.[182] This led to the creation of STRACNET, a 41,000-mile rail line strategically connecting key defense installations to strategic seaports, providing a strategic advantage for the United States.[183] However, DOD has a limited ability to accurately forecast the requirements of CL I railroads to ensure rail availability. China is the undisputed global leader in high-speed rail, with over 40,000 miles of track, offering a dual-use advantage for economic integration and rapid military mobilization due to its high level of electrification and centralized control.[184] China's BRI and its extensive high-speed network represent a significant strategic advantage in transportation and logistics. Russia's rail network ranks third globally and integrates rail into its strategic mobility framework, benefiting from regional connectivity and dual freight-passenger capabilities, although its system lags behind that of China in terms of technological advancement and electrification.[185]

Infrastructure evaluates the quality and extent of the rail networks and supporting facilities crucial for efficient rail operations. Regarding infrastructure, investments and ownership structures significantly impact rail development and maintenance. The U.S. CL I rail freight market is highly concentrated with six privately owned CL I carriers. An advantage of a privately owned rail industry is that these carriers are responsible for operating and maintaining their fleet and are not dependent on the federal government. In 2023, U.S. CL I railroads reinvested over $26.8 billion in modernization and infrastructure, improving safety and reliability.[186] China's investments in rail have been predominantly in high-speed rail domestically and rail infrastructure outside of China through the BRI.[187] China has invested more than $679 billion in rail infrastructure projects through the BRI in nearly 150 countries.[188] Domestically, China invested more than $100 billion annually on railway construction from 2013 to 2023.[189] The state-owned nature of China's rail enterprise offers a strategic advantage over U.S. privately owned enterprises because Beijing can out-invest Washington in infrastructure. There is limited data on Russian rail infrastructure and investments in its rail freight industry. The rail industry in Russia, like China, has a heavy state focus on the sector to drive the economy. However, the recent conflict with Ukraine, including European Union sanctions, has negatively affected Russian state-owned rail operations.[190] These sanctions will impact Moscow's ability to make substantial financial investments in infrastructure, which is likely to have a compounding effect on the overall economy.

Trucking



To evaluate the U.S. commercial trucking industry's readiness for national mobilization and its standing relative to strategic competitors, three lines of effort (LOEs) were considered: capacity, human capital, and infrastructure. These criteria provide a structured lens for comparing

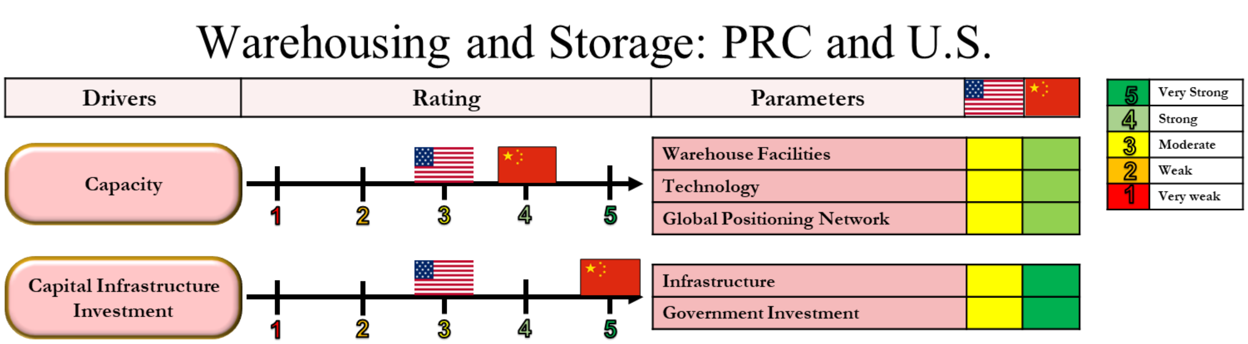
U.S. capabilities against those of China and Russia. Each LOE incorporates measurable parameters, ranging from freight tonnage moved and fleet size to driver availability and road network quality. This analysis highlights the critical role of trucking in national logistics and resilience. Overall, the United States possesses significant trucking capacity but faces notable challenges in human capital and infrastructure sustainment, areas where China is rapidly advancing, while Russia lags considerably.

Capacity is the baseline metric of a nation's ability to move goods overland in response to mobilization demands. The United States transports approximately 11 billion tons of freight annually, supported by the world's largest commercial truck fleet, estimated at 14 million vehicles.[191] This extensive fleet provides substantial potential surge capacity. China, while possessing a smaller fleet of around 8 million trucks, moves a significantly larger volume of freight, exceeding 40 billion tons annually, indicative of high utilization and a rapidly growing economy.[192] Russia moves considerably less freight, at 6.2 billion tons annually, with a fleet of 3.6 million trucks.[193] While the United States possesses the largest fleet, suggesting high surge potential, China's current throughput is higher. Russia's capacity is significantly constrained compared to both the United States and China.

Human Capital assesses the availability, compensation, and conditions of the workforce essential for operating the trucking fleet. The United States faces a severe driver shortage despite offering relatively high average annual wages (around $47,000).[194] Labor conditions, while established, are often demanding. China also confronts a severe driver shortage, with average wages significantly lower (around $15,000 per year) and labor conditions described as difficult.[195] Russia mirrors this trend, experiencing driver shortages with the lowest average wages among the three (around $10,000 per year) and difficult conditions.[196] The widespread driver shortage across all three nations represents a critical vulnerability, potentially limiting the ability to surge operations regardless of fleet size.

Infrastructure evaluates the quality and extent of the road networks and supporting facilities crucial for efficient trucking operations. The United States possesses an extensive highway system, fundamental to its trucking industry.[197] However, this infrastructure is aging and suffers from underinvestment, leading to potential delays, increased maintenance costs, and challenges in adapting to new needs like electric truck charging.[198] China has undergone an infrastructure boom, significantly investing in and expanding its highway network, which has fueled growth in its trucking sector and supports long-haul capabilities.[199] China is also actively developing electric charging infrastructure.[200] Russia's trucking industry is hampered by significant infrastructural constraints, particularly an underdeveloped road network in its vast Asian regions.[201] While prioritizing new transport corridors, substantial investment is required to overcome existing limitations.[202] Infrastructure quality directly impacts the efficiency, resilience, and scalability of trucking operations in all three countries.

Warehousing and Storage



As competition between the United States and China continues to intensify across multiple domains, logistics, particularly warehousing, has become a crucial dimension of national competitiveness in global power projection. Within this context, both capital and capacity are examined as distinct lines of effort that have revealed critical asymmetries between the two nations. Taken together, these factors suggest the United States retains a qualitative edge in logistics technology and allied partnerships but faces a numerical and infrastructural gap, especially in the Indo-Pacific region.

Capacity measures the number of facilities available to support stockpiling requirements. China possesses a clear quantitative advantage in warehousing infrastructure, with over 84,000 establishments and a workforce exceeding 3.5 million.[203] This advantage is amplified by strong state support and alignment with its expansive BRI, which, as a result, extends Beijing's logistics reach into Africa, Southeast Asia, and Europe.[204] By contrast, the United States maintains roughly 47,799 warehouses and relies on a more decentralized private-sector model.[205] While U.S. firms are leaders in automation and global presence, they lack the unified planning and scale underpinning China's infrastructure expansion.

Capital Investment highlights the country's focus on building, sustaining, and improving storage capacity. Between 2011 and 2020, the United States invested $25.5 billion in its transportation and warehouse sectors.[206] These investments were predominantly through the private sector and focused on automation, e-commerce fulfillment, and urban logistics. In contrast, China's capital investments are strategically coordinated through regional development plans that prioritize not only domestic capacity but also forward-positioned logistics hubs along BRI corridors.[207]

Annex B: Wargaming

Incorporating the transportation and logistics industry into DOD wargaming is essential, given a tendency by military officials to assume away any logistical or sustainment problems as they pursue their operational plans.[208] For any U.S. military strategy to be useful and successful, it must include realistic logistical considerations. This is especially relevant given the tyranny of distance in the Indo-Pacific theater.

Meetings and site visits in the spring of 2025 revealed that tabletop exercises are being conducted on an ad-hoc basis in some industry segments. For example, the Port of Baltimore conducted a scenario-based exercise involving numerous stakeholders in early 2024 that simulated port disruptions and included communications with local law enforcement to halt traffic flows on either side of the Francis Scott Key Bridge. The collective experience enabled a faster, more effective response to the bridge collapse that occurred only a few weeks later.[209] Despite sporadic anecdotal successes, there is substantial untapped potential to scale up wargaming as a part of a coordinated approach across the transportation and logistics industry.

Effective wargaming would not only improve national readiness for war, but it would also demonstrate U.S. capability to mobilize quickly and sustain a protracted war, resulting in stronger deterrence against near-peer adversaries. Such exercises should leverage AI and digital twin technology, while including all relevant transportation and logistics stakeholders—including representatives from short-line rail, CL I railroads, drayage rail and trucks, stevedores, dockworkers, terminal operators, port authorities, the Ready Reserve Fleet, and the Civil Reserve Air Fleet. Separately, additional efforts should be made to include industry stakeholders in classified wargames to identify latencies and potential friction points. This approach recognizes that commercial industry is a critical partner in any major mobilization or war sustainment effort.

- **Air Transport.** Wargame scenarios should include the CRAF program to ensure its continued reliability when surge support is required, and they should identify any challenges in utilizing OCONUS airfields for power projection. This could be accomplished by testing the integration of commercial logistical capacity into mobilization plans, including real-world industry participation and AI-based simulations.
- **Deep-sea Shipping.** Wargaming could determine realistic RRF capabilities, thereby improving strategic planning considerations and providing useful data to justify recapitalization of the fleet and investment in the mariner workforce. For instance, during a site visit, students learned that in one case, 6 days had to be added during equipment delivery when a 40-year MARAD ship was unable to berth on a modern pier.[210]
- **Ports and Harbors.** The NPRN should require annual wargaming at each Commercial Strategic Port, involving all relevant stakeholders, to identify bottlenecks and spur efficiencies. Such wargaming exercises through transportation corridors and key ports would validate that the industry can support a mobilization effort in time of war, lowering risk during future national crises. Recognizing potential cost barriers associated with closing terminals, DOD and industry stakeholders could explore using digital twin technology to simulate full mobilization as a first step.
- **Rail Freight.** Wargaming could identify STRACNET vulnerabilities while exploring challenges associated with the need for a significant number of commercial railcars during mobilization.
- **Trucking.** It would be valuable to test the response capability and resilience of a partially or fully transitioned battery electric truck (BET) fleet during a national crisis; such findings could provide feedback to refine federal emissions standards.
- **Warehousing.** By analyzing logistics and operational data, AI systems can improve warehousing management effectiveness and optimize location and provisioning strategies based on evolving demand signals during wargaming, accounting for challenges like congestion and security threats.

Overall, table-top exercises and wargaming are critical components of any successful strategy to deter a near-peer adversary and increase operational readiness.

Annex C: Industry-Specific Policy Recommendations

Increasing Government and Industry Planning and Coordination

- **Air.** Integrate equipment needs into DOD studies and prioritize military aircraft compatibility with commercial systems to address ground integration. Encourage allied investment in their sovereign airlift capacity and maintain U.S. leadership in international bodies such as International Civil Aviation Organization to pursue operating process and equipment standardization. Expand air freight capacity within the CRAF program to address limited domestic cargo airline participation.
- **Deep-sea Shipping.** Create an Allied Maritime Capacity Framework to pool assets for logistics, crisis response, and wartime surge.
- **Ports and Harbors.** SDDC should facilitate a table-top mobilization wargame exercise for each Commercial Strategic Port to include all key stakeholders relevant to the deployment corridor to validate that ports and their associated transportation corridors are capable of handling large-scale military deployments and to validate SDDC's readiness. Detailed after-action reviews could be used to update standard operating procedures for critical collective tasks, while identifying issues requiring resolution.
- **Rail Freight.** Establish a National Rail Strategy Council within the DOT to coordinate federal, state, and industry priorities under a unified vision. Integrate rail corridors explicitly into national security and defense logistics strategies, to actively assess vulnerabilities and to identify priority areas for risk mitigation investment.
- **Trucking.** Strengthen collaboration between the government, DOD and the trucking industry by convening supply chain stakeholders to identify freight policy priorities and enhance operational communications.[211]
- **Warehousing.** Pursue public-private partnerships with Indo-Pacific allies to establish a distributed warehousing architecture. Mirroring the Marine Corps prepositioning program in Norway, these networks should span the second and third island chains and be configured for dual-use operations.[212] Facilities must be interoperable, locally integrated, and enable shift from peacetime commerce to wartime logistics.

Facilitating Infrastructure Improvements and Research

- **Air Freight.** Sustain federal funding for infrastructure modernization and workforce development, potentially revisiting the Passenger Facility Charge cap.[213] Ensure designs for once in generational upgrades to airfield facilities consider potential future military usage and developing technology requirements.
- **Deep-sea shipping.** Through the Restoring America's Maritime Dominance Executive Order (EO #14269), focus on a revitalization of the U.S.' shipbuilding capacity through sustained federal investment, incentives for private sector investment, modernizing

infrastructure, and strategic partnerships with allies. Increase federal support for zero-emission vessel R&D.

- **Ports and Harbors.** SDDC should proactively engage with port authorities, so they incorporate military mobilization requirements in the design phase of development plans at Commercial Strategic Ports. MARAD's PIDP funding could then be targeted to support these development projects. Across all ports, invest in dual-use dockside rail access to increase intermodal transfer efficiencies.
- **Trucking.** Modernizing and repairing existing roads and bridges to reduce delays and maintenance costs; expanding highway capacity in key freight corridors to alleviate congestion; improving truck parking facilities; investing in intermodal connectors to improve the efficiency of freight movement; and investing in intelligent transportation systems infrastructure to enhance trucking operations.[214]
- **Warehousing.** Offer tax incentives and capital grants to stimulate domestic warehouse expansion in underserved regions to incentivize the buildout of domestic storage capacity needed to transition from just-in-time to just-in-case logistics.[215] Additionally, build partnerships by working with allies and partners to create a dispersed warehousing and storage network across the Pacific with a focus on the second and third island chains.

	National Port Intermodal Modernization Program (NPIMP)
Description:	A DOD-coordinated policy initiative in partnership with MARAD and the Department of Transportation to fund and implement dual-use dockside rail infrastructure at all Commercial Strategic Ports. The goal is to ensure rapid, efficient intermodal transfer of military and commercial cargo, improving throughput and national readiness during large-scale mobilization events.
Objective	Increase the intermodal efficiency and mobilization readiness of U.S. strategic ports by installing, upgrading, or restoring direct dockside rail infrastructure capable of handling both commercial and military cargo.
Lead Actor	DOD – supported by SDDC and USTRANSCOM
Key Stakeholders	• U.S. Maritime Administration • Department of Transportation • Port Authorities • Surface Deployment and Distribution Command • U.S. Army Corps of Engineers • Local and State Governments • Commercial Rail Operators • Labor Unions and Terminal Operators
Timelines	• Policy Launch & Feasibility Studies: 6–12 months • Project Selection & Funding Allocation: 12–24 months • Construction & Modernization: 2–5 years (phased by port readiness and impact)
Legislation/ regulations	• Expand MARAD's PIDP with explicit dual-use language supporting military intermodal readiness • Amend the National Defense Authorization Act (NDAA) to include annual DOD reporting on port intermodal capabilities • Authorize DOD to serve as a NEPA sponsor to expedite environmental assessments for military-use upgrades at ports

Cost	Estimated \$3–6 billion over 10 years (roughly \$150–300M per major port depending on scope, geography, and preexisting rail infrastructure)
Risk	• Interagency Coordination: Differing priorities among DOD, DOT, and local port authorities could delay execution • Labor Resistance: Dockside automation and rail integration may be opposed by unions fearing job losses • Construction Disruption: Port operations may be temporarily impacted during infrastructure upgrades • Funding Competition: Dual-use investments may be deprioritized against immediate commercial interests
Mitigation	• Require military-civilian coordination in project design via the NPRN • Tie funding to local labor agreements to preserve employment • Phase upgrades to minimize downtime and maintain throughput • Highlight dual-benefit ROI for both economic and national security outcomes

Incentivizing Technology Improvements

- **Air Freight**. Prioritizing AI adoption**.** DOD lead annual exercises using AI simulations to test commercial logistics integration. Leveraging technologies like drone delivery and autonomous systems for military logistics to reduce manpower and risk in contested environments.
- **Rail Freight.** Authorize tax credits and grants for transition to sustainable technologies, such as battery-electric locomotives and hydrogen propulsion, to move towards alignment with carbon emission goals and to support the sector in remaining financially viable amidst a highly regulated industry.
- **Trucking.** Promote responsible and approachable technology adoption and integration of emerging technologies like electric trucks and charging infrastructure through strategic investment and planning. Ensure modernization proceeds practically through approachable emissions regulations that involve stakeholders from the government, industry, and national defense. Electric charging infrastructure and affordable technology options for BETs must be readily available before mandates go into effect.
- **Warehousing.** Embed AI into Strategic Logistics Planning to optimization logistics to integrate real-time data, warfighting scenarios, and demand signals to enable predictive mobilization.[216]

Alleviating Workforce Shortages

- **Air Freight**. Expand training pipelines for maintenance crews, cargo handlers, and air traffic controllers. Offer targeted incentives for retention and upskilling, while integrating automation to reduce workload and improve efficiency.
- **Deep-sea Shipping.** Through the Restoring America’s Maritime Dominance Executive Order (EO #14269), strengthen the maritime workforce by investing in academies and training, creating scholarship programs, and improving recruitment and retention.

- **Ports and Harbors.** Initiate a federal defense industrial base (DIB) Workforce Transition Program to fund training for skilled workers to enable more agile industry employment to remove barriers to port modernization.
- **Rail Freight.** Invest in skilled labor pipelines through expanded vocational education, apprenticeship programs, and partnerships with technical colleges, exploring creative solutions for enhancing access to training.
- **Trucking.** Implement policies to improve truck driver recruitment, training, and retention through incentivized programs that provide licensing and truck lease options for new drivers with a predetermined contract for years of service in return. Improve and expand parking and truck service capacity nation-wide through public-private partnerships.

Refining Regulations and Policy

- **Air Freight**. Adhere to commercial standards to maximize military and commercial fleet interoperability. Separately, expand CRAF participation to include a broader range of commercial and multimodal operators would increase resilience, reduce operational bottlenecks, and better align the program with contemporary logistics realities. These partners not only bring additional lift capacity but also provide valuable situational awareness of global air infrastructure, helping to identify potential constraints and inform operational planning. As future conflicts demand rapid, distributed, and sustained force projection, a modernized, diversified, and better-integrated CRAF will be essential to meeting the strategic mobility needs of the United States.
- **Deep-sea Shipping, Ports and Harbors.** Approve legislation to develop and enact a national maritime strategy to unify inter-agency efforts and establish a single coordinating body. Reform the Jones Act and MMA to allow targeted integration of allied shipping firms and labor.
- **Ports and Harbors.** Recalibrate federal grant funding mechanisms for port enhancements (such as FEMA's PSGF and MARAD's PIDP) for port investment to remove barriers, including those that inhibit participation from small ports; include a mechanism to prioritize ports with the greatest strategic value for relative impact to economic and national security.[217] Enable DOD to serve as the sponsoring agency for NEPA environmental assessments, which would overcome a perennial hurdle faced by many grant applicants.
- **Rail Freight.** Impose regulation to mandate cybersecurity risk assessments and incident response plans, supported by federal financial incentives. Separately, create a Civil Reserve Rail Fleet (CRRF), to formalize surge capacity and enhance military readiness. Update STRACNET policy to clearly identify commercial railcar requirements and incorporate regular wargaming/simulations led by TRANSCOM/SDDC.[218]
- **Trucking.** Review and update trucking workforce regulations to incentivize the profession; support job training and Registered Apprenticeship programs to connect individuals, to supply chain jobs.[219]

Recalibration of Port Federal Grant Funding and Development

Description	Currently, federal funding for infrastructure development is stove-piped across agencies. MARAD manages the PIDP grant program for port enhancements, while the Federal Highway Administration (FHA) oversees grants related to surface transportation such as the National Highway Freight Program, the Congestion Relief Program, the National Highway Performance Program, and the Surface Transportation Block Grant Program. Bureaucratic red tape has impeded ports from accessing federal funding that could otherwise assist the industry in becoming more competitive compared to international ports. This may reduce project delays and incentivize participation, preventing infrastructure atrophy and increasing readiness. U.S. efforts should prioritize port modernization efforts that have the greatest potential to facilitate mobilization during a potential military conflict. Federal infrastructure funding will be prone to inefficiencies and untapped potential without complementary efforts to refine processes, regulations, and stakeholder communications. To serve both commercial and national security interests, a certain percentage of infrastructure development funding should be focused on improving transportation corridors that align with Commercial Strategic Ports. The PIDP grant program must be modified such that a certain percentage of its funding be designated only for Commercial Strategic Ports. Simultaneously, based on TTX and exercise results, SDDC must provide each relevant port with military requirements that need to be incorporated into its infrastructure development plan. Further, PIDP proposals could be favored if they are tied to FHA surface transportation projects designed to improve overall throughput of the transportation corridor.
Objective	To remove barriers, including those that inhibit participation from small ports and to prioritize ports with the greatest strategic value for relative impact to economic and national security.
Lead Actor	Department of Transportation
Key Stakeholders	• NSC • DOD • DOC • Department of Treasury • DOL • DOE • DOT • FEMA • USTRANSCOM • SDDC • Industry bodies, associations, and academia.
Timelines	**12 months:** Rewrite **24 months:** Assess and update requirements as needed
Legislation/ regulations	**Statutory Authorization and Mandate.** No additional legislation or regulation is required, however revision of current FEMA and MARAD programs is crucial to ensuring national security objectives are met.
Costs	**Personnel**. No additional personnel **Financial**. No additional cost
Risks	**Interagency/Congressional District Coordination**. Overlapping jurisdictions and parochial interests could impede effective cooperation and delay decision-making. • **Mitigation**. Strategic communication and language included in the National Defense Industrial Strategy and National Defense Strategy.

Development of a National Maritime Strategy

Description	Currently, policies are disjointed across agencies and there is no single coordinating body with the authority or mandate to align maritime interests under a unified vision. The United States needs a comprehensive guiding plan that aligns ports and all other maritime activities with strategic goals. Leveraging the authority of the newly published Executive Order on “Restoring America’s Maritime Dominance,” MARAD, with other stakeholders such as the Federal

	Maritime Commission, the USCG, and the USACE, must create, publish, and administer a National Maritime Strategic Plan. Maritime authorities must construct a plan that is informed by commercial port wargaming and exercises nationwide and stakeholder input to identify points of contact to support efforts to shore up vulnerabilities. Additionally formalizing a network that facilitates interagency connectivity to mitigate confusion in satisfying stakeholder requirements, including across different sectors of the transportation industry. These efforts will drive efficiency gains and improve port readiness by reinforcing messaging across the industry domestically and beyond.
Objective	To unify inter-agency efforts, integrate commercial, defense and industrial priorities, and establish a single coordinating body.
Lead Actor	MARAD
Key Stakeholders	Executive Appointee, National Security Council, Department of Defense, Department of State, Department of Commerce, Department of Treasury, Department of Labor, Department of Energy, Department of Transportation, Federal Emergency Management Agency, USTRANSCOM, SDDC, Industry bodies/associations and Academia.
Timelines	12 months to write, 12 months to enact
Legislation/ regulations	**Statutory Authorization and Mandate.** The National Security Strategy must require a nested National Maritime Strategy (NMS) akin to the National Defense Strategy.
Costs	**Personnel**. Dedicated research, planning, and writing teams from across the DIB. **Financial**. Costs incurred only through FTE time expended.
Risks	**Interagency coordination**. Overlapping jurisdictions and parochial interests could impede effective cooperation and delay decision-making. • **Mitigation**. NMS is tasked under the Executive branch and reported to both the NSC (quarterly) and to the Congress (annually).

Creation of the Civil Reserve Rail Fleet (CRRF)	
Description	Airlift and sealift each have national reserve fleets designated for national emergencies. The United States must also identify a fleet of commercial railcars, informed by STRACNET, as a Civil Reserve Rail Fleet (CRRF). The CRRF formalizes agreements with commercial rail carriers to surge capacity during national emergencies and large-scale mobilizations. This framework would enhance military readiness by ensuring rapid deployment capabilities for equipment and personnel as well as providing revenue to the railways to incentivize prioritization of defense freight. In addition, it provides all agencies involved predictability on the requirement without significantly impacting the U.S. domestic economy and the industry.
Objective	To formalize surge capacity and enhance military readiness.
Lead Actor	USTRANSCOM
Key Stakeholders	• DOD • DOS • DOC • Department of Treasury • DOL • DOE • DOT • FEMA • SDDC • Industry bodies, associations, and academia.
Timelines	**12 months:** Establish
Legislation/ regulations	**Statutory Authorization and Mandate.** CRRF requires explicit legislative authorization defining its mission to augment, coordinate, and integrate commercial rail carriers' preparedness for mobilization efforts across federal departments and agencies. Enact as a new statute or as a provision to existing laws such as the DPA.
Costs	**Personnel.** CRRF requires up-to ten dedicated, trained staff with logistics, industrial (Including industry associations), and interagency coordination expertise. **Financial.** Minimal annual cost in the millions of dollars.
Risks	**Interagency coordination**. Overlapping jurisdictions and parochial interests could impede effective cooperation and delay decision-making. • **Mitigation**. CRRF is placed under the proposed ONM and reports to both the NSC (quarterly) and to the Congress (annually).

Annex D: Figures

Figure I: U.S.-International Freight by Weight[220]

Weight of U.S.-International Freight Flows by Geography and Transportation Mode in Thousands of Short Tons (2023)*							
Geography	**Truck**	**Rail**	**Air**	**Ship**	**Pipeline**	**Other**	**Total**
Total	**124,478**	**100,873**	**4,315**	**853,200**	**201,700**	**9,310**	**1,293,877**
Canada	63,229	82,047	259	92,710	201,440	8,532	**448,220**
Mexico	61,249	18,826	135	122,124	259	777	**203,372**
Asia	-	-	1,807	290,901	-	-	**292,709**
Europe	-	-	1,371	177,253	-	-	**178,624**
Other	-	-	760	170,211	-	-	**170,971**

* *Transportation mode represents the mode by which freight arrived or departed from the United States. Therefore, truck, tail and pipeline are only available for Canada and Mexico.*

Figure II: U.S.-International Freight by Value[221]

Value of U.S.-International Freight Flows by Geography and Transportation Mode (2023) in Millions of 2017 Dollars*							
Geography	**Truck**	**Rail**	**Air**	**Ship**	**Pipeline**	**Other**	**Total**
Total	**966,352**	**209,224**	**1,399,452**	**2,117,239**	**112,563**	**265,204**	**5,100,034**
Canada	435,702	113,860	35,577	34,901	105,197	48,702	**773,939**
Mexico	560,650	96,364	21,563	91,414	7,366	22,477	**789,834**
Asia	-	-	633,134	1,109,398	-	89,444	**1,831,977**
Europe	-	-	599,573	540,917	-	81,799	**1,22,289**
Other	-	-	109,605	340,609	-	22,782	**472,966**

**Transportation mode represents the mode by which freight arrived or departed from the United States. Therefore, truck, tail and pipeline are only available for Canada and Mexico.*

Figure III: Port Stakeholders

Port Stakeholders		
Actor	**What do they Value?**	**What Issues do they Face?**
Local, state, and federal government entities	National security, economic prosperity	Insufficient funding, lack of personnel, uniting relevant stakeholders
Port authorities (public or private)	Public interest	Contribute to local and regional growth, create jobs, maximize throughput
Terminal operators	Profit maximization	Maximize throughput, navigate labor union demands, high costs for modernization
Laborers (such as longshoremen)	Job security, income	Job loss from automation, difficult working conditions compared to other industries
Unions (wield power to disrupt port throughput)	Safety, job security	Job loss from automation
Shipping companies	Profit maximization	Deliver highest volume at lowest cost; minimize time in port
Port-adjacent intermodal stakeholders	Profit maximization	Intermodal competition, congestion, labor shortages
Associations (such as the American Association of Port Authorities)	Policies that promote port performance	Securing federal funding for ports, fair trade policies
U.S. military (as applicable)	Mobilization, readiness	Ensuring sufficient capacity and readiness for rapid mobilization
Suppliers shipping goods through U.S. ports	Profit maximization	Fees, port congestion
U.S. consumers	Affordability, convenience	Increasing cost of goods

Figure IV: Strategic Seaports

U.S. Commercial Strategic Seaports and Military Strategic Seaports[222]	
Commercial Strategic Seaports	**Military Strategic Seaports**
Anchorage, AK	Military Ocean Terminal, Sunny Point
Beaumont, TX	Military Ocean Terminal, Concord
Charleston, SC	Indian Island
Corpus Christi, TX	JB Pearl Harbor Hickam
Port of Everett, WA	JB Charleston (Specifically "TC Dock")
Guam	Naval Base Ventura County, Port Hueneme
Gulfport, MS	
Hampton Roads, VA	
Jacksonville, FL	
Long Beach, CA	
Morehead City, NC	
Oakland, CA	
Philadelphia, PA	
Port Arthur, TX	
San Diego, CA	
Savannah, GA	
Tacoma, WA	
Wilmington, NC	

Annex E: Glossary

Advanced Driver-Assistance Systems: systems designed to help drivers with certain driving tasks (e.g., staying in the lane, parking, avoiding crashes, reducing blind spots, and maintaining a safe headway). ADAS are generally designed to improve safety or reduce the workload on the driver.

Autonomous Track Inspection: a capability that uses sensors and AI technology to inspect rail tracks and generate an extensive dataset on track health, used for maintenance and planning.

Air freight: The logistical actions and costs required to move material by air, of which air cargo is a subset.

Air transport industry: A dual-use market supporting commercial and defense needs that includes moving passengers and cargo, and shipping goods.

Belt and Road Initiative: global infrastructure development strategy adopted by the government of China in 2013 to invest in more than 150 countries and international organizations.

Class I Railroad: A carrier earning revenue greater than $250 million.

Class II Railroad: A carrier earning revenue between $20 million and $250 million.

Class III Railroad: A carrier earning revenue less than $20 million.

Civil Reserve Air Fleet: Selected aircraft from U.S. airlines, contractually committed to support DOD airlift requirements in emergencies when the need for airlift exceeds the capability of available military aircraft.

Civil Reserve Rail Fleet: A proposed fleet of rail cars that serve to formalize surge capacity and enhance military readiness akin to the existing Civil Reserve Air Fleet.

Deep-sea shipping: The maritime transportation of goods between continents or across large ocean distances.

Drayage trucking: The short-distance transport of goods, often shipping containers, is a small but essential component of the short-haul segment that facilitates international trade flow at ports.

Intermodal: Facilitating transshipment of goods from ships to other transportation modes for final delivery.

"Just-in-time" logistics: a system where materials and components are delivered to a production facility exactly when they are needed, eliminating the need for large inventory stockpiles.

"Just-in-case" strategies: an inventory management approach where a company maintains a larger-than-needed inventory to mitigate risks associated with supply chain disruptions, unpredictable demand, or other uncertainties.

Last-mile logistics: the final stage of the supply chain where goods are delivered from a local distribution center to the end consumer.

National Defense Reserve Fleet: a fleet of approximately 100 inactive, Government-owned vessels managed and maintained by MARAD for national defense purposes.

Network Flow Contested Logistics: a model that simulates the flow of resources across a network to identify vulnerabilities and ensure resilience in the face of disruptions, such as attacks on supply lines or cyber interference.

National Port Readiness Network: a cooperative designed to ensure the readiness of commercial ports to support force deployment during contingencies and other national defense emergencies.

Precision Scheduled Railroading: a railway operational model that aims to improve efficiency and reduce costs by optimizing schedules and asset utilization.

Positive Train Control: an advanced train safety system designed to prevent accidents by automatically stopping trains when they are about to exceed speed limits, enter misaligned track switches, or enter work zones.

Ready Reserve Force: A high-readiness subset of the NDRF designed to be activated within 5-10 days to rapidly deploy heavy military equipment.

Strategic Rail Corridor Network: an interconnected and continuous rail line network consisting of over 41,300 miles of track serving 141 defense sites.

Strategic sealift: the ability to transport military equipment, personnel, and supplies quickly and efficiently over long distances by sea.

Train Inspection Portals: a facility that uses advanced imaging and analysis technology to inspect trains moving at full speed.

Endnotes

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