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Global Agility AY 2019-2020

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Abstract: This report provides an overview of issues present within the Global Agility (GA) ecosystem and proposes recommendations for improvement. Research was conducted on the Global Agility (GA) ecosystem consisting of seven industries: Rail, Trucking, Air Freight, Ports and Harbors, Deep Water Shipping, Inland Waterways, and Warehousing. Students examined the role of each industry in the movement of goods worldwide along with its impact on the national security of the United States (U.S.). Instructors placed emphasis on how these industries support Joint Force mobilization to deter or defeat a great power competitor.

Within the GA ecosystem, there are many shared challenges which, if not addressed, will limit the U.S. from achieving its full economic potential. This leads to the conclusion that to effectively support mobilization, the U.S. Government must develop a national transportation plan that prioritizes strategic resources and optimizes infrastructure across all modes.

Without a national strategic plan, research indicates these shared challenges will negatively impact the nation's ability to flow and sustain the Joint Force and may impair the Nation's strategic options in times of crisis.

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*Global Agility did not participate in all planned domestic or any international field studies due to the COVID-19 crisis.

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Executive Overview

The 2018 National Defense Strategy (NDS) directed the United States' focus on the great power competition, identifying the reemergence of long-term, strategic competition by the revisionist powers of China and Russia as a challenge to U.S. prosperity and security.¹ Key aspects to competing in this arena include force posture, alliance and partnership architecture, and modernization to provide capability and agility.² Force posture not only relates to a lethal Joint Force, but to the capability to move and sustain the Joint Force anywhere in the world. For this reason, the Global Agility (GA) ecosystem enables U.S. national security objectives through both economic and military elements of power. America's intermodal network delivers goods and services in support of the economy and in the mobilization and sustainment of a Joint Force. Furthermore, the GA commercial ecosystem encompasses 90 percent of the nation's strategic lift capabilities and the infrastructure used to store strategic national materiel. The GA ecosystem is vital to the health of the U.S. economy *and* national security, solidifying its importance as an industry study at the Eisenhower School for National Security and Resource Strategy.

Students of the Global Agility Industry Study (GAIS) researched the Global Agility (GA) ecosystem consisting of seven industries to include Rail, Trucking, Air Freight, Ports and Harbors, Deep Water Shipping, Inland Waterways and Warehousing. Students examined the role of each industry in the movement of goods worldwide along with its impact on the national security of the United States (U.S.). Through site visits as well as research and dialogue with leaders in the industry, the seminar identified challenges faced by each industry to meet this responsibility. Though some travel was canceled due to the COVID-19 crisis, students were able to apply mobilization concepts and strategies to a real-time crisis in all aspects of their studies; however, COVID-19 is not the focus of this report. Specifically, while the COVID-19 pandemic may have highlighted some near-term issues, the findings address existing and sustained issues within the GA ecosystem. Accordingly, the research resulted in the following three findings and resource informed policy recommendations:

Finding 1: The U.S. lacks an integrated national transportation strategic plan. This promotes intermodal competition rather than optimization of current infrastructure capacity.

Recommendation 1: Develop and publish a national transportation strategic plan that supports the NDS, promotes intermodal cooperation, and maximizes capacity. The plan must address human capital, funding, emerging technology, and foreign investment challenges.

Finding 2: The GA ecosystem contends with human capital challenges defined predominately by an aging workforce, lack of diversity, and decreasing interest by younger generations.

Recommendation 2: Develop a national plan to incentivize vocational training programs and reduce barriers to entry in key industries.

Finding 3: U.S. transportation infrastructure development lacks consistent and sufficient funding.

Recommendation 3: Amend the Defense Production Act (DPA) to increase access to production loans, establish a National Infrastructure Bank to provide economical, long-term financing for infrastructure projects, and adjust tax codes to increase tax code parity across all modes.

I. Executive Summary

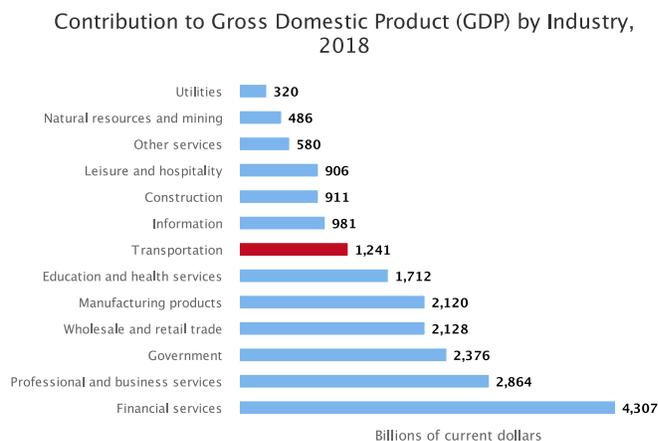
A. Introduction

During the 2019-2020 academic year, students of the GAIS at the Dwight D. Eisenhower School for National Security and Resource Strategy focused their research on the GA ecosystem consisting of seven industries to include Rail, Trucking, Air Freight, Ports and Harbors, Deep Water Shipping, Inland Waterways and Warehousing. Students examined the role of each industry in the movement of goods worldwide along with its impact on the national security of the United States (U.S.). Research throughout the semester led the seminar to conclude that the GA ecosystem consists of fragmented systems of various modes of transportation rather than a smooth, continuous transport solution. The lack of a holistic, intramodal plan limits the U.S. from achieving its full economic potential and, more grievously, exposes supporting mobilization requirements to increased risks during a national crisis.

While each industry within GA faces unique challenges, the seminar concluded unanimously that the U.S. Government must develop an integrated national transportation strategic plan. The plan must promote intermodal cooperation, balance capacity between transportation modes, and address human capital shortages and infrastructure funding shortfalls. The U.S. relies on critical modes of transportation by way of air, land, and waterways for its economic health. Collectively, these industries provide global reach, move bulk commodities from farms, mines, and factories to market, and enable the storage of goods within the proximity of need. To remain globally competitive, the U.S. Government must consider Global Agility industries as a national priority that requires immediate attention and prioritization.

B. Global Agility Industry Defined & Methodology

The transportation network comprises infrastructure, conveyances, services, information, and people. The industry is stable, but the distances, capacity, procedures, and pace have changed significantly over time. Today, industrial transportation either supports an industrial process, is an integral part of just-in-time manufacturing or is its own value creation. In the U.S., as of 2018, the transportation industry produces 5.9 percent of the nation’s gross domestic product.³ The transportation services range from large deep water freighters with capacities of over 20,000



Source: U.S. Department of Transportation

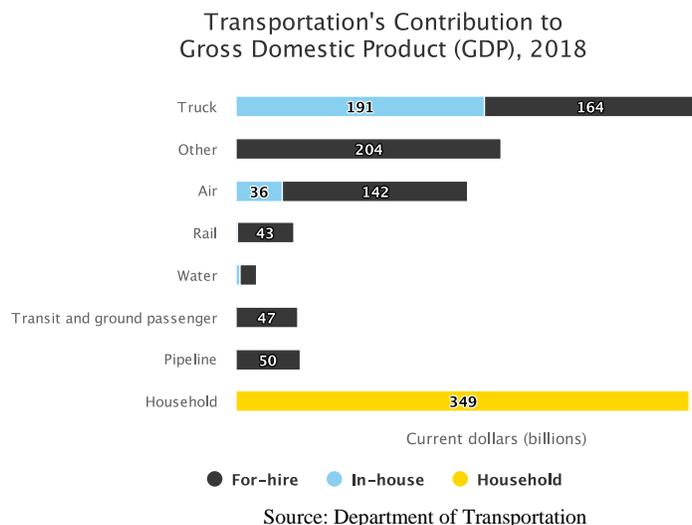
containers, to small delivery vehicles with fewer than a hundred boxes. This combination of services provides access to national, international, and inter-city options to support the full range of market needs.

At all levels, the network attempts to connect origins and intermediate locations with consumers’ destinations in the best, most efficient manner which can result in either intermodal cooperation or competition. Economic competition results in specialization of

companies that are reliant on core competencies and best practices. Because of this, the industry has developed a broad spectrum of services that this IS defines as the GA ecosystem. Air facilitates the rapid movement of goods worldwide, primarily in dedicated freight plans or the “bellies” of passenger planes. Air freight’s superpower is speed but is hindered by low capacity. Deep water shipping and ports and harbors work together with 100,000 oil-powered vessels moving more than 11 million tons of goods each year through docking and pier facilities or canals.⁴ Port activities include loading and unloading cargo from ships, operating lighthouses, and connecting cargo with recipients. Comprised of over 12,000 navigable miles, U.S. inland waterways are an essential artery in the movement of bulk commodities from farms, mines, or factories to market. Railways and trucking are responsible for the bulk of land transport. Annually, rail transports over 40 percent of all ton-miles for freight in the U.S. while trucking moves 71.4 percent of the nation's freight by weight.^{5, 6}

Finally, with warehousing, the process of storing goods for resale or distribution is garnering more important roles in the network because of its ability to reduce transportation time based on proximity to strategic transportation nodes. With the growing trend for e-commerce and consumer desires to have goods in-hand faster, these modes must work hard individually and collectively to meet those demands.

The transportation industry is filled with a host of considerations and challenges. Legal regulations, technical requirements, and cultural nuances for global operations take center stage and the ease of doing business can take time to establish. Continuous passage rights for ships, slots at high-performance transshipment points and airports, and friction-free customs processes add value that contributes to the actual shipment at hand.



New technologies also play a part in that they can change not only processes (e.g., the automated sorting of containers in ports to enable the best follow-on transportation), but also make some workspaces safety-redundant with technologies that minimize failure rates. An example of this is the use of artificial intelligence by a rail company to recognize mechanical breaks between its car joints to prevent accidents. Changes such as embracing new technologies can revolutionize the entire industry or can risk harming efficiency based on the success of deployment. For instance, standards and deregulation resulted in the 20-foot standard container and removed fixed transportation fees. While these changes are often seen as positives, change has also resulted in personnel shortages and the need for highly specialized qualifications. Recently, a perceived lack of interest by younger generations to enter these career fields has only increased the personnel shortages.

Further, as the GA ecosystem is essential to mobilization operations, the Nation must ensure a sufficient pool of transportation assets exist for air, land, and sea deployments of military forces while maintaining the needs of the U.S. economy. This requires development and maintenance of relationships with industry during peace time which can be utilized to support surge and mobilization requirements during a crisis. Together, the federal and state governments play a vital role in providing overarching guidance and the development of a national transportation strategic plan. Their combined efforts are required to ensure the reasonable allocation of resources in providing and maintaining the U.S.'s GA ecosystem in partnership with industry.

Methodology

Throughout the spring semester, students received briefings from representatives of every industry within the GA ecosystem as well as supporting functions such as inventory tagging and big data analysis, to provide a comprehensive picture of the industrial stakeholders. Speakers provided wide-ranging perspectives on topics representing the views of lobby groups, labor unions, company executives, the U.S. military, and NATO allies and partners. Despite the variance in organizations, differing opinions, recommendations, and expectations, common themes emerged regarding the well-defined roles, functions, and provisions of all players in times of mobilization. Federal regulations such as the Jones Act and Harbor Trust Fund served as reference points for the pros and cons of governmental market intervention. Additionally, GAIS students took a companion course titled "Industry Analysis" in which they conducted market and firm analyses on specific companies within the Global Agility ecosystem. ([Annex IV](#)).

Students attended guest speaker lectures and field trips designed to reach a deeper understanding of topics, benefiting from the knowledge shared by experts within each industry. The group visited a host of operational ready reserve vessels, logistics providers, and companies integral to the GA ecosystem. A visit to the Army Corps of Engineers Baltimore District highlighted their unique role in dredging and inland waterway maintenance. To emphasize the importance of mobilization to Defense Strategy, the GAIS course included a military perspective informed by engagements with defense entities such as the Defense Logistics Agency, the U. S. Transportation Command, and the NATO Movement Coordination Centre and the Joint Support Enabling Command. Their views helped the seminar understand the specific military requirements for mobilization operations and enabling partnerships. These experiences informed student industry issue papers ([Section II](#)) and informed the overall findings and recommendations for the Global Agility ecosystem.

C. Global Agility Ecosystem & Current Conditions

The GA ecosystem consists of several critical and dominant stakeholders that shape and affect the output, growth, and viability of the industries that operate within the GA domain. The transportation, distribution, and power projection capabilities found within the GA domain are essential to the national security and national defense of the United States. Globalization in the 21st century continues to evolve, and the world has become more interconnected than ever before. This is primarily due to the increased capacity and emerging technology that enables people and things to move rapidly, communicate, and track movements in real-time. In a very

real sense, the world has shrunk by reducing the friction of distance and enabling the world's supply chain to sustain urban and rural communities around the globe.⁷

Domestically, the key stakeholders within the GA ecosystem are United States Government (USG) departments and agencies (including the Department of Defense (DoD) and the Department of Transportation (DoT)), private transportation industries, special interest groups, allies and partners, as well as society at large. The stakeholders within the ecosystem rely upon each other to successfully complete their objectives which facilitates synergy within and across the GA domain.

The DoD and the DoT are the predominate U.S. government agencies with oversight and influence on the system. The DoT is responsible for overseeing all aspects of the U.S. transportation system, including enforcing regulations, shaping policies, and writing legislation. The DoD generates most of the U.S. strategic transportation requirements for the GA domain and benefits from a strong defense industrial base within the ecosystem. This emphasis is necessary to ensure the U.S. military can quickly project power and resources to respond to crises and other national security objectives, as needed.

The U.S. Congress passes laws and ensures sufficient oversight as well as checks and balances exist within the system. In related activities, special interest groups are influential with government agencies and Congress in championing legislation to support their industry or to improve employee conditions. A few examples of special interest groups are the American Transportation Association, the National Defense Transportation Association, the Airline Pilots Association, the American Port Authority Association, and the Atlantic Intracoastal Waterway Association. These interest groups push to influence public policy within their industry of interest but do not generally work together for a holistic solution.

Allies and partners within the ecosystem facilitate the United States' mobilization efforts, projections of military forces, and responses to natural disasters or crisis. Allies and partners also provide access to the global transportation infrastructure including access and overflight and provide key offsets to our resource gaps. Without these relationships, strategic lift capabilities will be materially harmed.

Finally, the last stakeholder within the ecosystem is society, which encompasses communities all around the world. The global community is heavily reliant upon the GA domain for the transportation, storage, and distribution of goods and the movement of passengers. Over the past few decades e-commerce has greatly influenced the commercial market and has quickly transformed the commercial marketplace. Even without e-commerce, products at grocery stores, department stores, and shopping malls likely relied on intermodal transportation to reach their destinations. In many cases, products have crossed multiple continents, oceans, and time zones to reach the consumer.

Population growth will also increase stress on the global ecosystem. As the global population is expected to increase from 7.4 billion to 10.6 billion by 2050, the volume of goods shipped is expected to quadruple.⁸ This growth will see a corresponding increase in urbanization, disposable income, internet penetration, and ease of access to new technologies.⁹ With the rapid

pace of change within the GA ecosystem, outreach, and collaboration across all stakeholders is critical. Forging closer ties within the ecosystem based upon shared interests and needs will not only increase efficiency but enable the needed flexibility to support the expected increase in demand resulting from a growing global population.

D. Current Conditions

The current conditions of the industries within the GA ecosystem are relatively good due to the strength of the U.S. economy. The air freight industry is a high-value capability but is stifled by high costs per volume, representing less than one percent of global trade tonnage. However, that small percentage transports more than \$6T of goods annually and represents 35 percent of global trade by value. In 2018, air freight in the U.S. grew eight percent, accounted for 14 percent of the global sector, and was valued at almost \$18B.¹⁰

In 2018, the U.S. rail industry moved 4.7 billion passenger trips covering over 32 billion passenger miles.¹¹ Rail Freight provides over 40 percent of all ton-miles of U.S. freight transportation.¹² This makes rail freight the single largest by-ton mode of transportation and a critical link in sustaining the U.S. economy.¹³

The trucking industry moves 71.4 percent of the Nation's freight by weight.¹⁴ The gross freight revenues from trucking are \$796.7B USD, representing 80.3 percent of the Nation's freight bill in 2018.¹⁵ The industry employs a labor force of 8.9 million employees, including 3.5 million professional drivers.

The Inland Waterway System (ILWS) delivers more than 600 million tons of cargo valued at over \$300B. The ILWS also supports more than half a million jobs and complements both the highway and rail system, supporting the national multimodal freight transportation system.

The deep water shipping industry has approximately 100,000 vessels powered by oil-fired engines and moves more than 11 million tons of goods while consuming approximately 250 million tons of fuel each year.¹⁶ Demand for shipping closely follows the world economy and was projected to grow by 3.4 percent per year through 2024 before the COVID-19 downturn in trade.¹⁷

The ports and harbor industry has experienced annual growth rates of 1.9 percent from 2015 to 2020.¹⁸ Experts predict that growth will slow to 1.8 percent annually through 2024.¹⁹ While trade is expected to increase, U.S. industry export revenue growth is expected to lag thanks to suboptimal U.S. port infrastructure.

Finally, the warehousing industry supports manufacturers, importers, exporters, wholesalers, and transportation businesses that purchase or lease warehouse space to store raw materials, spare parts, and components used in manufacturing. The warehousing industry today generates \$25.1B of revenue with a profit margin of 17.1 percent.²⁰ As the demand for the industry's services aligns with trends in consumer spending, expected annual growth of 3.4 percent to \$29.7B USD over the next five years is predicted.

E. U.S. Government Challenges with Global Agility

The federal government is dependent upon the successful integration of these commercial industries to provide the necessary capability to achieve global agility. To be successful these industries must anticipate and respond to the changing political, environmental, and market conditions, both domestically and abroad. However, there are numerous challenges these industries face that inhibit their ability to be ready and responsive to the federal government and to facilitate U.S. national security interests.

One of the major challenges facing GA industries is the condition and capacity of infrastructure. In a fiscally constrained environment, these industries compete for scarce financial resources, further limiting their ability to scale capacity to need. Therefore, the federal government must consider improving the infrastructure that supports these transportation modes as strategic national objectives. The economic development and livelihood of the entire nation as well as the ability of the industry to mobilize in times of war depends on their success. Without successful integration amongst these modes, the U.S. competitive advantage will decline.

Having a safe and reliable infrastructure is critical to providing the means to transport both commercial and military cargo and personnel across the U.S. and overseas. Unfortunately, the American Society of Civil Engineers has assigned the Nation an overall infrastructure grade of D+. Across the modes of transportation, aviation, roads, and inland waterways all scored a grade D, ports a grade of C+, and rail (the highest) with a grade of B. (NOTE: Rail infrastructure is privately funded while other modes receive a significant if not full funding through public appropriations.) A grade of D indicates that the existing infrastructure is in poor to fair condition, exhibits significant deterioration with a high risk of failure, and is approaching or exceeding its rated service life.²¹ Without a coordinated plan to address these infrastructures needs, investments and prioritization will not guarantee access to a whole-of-government approach needed to target issues across the modes and meet the future demands of the Nation.

Although ports score a grade of C+, the existing infrastructure is limited in its ability to support increased capacity across the Nation. Both improved containerization and growth in demand on the trucking industry have led to the increased importance of ports and harbors on the wider economy.²² These changes affected the land-maritime interface and the ability to integrate efficient commodity flow between trucks and ports. With increasing export and import volumes and the decentralization of logistics services from ports' regions, more efficient transit routes, such as freight rail expressways would mitigate the impacts of traffic congestion in urban areas that impact transit times and costs. Because of the Nation's increasing economic dependency on ports, the federal government must focus attention on the capacities of the ports - specifically their intermodal connections.

Whether at the ports or along the various modal routes, poor infrastructure directly disrupts or delays the transportation of goods, services, and personnel. This directly translates into shipper costs and lost economic competitiveness, or, in the worst case, the inability to support DoD movement and mobilization. Ultimately, congestion along the modes of transportation leads to lost productivity, increased fuel consumption, and major safety concerns, all of which negatively impact these industries.

Government regulations also play a significant role in limiting GA industries from expanding capacity. With increasing pressures to be more environmentally friendly by limiting fossil fuel emissions, the government may have little choice but to continue to establish policies to limit their effects. For example, maritime shipping, whether by container ship, bulk cargo, or tanker, is easily the most carbon-efficient and cost-effective method of transporting cargo.²³ However, given that more than 90 percent of the world's trade is carried by sea, it is the sixth-largest source of greenhouse emissions on Earth despite its efficiency relative to other cargo transportation methods.^{24 25} With models forecasting a 50 percent increase in carbon emissions by 2050, industry and government are in a struggle between economic efficiency and mitigating environmental impacts.²⁶ Additionally, different standards and policies among the modes, particularly related to fuel consumption and taxes, directly contribute to intermodal competition and adversely affect efforts to shrink intermodal capacity gaps.

Increasing capacity within the industries is also affected by limitations within the industrial base to support increased demand. For example, air freight has been significantly impacted by low capacity due to overall decreases in the number of planes and human capital constraints. These capacity limitations not only constrain civil operations but that of simultaneous support of DoD mobilization. The maritime industry also faces a declining industrial base, which significantly limits their ability to support necessary transport and sealift capabilities. Given that over 90 percent of military equipment, supplies, and fuel travels by sea, this poses a significant threat to U.S. power projection.²⁷

Human capital challenges are another major issue affecting GA industries and limit their ability to support the federal government. Attracting, training, and retaining a skilled workforce is critical to supporting the transportation industry's ability to surge for increased demand and provide the capacity to support a mobilization effort. This is prevalent across the various modes and primary factors include demographics such as age, gender, lifestyle/work-life balance, and high costs associated with training and certifications.

The highest personnel shortages exist among pilots, truckers, and merchant mariners. For example, the American Transportation Association (ATA) estimated that the trucking industry had a shortage of 60,800 drivers to meet the 2018 U.S demand for freight services.²⁸ The personnel shortage has fluctuated over the past ten to fifteen years, moving with the U.S. economy. In recent years, the significant growth of e-commerce and technology has resulted in an increased need for transport and freight services as well as employees. The existing shortages aggravate the competition for personnel resources between the commercial sector and those necessary to support DoD. Per Rear Admiral Mark Buzby, administrator of the Maritime Administration, the merchant mariners currently available are all fully employed on commercial vessels.²⁹ While those vessels provide sustained sealift, the same crewmembers cannot simultaneously man those vessels *and* the surge of National Defense Ready Reserve Fleet (NDRRF) vessels. Continuing the status quo without policies to address these shortages could severely impact the supply chain, the economy, and the national security of the U.S.

Lastly, none of these issues can be addressed without consistent and sufficient funding. This is particularly vital in addressing the problem of failing infrastructure across the modes. Lack of sufficient and consistent investments escalates the costs and risks of aging infrastructure – an

option the country, the economy, and families can no longer afford.³⁰ Resource competition with higher visibility issues such as healthcare and taxes manifests as inconsistent appropriations, further intensifying the growing backlog of infrastructure and maintenance projects and competition among the modes for the limited resources.

F. Global Agility and Its Impacts on National Security

The GA ecosystem supports the warfighter through the deployment and sustainment of war materiel wherever it is needed. Use of commercially available services and development of relationships with industry during peace time provides DoD access to capabilities as a cost-effective alternative to purchasing and maintaining capabilities internally. It is important to note that the industry possesses 90 percent of the Nation's strategic lift capability and is required to rapidly shift from commercial operations to military mobilization. However, this may come at the expense of the domestic economy. Improving the ecosystem's capacity and infrastructure should be a national priority to ensure the U.S. remains viable to simultaneously support civil economic needs and defense operations. The methods by which each of the seven industries support mobilization are detailed below:

Ports and harbors serve as the key installations for intermodal connections and infrastructure, linking roads, railways, and inland seaways. These strategic points of embarkation support the economy writ large as the entry and exit point for international shipments. Similarly, ports support the deployment of military forces and equipment during the mobilization of U.S. national defense. These capabilities are also critical to projecting U.S. military strength overseas. Furthermore, the volume of shipments, and their impact on the national economy support the development of alliances, fund the military, and underwrite diplomatic and development efforts.³¹ As a result, DoD and its partners in the commercial port industry must look for ways to minimize disruptions to port and harbor activity and increase capacity.

The **deep water shipping** industry is critical to the national security of the United States. The strategic sealift capabilities provided by the industry serve to transport the lion's share of military cargo globally. The use of U.S.-flagged merchant marine ships from the Maritime Administration's (MARAD) Ready Reserve Fleet and private cargo carriers participating in the Maritime Security Program or the Voluntary Intermodal Sealift Agreement program supplement the organic sealift capacity of DoD ships. Combined, the DoD and deep water shipping industry produce the 19.2 million square feet of sealift capacity needed for mobilization.³² While there is consensus from USTRANSCOM, MARAD, and the Deputy Chief of Naval Operations for Logistics that the current fleet meets the strategic sealift requirement, DoD will need to replace aging vessels with new ships to maintain readiness levels.^{33, 34, 35}

The **air freight industry** provides rapid transportation of units and equipment across the globe through the Civil Reserve Air Fleet (CRAF). Major U.S. airlines contractually commit select aircraft to the CRAF to supplement military airlift under two segments (Domestic and International), and three successive stages of utilization. The first stage, "Committed Expansion," employs CRAF aircraft to support minor regional crises. The second stage, "Defense Airlift Emergency," calls for aircraft to support a major theater war. Stage three, "National Emergency," calls for national mobilization.³⁶ The program offers the DoD a cost-

effective medium to secure air freight services without incurring the costs of purchasing and maintaining additional aircraft and having crews during peacetime. The DoD incentivizes U.S. air carriers to commit aircraft to the program by allocating peace airlift operations via CRAF Charter Airlift Services contracts to program participants. As of April 2019, 25 carriers participate in the program, committing 433 aircraft.³⁷ However, the limited cargo capacity of newer, small-body aircraft, as well as the overall availability of aircraft by U.S. airlines, can impact the CRAF participation level, thereby constraining military air mobility.

The ***inland waterway system*** supports national defense and the maritime industrial base through the transport of bulk commodities. During a mobilization effort, these capabilities offer strategic sealift for bulk cargo, including essential inputs used to manufacture war materials such as petroleum and steel. Additionally, the use of the inland waterway system could supplement the transit of low priority defense materiel to allow other modes to focus on the transport of time-sensitive shipments. While the Jones Act maintains the security of the inland waterway system by restricting foreign ownership and operations, unpredictable funding for the Army Corps of Engineers results in inconsistent maintenance of the waterways, which could lead to disruptions or infrastructure failure, placing additional strain on the remaining modes of transportation.

The ***railroad industry*** supports U.S. national security by facilitating the efficient transport of large military weapon systems for planned exercises and full-scale mobilization deployments across the Strategic Rail Corridor Network (STRACNET). STRACNET's 33,000 miles of interconnected rail corridors and 4,700 miles of connector lines links over 120 military defense installations across the United States. If a full-scale mobilization were to take effect, 70 percent of the force would move by train on STRACNET, according to estimates by the Surface Deployment and Distribution Command.³⁸ Rail transportation offers an environmentally-friendly freight movement that limits the strain on and congestion of the U.S. highway system. Increased investment by Chinese state-owned enterprises into the rail industry's supply chain and its integration into the U.S. rail network pose an increased risk to the industry's technological and physical infrastructure. Were STRACNET compromised, the military would lose the ability to transport heavy equipment and materiel between military installations via an interconnected network, severely weakening combat readiness.

The ***trucking industry*** accounts for the movement of 71.4 percent of the Nation's freight by weight and remains a crucial component for the transport of defense equipment and supplies across the United States. Daily, it delivers shipments to ports, military installations, and defense industrial base facilities. During a mobilization, such capabilities would need to expand in scope and scale. However, human capital challenges, including an aging workforce, are contributing to a truck driver shortage, which could disrupt the industry. Such a disruption would not only affect the U.S. economy, which is a national security risk but would also adversely impact mobilization in defense of the Nation.

The ***warehousing industry*** supports U.S. national security by stockpiling and prepositioning military equipment and supplies. Commercial warehousing has benefited from the growth of e-commerce, not just through increased profitability, but also improvements in efficiency through modernization. However, lack of a strategic requirement for a time of crisis or contingency operation, the commercial warehousing industry does not have dedicated infrastructure to

support the DoD during a national military mobilization without severely impacting commercial operations, and by extension, the U.S. economy.

Combined, the industries represented in GA not only contribute to commerce and U.S. economic strength but also the national defense of the country. The commercial sector's ability to house, sustain, and rapidly transport finished goods in a cost-effective manner provides a critical capability to the warfighter in times of mobilization, deployment, and conflict. Because GA industries are vital to national security, it is imperative the USG prioritize industry challenges and take an active role in solutions to ensure these capabilities are available to support when needed.

G. Enabling Global Agility – Long-Term Outlook

The GA ecosystem encapsulates several separate and distinct industries, each with its unique challenges and opportunities. While largely disparate and, in many cases, competing, the long-term outlook of these industries is critical to the future readiness of the U.S. in support of mobilization and national defense. Experts predicted growth in many GA industries due to increasing demand and a strong economy. According to projections by the International Transport Forum (ITF), global freight demand is expected to triple by 2050.³⁹ However, GA industries are limited in reaching their full potential unless the USG develops a strategy to prioritize resources and provides adequate investment in infrastructure.

Demand for air freight, maritime shipping, and commercial warehousing is trending upward. However, limitations in each industry continue to hinder growth. For instance, the expected growth rate for air freight is three percent per year for the next decade, but airfreight capacity remains a limiting factor and is further constrained when the industry must address mobilization requirements in the name of national security.⁴⁰ To address capacity issues, the USG must take measures to increase CRAF participation within the industry by incentivizing the program through tax credits or other tailored incentives to motivate participation.

In maritime shipping, the International Transport Forum Transport Outlook 2019 predicts continued growth over the next 30 years, with ships transporting more than three-quarters of all goods movements by 2050.⁴¹ However, while it is easily the most carbon-efficient and cost-effective method of transporting cargo, it is one of the largest contributors to global air pollution.⁴² Regulation and eco-friendly upgrades are cost-prohibitive and, as such, the U.S. needs to make additional strides towards efficiency while helping companies overcome the significant economic barriers to reducing emissions. These changes may include tax breaks or fuel tax reductions for companies with vessels undergoing environmentally friendly upgrades.

Finally, commercial warehousing is thriving and profitable due in large part to e-commerce and the growing recognition of the value of supply chain management to increase business competitiveness. Yet, when it comes to national security, the current and future commercial capacities may not be readily available to support DoD requirements. The U.S. must develop a national strategy that encompasses civil and military operations to ensure it can maintain both if possible, in times of national crisis.

For a few industries, both capacity and funding limitations contribute to its negative long-term outlook. For example, according to industry experts many ports and harbors “no longer contribute to the economic development of the metropolitan areas in which they are located,” but rather to the region or entire Nation, thereby expanding capacity demands.⁴³ Port authorities face the challenge of providing an efficient commodity flow from the port inland which often extends past port perimeters. With increasing export and import volumes and the decentralization of logistics services from port perimeters, more efficient transit routes through urban areas are necessary to avoid congestion. The port and harbor industry is a significant driver for U.S. economic growth but it will not realize its full potential without federal government investment in intramodal transportation connections.

A related issue lies within the U.S. ILWS industry which has been supported by the Inland Waterways Trust Fund and the Jones Act for many years. The ILWS is plagued by aged infrastructure and insufficient and inconsistent funding for key projects and upgrades. As a result, many U.S. industries that rely on inland waterways for transport have lost, or are at risk to lose, their competitive pricing advantage.⁴⁴ For example, it is estimated that one critical failure in the Upper Mississippi River System could cost nearly \$1.6B in lost revenue and require 500,000 additional truckloads to transit goods to market.⁴⁵ At worst, the failure to proactively stabilize vital systems could cost lives as well as livelihoods when rivers overrun their banks and dams fail. If the U.S. is to remain globally competitive against near-peer competitors, its port, harbor, and inland waterway infrastructure must be prioritized amongst other projects to enable GDP growth and maximize influence abroad.

Finally, the rail and trucking industries face similar resourcing challenges, which has led to an overreliance on foreign investment and massive workforce shortages. Within the continental U.S., rail freight is the single largest by-ton mode of transportation and is critical to the sustainment of the U.S. economy.⁴⁶ Since 2014, China Railway Rolling Stock Corporation (CRRC), a state-owned enterprise, has underbid competitors and won \$2.6B in contracts to supply subway carriages in major U.S. hubs. This represents a potential threat to national security through increased reliance on foreign manufacturers of critical infrastructure assets.⁴⁷ Strengthening railroad infrastructure and supporting increased domestic ownership within the U.S. will improve safety, bolster reliability, support full-scale mobilization, and sustain a growing economy that does not have to rely so heavily on foreign investment.

Lastly, the trucking industry is a significant U.S. employer with 8.9 million employees, including 3.5 million professional drivers. However, according to the American Transportation Association, the industry is facing a driver of over 60,800 personnel. If conditions do not drastically improve, that number could grow to over 100,000 drivers in five years and 160,000 drivers by 2028.⁴⁸ This would negatively impact the U.S. economy, supply chains, the DoD’s ability to project military power, and, ultimately, U.S. national security.

H. Findings and Recommendations

After gaining a better appreciation for the GA ecosystem, its current conditions, and impacts on national security, it was clear that all seven industries face similar, interrelated challenges. While different in the utilization of their vehicles, vessels, and structures as well as the execution of their services, they all require the need for strategic guidance to inform prioritization,

innovation and investment, stable funding to maintain current operations and investment in future infrastructure, and human capital investment to ensure skilled personnel are available to fill the critical demands. The seminar arrived at three main overall findings and resource informed policy recommendations to address ways to improve the commercial industry as well as strengthen its partnership with the DoD and improve the U.S.'s capacity and capability.

Finding 1: The lack of an integrated national transportation strategic plan promotes intermodal competition rather than cooperation and optimization of infrastructure capacity. The lack of an overarching plan creates capacity gaps at various level within each mode of transportation.

Recommendation 1: The U.S. must develop and legislate a national transportation strategic plan that supports the NSS, promotes intermodal policy cooperation, and maximizes capacity. An overarching federal plan managed at the appropriate governance level would provide the required federal oversight on capacity levels, prioritization and allocation of resources, and a mechanism to track and monitor appropriate metrics. Furthermore, the legislation should classify the GA ecosystem as a critical, strategic, national security asset. This would facilitate the oversight of foreign investment from near-peer competitors into the GAIS. This will ensure a balance between domestic and foreign sources as well as protect the U.S. from intrusion and malicious incidents. The plan would also help identify, monitor, and address some of the current capacity issues and risks of each industry, holistically. Some of these include declining human capital, inconsistent funding, technology gaps, security concerns, and foreign investment challenges. Finally, an overarching plan would ensure that future policies are coordinated such that a policy which supports one mode does not harm another. At a minimum, the USG would ensure that impacts are appropriately mitigated or compensated so that each industry identified in the global agility ecosystem remain in a position to fulfill its obligations towards the Nation's economic and national security objectives

Finding 2: The industries within GA contend with human capital challenges defined predominately by an aging workforce, amplified by a lack of diversity, and little interest from younger generations.

Recommendation 2: The U.S. should develop a national plan to incentivize vocational training programs and reduce barriers to entry for skilled employees in in key industries. The USG should increase apprenticeship programs, conduct national outreach, and address health and safety concerns.

Apprenticeship Programs. The federal government should develop more apprenticeship programs to attract a younger demographic or those who may have minimal background in GA industries. For example, the Drive Safe Act directs the DoT to promulgate regulations to implement an apprenticeship program for licensed commercial motor vehicle drivers under the age of 21.⁴⁹ Codifying a framework such as the Drive Safe Act into legislation would ease barriers into key GA industries in a responsible and safe manner.

National Outreach Plan. The government must also incentivize programs that focus on recruitment efforts towards the 18 to 25-year-old workforce. These outreach programs should focus on eligible high school students, community college students, and women as these

demographics are not highly represented in GA industries. Benefits of these incentive programs could be in the form of bonuses, college education funds or loan repayment, and/or free or reduced licensing fees. Many companies have started to concentrate on recruiting women but still need to improve on addressing issues that concern women such as safety, job flexibility, and strong mentorship programs.

Improve Health and Safety. Within GA industries, health and safety are often reported as key concerns by employees, unions, and businesses, alike. As such, additional resources could be allocated to the Department of Labor Health and Safety Office to enhance the assistance provided to small and medium enterprises (SME) regarding their health and safety compliance programs. These enterprises account for most of the GA businesses, but often lack the appropriate resources and competence to deal with issues that stem from these areas. Education and training would not only help them retain their current workforce but would also allow them to attract new employees through the promotion of safe working environments.

Finding 3: The U.S. transportation infrastructure development lacks consistent and sufficient funding.

Recommendation 3: Over the last 20 years, federal, state, and local investments in transportation infrastructure have declined while population, congestion, and maintenance backlog have increased.⁵⁰ The federal government should amend the Defense Production Act (DPA) to increase access to loans, establish a National Infrastructure Bank (NIB) to provide economical, long-term financing for infrastructure projects, and adjust tax codes to increase policy parity across all modes. Coupled with finding and recommendation #1, establishing a national strategic infrastructure plan that prioritizes critical projects would strengthen the infrastructure and improve the competitiveness and efficiency of each transportation entity under the GA industry umbrella.

Amend the Defense Production Act. Sections 301 and 302 of the DPA Title III authorizes the President to issue government loans and financing options to private institutions in support of expediting production capabilities and supplies.⁵¹ However, a 1974 amendment to Title III requires Congressional appropriation before loans can be issued, absent a declared national emergency. These requirements have impaired the flexibility of Title III's financial support options to such a degree that no DPA loans were issued in the past 30 years.⁵² Reducing the barriers to entry for Title III loans could be an efficient way to partner with industry and introduce additional resources for productivity enhancements. The DPA should be amended to repeal Sections 301(a)(3)(A) and 302 (c)(1)(A) which require Congressional appropriation before DPA loans and financial support can be issued. Rather, Congress should establish a pool of funds to source financial instruments under DPA Title III, which could take the form of the NIB, discussed below.

Establish the National Infrastructure Bank. To provide dedicated and sustainable funding, the U.S. government should establish a financial institution that incorporates the goals of the National Infrastructure Bank Act of 2020 to provide economical, long-term financing for infrastructure projects.⁵³ No federal source of funding is dedicated to multimodal freight projects. The only federal funding mechanism for infrastructure is through direct grants to states

or through indirect methods such as tax incentives for private investors through municipal bond market purchases.⁵⁴ The process to apply for federal grants is difficult, insufficient, and does not facilitate collaboration with the private sector. A national infrastructure bank could accept proposals from a wide spectrum of sectors, reside under the Department of Transportation, and be supported by an appropriation that pays the subsidy and administrative costs as outlined in the Federal Credit Reform Act of 1990.⁵⁵ The National Infrastructure Bank Act of 2020, currently under committee review in the House of Representatives, provides a published framework to explore the type of legislation required to establish this structure.

Increase Tax Policy Parity. Another option which could resource intermodal infrastructure projects is by adjusting the Federal Fuel Tax and establishing an Overland Transportation Excise Tax. The federal fuel excise tax, by statute, is not adjusted for inflation and has not increased by legislative act since 1993.⁵⁶ This is perceived by some as a non-agnostic policy decision by the Department of Transportation in favor of the trucking industry. In 2018, the Congressional Budget Office published two opinion papers on the fuel tax to evaluate options for reducing the federal deficit. Using this data for another purpose provides policy recommendations that could improve parity between modes of transportation and funding for infrastructure projects. These recommendations include either indexing the federal excise tax to account for inflation (impacting private citizens and corporations alike), or adding an additional overland freight tax, impacting truck and rail operators, but not private citizens.⁵⁷ Combining the CBO's recommendation to price the negative externality effects of CO2 emissions more accurately could provide funding for infrastructure projects, improve parity between transportation modes, and mitigate fuel consumption and greenhouse gas emissions. Furthermore, this may also incentivize adoption of alternative transportation modes to trucking, further reducing the negative externalities of the trucking industry – congestion, infrastructure damage, and pollution.⁵⁸

I. Conclusion

The capacity and capability to move products and deliver services at the speed of relevance is the lifeblood of GA. The industry is not only vital to the U.S. economy but that of national defense. To maintain seamless transport, distribution, prepositioning, and storage of materiel and equipment for mobilization and conflict, the U.S. must develop an overarching strategy that drives both healthy competition of its transportation industry players while promoting intermodal policy cooperation and integration. The plan must also address how the U.S. can more efficiently maintain competencies and skillsets in its workforce as well as develop ways to attract younger, more diverse personnel. Finally, to remain a leader in innovation and on the cutting edge of technology, the U.S. should not just address infrastructure when it is failing but ensure stable funding is available for both maintenance and upgrades that will provide positive impacts on the industry, the environment, and its personnel. Implementing the recommendations noted in this report will ensure the Global Agility ecosystem remains competitive, sustainable, and viable in both the commercial world and for national defense.

II. Global Agility Issue Papers

A. Ports & Harbors: Intermodal Connection Infrastructure

1. BLUF. If the U.S. is to remain globally competitive, the U.S. government must take action to provide port authorities the oversight and resources required to keep pace with a growing and evolving demand for international trade.

2. Industry Defined & Current Condition. The U.S. Port and Harbor industry involves the operation of ports and harbors, to included docking and pier facilities or canals.⁵⁹ Port activities include loading and unloading cargo from ships, operating lighthouses, and connecting cargo with recipients.⁶⁰ While the port industry experienced annual growth rates of 1.9 percent from 2015 to 2012, experts predict that growth to slow to 1.8 percent annually through 2024.⁶¹ While trade is expected to increase, U.S. industry export revenue growth is expected to lag thanks to suboptimal U.S. port infrastructure.

3. Issue. Port and harbor intermodal connection infrastructure lacks federal level prioritization and funding.

4. Background & Government Challenges. The Federal Government must consider ports, harbors, and their corresponding infrastructure as national assets. “Many ports no longer contribute to the economic development of the metropolitan areas in which they are located, but rather to the region or entire nation.”⁶² Both improved containerization and expansion of the trucking industry have led to the expansion of the impact of the port and harbor on the wider economy. These changes moved “the mechanical break in the ‘river of traffic’” inland from the land-maritime interface.”⁶³ Port authorities face the challenge of providing an efficient commodity flow from the port inland which often extends past port perimeters. With increasing export and import volumes and the decentralization of logistics services from ports’ regions, more efficient transit routes through the urban areas around ports are necessary to avoid congestion. Because of the nation’s economic dependency on ports, the federal government must focus attention on the capacities of the ports and especially their interconnections.

The U.S. Government response to the 9-11 attacks set a precedent for a more aggressive federal role in port oversight and resourcing. The Maritime Transportation Security Act in 2002 and the Security and Accountability for Every (SAFE) Port Act in 2006 established mandates for security, provided funding and assistance for preparedness, and planned a coordinated response to future interruptions of port and harbor activity. The 9-11 federal government response may serve as a model to organize federal level coordination and establish resource prioritization for ports and harbors and their interconnections.

5. National Security Implications. Ports influence national security both strategically and operationally. Ports drive the economy as they serve as gateways to the global market. A strong economy enables the U.S. to develop alliances, pay for its military and underwrite diplomatic and development efforts.⁶⁴ Operationally, ports support military force deployment during contingencies and other national defense emergencies. The partnership between the military and

the port commercial industry enables the U.S. to expeditiously project military capability to gain the initiative anywhere in the world.

6. Recommendations.

a. Recommendation 1: Provide Federal level oversight to ensure prioritization and allocation of resources in accordance with national plans for infrastructure and trade development.

Risk/Tradeoff: Centralization can lead to bureaucratic slowdowns and inaccurate allocation of resources.

b. Recommendation 2: The federal level needs a mechanism to track and monitor port and harbor metrics. This will allow the effective prioritization outlined in recommendation number one.

Risk/Tradeoff: Increasing transparency increases the vulnerability of businesses to trade secret theft, making the nation more vulnerable to exploitation of that information.

7. Long-Term Outlook. The port and harbor industry is a significant driver for U.S. economic growth but it will not realize its full potential without federal government investment. If the U.S. is to remain globally competitive against near-peer competitors, its port and harbor infrastructure must be prioritized amongst other infrastructure projects to enable GDP growth and maximize influence abroad.



Image 1: Port of Baltimore, February 13, 2020.

B. Deep Water Shipping: Barriers to Green Technology

1. BLUF. Deep water shipping is dependent on fossil fuels and is a major source of environmental pollution. New technologies including wind, solar, and hull-scraping are now available to make operations cleaner; however, these advancements are costly. Most require extended vessel downtime, which decreases revenue and leads shippers to seek government assistance.

2. Industry Defined & Current Conditions. Approximately 100,000 vessels powered by oil-fired engines move more than 11 million tons of goods and consume approximately 250 million tons of fuel each year.⁶⁵ Demand for shipping closely follows the world economy and was projected to grow by 3.4 percent per year through 2024⁶⁶ prior to the COVID-19 downturn in trade. Fuel is the second-largest operating cost after the crew.

3. Issue. Maritime shipping, whether by container ship, bulk cargo, or tanker, is easily the most carbon-efficient method of transporting cargo.⁶⁷ It is also, by far, the most cost-effective way to move en masse goods and raw materials around the world, leading to more than 90 percent of the world's trade being carried by sea.⁶⁸ As a result, deep water shipping is the sixth-largest source of greenhouse emissions on Earth,⁶⁹ despite its efficiency relative to other cargo transportation methods. It seeks to "go green" to improve its environmental stewardship, reduce fuel costs, and avoid prescriptive government regulations by taking innovative leaps forward without incurring excessive costs. U.S. shipping companies seek tax incentives to help defray costs for U.S. ships.

4. Background & Government Challenges. Models forecast carbon emission increasing 50 percent by 2050 and industry and government are in a struggle between profit and environment. The cost of the upgrades is prohibitive and has an often-lengthy payback period. Furthermore, the U.S. is a minor player in the global deep water shipping industry. For example, as of 2018, the U.S. held only a one percent market share in the global containerized shipping industry.⁷⁰ The U.S. deep water shipping industry's viability is directly tied to the Jones Act, which restricts shipments between U.S. ports to U.S. built, U.S. owned, and U.S. operated vessels. As a result, U.S. government efforts to increase regulation will only further decrease competitiveness of U.S. carriers, while having essentially no impact on global emissions. Currently, the government is not incentivizing shipping companies to do the work.

5. National Security Implications. Future regulations may cause financial hardships for shipping companies. The U.S. is limited on ships to support mobilization efforts. These ships must be modified at the proper low-risk time to ensure they are ready when necessary.

6. Recommendations:

- a. The U.S. government should incentivize start-up companies in off-port hull cleaning so that the hulls of ships can be cleaned without the added cost of dry-docking.
- b. The U.S. government should reduce or eliminate fuel taxes for companies that have ships being upgraded with solar or sail technology to help offset upgrade costs.

- c. U.S. government should work with the International Maritime Organization to require cargo shipping companies to reduce open ocean power output by 10 percent. This saves up to 4 tons of fuel per day, vastly decreasing the environmental impact in the industry.

7. Long-Term Outlook. Research and development are continuing around the globe, and more innovations are becoming available. As one of the largest world polluters, sea shipping needs to stay ahead of regulation, and the U.S. must help these companies overcome the significant economic barriers to making the upgrades.



Image 2. Aboard the Wallenius Wilhelmsen MV Tonsberg, February 7, 2020

C. Air Freight: Demand Exceeds Capacity

1. BLUF. The air freight industry fulfills a critical transportation need by facilitating the movement of goods worldwide. It allows for global reach capability at a fraction of the time it takes other modes to reach their final destinations and boasts a high accuracy of shipment tracking and time-definite delivery. One of the major issues it faces is low capacity compared to other transportation modes and other air carrier options for increasing it are dwindling.

2. Industry Defined & Current Condition. Air freight can be transported in dedicated freight planes or the belly of a passenger plane and typically falls into one of four main categories: 1) general freight; 2) large widebody freighter aircraft, crew, maintenance, and insurance services, also known as “wet-lease” providers; 3) international express; and, 4) low-cost carriers/long-haul. The industry is a high-value capability but is stifled by low volume, representing less than

one percent of global trade tonnage. However, that small percentage transports more than six trillion dollars of goods annually and represents 35 percent of global trade by value. In 2018, air freight in the U.S. grew eight percent, accounted for 14 percent of the global sector, and was valued at almost \$18B.

3. Issue. The major issue impacting the air freight industry is that increasing demand may exceed industry capacity. Declining Civil Reserve Air Fleet (CRAF) participation is further exacerbating this problem.

4. Background & Government Challenges. The airline industry has decreased significantly, resulting in fewer planes and capacity for air freight transport. Capacity limitations not only constrain civil operations, but that of simultaneous support to DoD mobilization. Approximately 50-80 percent of civil air freight travels on passenger planes so capacity could be further hampered if required to move large military equipment in the belly of an aircraft. Another consideration is the availability of airlines participating in the CRAF program and the lack of incentives for participation by smaller or newer airlines. Smaller airlines may not want to participate, or, feel they incapable due to smaller fleet sizes and/or limited capacity on their smaller-bodied aircraft.

5. National Security Implications. The air freight industry is an extremely valuable resource to national security. Select commercial aircraft from major U.S. airlines are contractually committed to augmenting the DoD airlift capability as part of the CRAF and it becomes available to augment military mobility use during three stages of activation; these range from minor regional crises response and humanitarian/disaster relief to major regional conflicts/war to multiple theaters of war and national mobilization. Utilizing the CRAF provides both a vital capability to the DoD and lowers costs of additional military cargo aircraft and associated personnel and maintenance. As of April 2019, there were 25 airlines and 433 aircraft enrolled in the CRAF program, highlighting the partnership between industry and the government, and how instrumental air freight is to both civilian and military operations. It is imperative that air freight is integrated into a national transportation and freight strategic plan, and that the plan is aligned to support the 2+3 of the NDS. This will allow the U.S. military to set and balance priorities, use this capability globally while promoting intermodal cooperation, and adding crucial access to capacity. It further prioritizes what is needed to “fight tonight” (air freight) vice what is needed to sustain a “deceive force” operation (multi-modal).

6. Recommendations.

Recommendation 1: The government should increase the utilization of the civilian fleet during peacetime through the CRAF contract – by having civilian airlines transport more military personnel and equipment instead of using a U.S. Air Force cargo aircraft and provide tax breaks and reduced fees in support of military mobilization.

Risk/Tradeoff: Since the DoD funds the CRAF program, the increased airlift utilization plans and associated budget requests would be orchestrated by AMC, and the USTRANSCOM working capital fund would pay out of its budget. Each military service, in turn, would be charged higher rates for transportation services. For tax breaks and credits, this would be offset by taxes and fees to other industries or from a slight increase to federal income tax.

Recommendation 2: Change incentives to attract more carriers to CRAF and expand invitation to joint CRAF to allies and partners. The current payment structure pays CRAF carriers pre-negotiated, static rates for services rendered. If the government were to pay market rates for these services, it would attract more carriers to participate. Additionally, opening CRAF membership to likeminded allies and partners will give the military access to additional capacity and allow the use of American based airlines global alliance networks.

Risk/Tradeoff: The U.S. government will pay more for the services and forecasting budgets to fund air carriers will be difficult. If international carriers are allowed to join, the U.S. runs a risk of them not being available when needed as they will be supporting their host nation.

7. Long-Term Outlook. The U.S. military is well postured to move air freight organically or by contract carrier. However, if the world economy continues to grow at its current pace, the demand for air freight will continue to be higher than the capacity can support. The U.S. military will need to continue balancing economic impacts and national security interests by right-sizing the members of the CRAF. The organic air freight capability the USAF possesses is not enough to sustain the force in a time of crisis. If right-sizing the members of the CRAF is done properly, access to air freight capacity will not be as challenging. By incentivizing carriers with market value prices for moving passengers and cargo, while providing tax incentives, promises to bring more aircraft to the CRAF. Further, making policy changes that will allow America's international partners to join the program will build depth and assure access to capacity. The U.S. military's ability to project lethal combat power at a time and place of its choosing is underpinned by the strategic airlift capability it possesses, both organically and through the CRAF program. America is the only nation on the planet that has this capability and it is a strategic imperative for the U.S. military. It would not be possible without the support of civil air carriers. This partnership with industry is critical and a healthy relationship is crucial to the national security of the United States.

D. Inland Waterways: Failing Infrastructure due to Insufficient Funding

1. BLUF. Comprised of over 12,000 navigable miles, U.S. inland waterways (ILWS) are an essential artery in the movement of bulk commodities from farms, mines, or factories to market. Unfortunately, decades of inconsistent and insufficient funding have resulted in an aging and unreliable system, with most locks and dams operating 20-30+ years (or more) beyond their expected 50-year service lives.

2. Industry Defined & Current Condition. The extensive ILWS is an economical and environmentally friendly transportation mode which offers competitive pricing advantages to multiple U.S. industries. Delivering more than 600 million tons of cargo valued at over \$300B, the system also supports more than half a million jobs and complements both the highway and rail system, providing a national multimodal freight transportation system.

3. Issue. Continuing the trend of inconsistent and insufficient funding increases the risk of delays and disruptions or a catastrophic infrastructure failure. Such a failure could harm the competitive advantage of U.S. industries by increasing the cost of transporting commodities, as well as result in damage to homes, cities, and possibly, to loss of life.

4. Background & Government Challenges. Despite funding from the Inland Waterways Trust Fund (sourced from fuel tax/user fees) a backlog of ILWS infrastructure and maintenance projects is sustained and substantial. As the ILWS does not garner much public attention, constituent focus and political will to support critical projects is unpredictable. Resource competition with higher visibility issues such as healthcare and taxes manifests as inconsistent appropriations for the Army Corps of Engineers (ACOE) to execute infrastructure projects; sometimes spanning decades from initial design to project completion.

5. National Security Implications. As a result of the Jones Act, the ILWS is largely protected from security concerns regarding foreign ownership and operation inside U.S. borders. However, the economic advantage industries such as agriculture, coal, and chemical manufacturers receive from the ILWS will be harmed by infrastructure failure. A catastrophic failure (either from age or severe weather events) could cause material harm to the economic security of affected areas.

6. Recommendation(s)

a. Recommendation 1: Increase diesel fuel taxes or institute an over-land freight tax to recognize the environmental benefit provided by the ILWS. This will also increase mode-agnostic DOT policies. Use the tax revenue to fund critical ILWS infrastructure projects.
Risk/Tradeoff: Increased taxes will have a ripple effect on the full intermodal transportation costs, possibly reducing or eliminating the U.S. competitive advantage in global markets.

b. Recommendation 2: Establish a national strategic infrastructure plan to prioritize projects that are most critical to U.S. economic health, public safety, and national security. Annual appropriations and other federal investments should reflect project prioritization.
Risk/Tradeoff: With a national intermodal strategic plan, ILWS will face strong competition for resources. As projects with lower prioritization may never receive federal funding, ILWS must ensure receipt of sustained and sufficient appropriations or risk negatively impacting state/local communities, jobs, and economies.

7. Long-Term Outlook. Without increased and consistent funding for ILWS infrastructure projects, at best, U.S. industries will lose their competitive pricing advantage. It is estimated that one critical failure in the Upper Mississippi River System alone could cost nearly \$1.6B in lost revenue and require 500,000 additional truckloads to transit goods to market. At worst, the failure to proactively stabilize vital systems could cost lives as well as livelihoods when rivers overrun their banks and dams fail.

E. Rail Industry: Vulnerabilities Due to Foreign Control of Rail Supply Chain

1. BLUF. Foreign investment into the supply chain of the U.S. passenger and freight rail infrastructure presents a national security risk. The government and Industry need to increase their scrutiny of the security, motives, and methods of foreign companies competing to control the U.S. Rail supply chain.

2. Industry Defined & Current Condition. In 2018, there were 4.7 billion passenger trips in U.S. rail cars covering over 32 billion passenger miles. Rail Freight provides over 40 percent of all ton-miles freight transportation in the U.S. Rail freight is the single largest by-ton mode of transportation and is critical to the sustainment of the U.S. economy.⁷¹

3. Issue. Chinese companies that are State-owned Enterprises (SoE) are an extension of the Chinese government. These companies continue to invest in U.S. commuter and transit railcars, as well as rail infrastructure technology, to obtain a competitive advantage and influence the global supply chain market. The exploitation of cyberspace vulnerabilities and reliance on rail supply chain parts could allow China to disrupt, monitor, or collect information on the U.S. transportation network infrastructure. This capability to control or influence information either through economic or militaristic means present a risk to our national security.

4. Background & Government Challenges.

- China Railway Rolling Stock Corporation (CRRC) is a Chinese SoE.
- The “Made in China 2025” initiative highlights the rail industry as one of its ten areas where China seeks to gain economic market control. The Government of China subsidizes the SoEs to gain market share.
- Since 2014, CRRC has won the U.S. \$2.6B in contracts to supply subway carriages to transit authorities in Boston, Chicago, Los Angeles, and Philadelphia.
- CRRC has regularly submitted bids that are 20 percent less than its competitors. In the case of the Boston metro contract in 2015, it underbid the rival Canadian Company, Bombardier, by more than 50 percent.⁷²
- The Chinese government and Industry have actively used espionage to gain market and security advantage. The U.S. gov't has highlighted concerns about potential backdoors into Chinese provided technology.

5. National Security Implications. CRRC manufactures commuter trains that contain Wi-Fi systems, automatic train control, automatic passenger counters, surveillance cameras, and internet-of-things technology that integrate information and communication technology infrastructure to transit authorities. The Chinese government is openly developing a system of “algorithmic surveillance” that uses advances in artificial intelligence and facial recognition technology to enable the Chinese Communist Party to monitor the movements and patterns of its citizens.⁷³ The integration of such technologies into the U.S. rail system by an SoE provides a China extensive capability to surveil U.S. citizens.

Freight railcars containing GPS and telematics monitor the contents and health of trains carrying sensitive cargo such as chemicals or military equipment. Access to this information would allow China to monitor or disrupt military logistical preparations, full-scale mobilization, or provide a competitive economic edge by utilizing freight data to identify market shortages.

6. Recommendations

a. Recommendation 1: Classify the railroad ecosystem network as a critical strategic national security asset.

Risk/Tradeoff: Resources will be required to enhance rail infrastructure, which may come out of DoD MILCON funding.

b. Recommendation 2: Enact legislation mandates to monitor the transportation supply chain network and limit foreign government competitors.

Risk/Tradeoff: Targeting companies can hinder awarding the best value contract and lead to stagnant in innovation.

7. Long-Term Outlook: Strengthening railroad infrastructure will improve safety, bolster reliability, support full-scale mobilization, and sustain a growing U.S. economy. A comprehensive national transportation network plan, that integrates the intermodal infrastructure, would provide a strategic capability.



Department of Transportation, January 22, 2020

F. Trucking Industry: Driver Shortage

1. BLUF. The U.S. Trucking Industry is vital to the economy, supply chains, and to the national security of the United States. This information paper will focus on the driver shortage which is the most critical issue within the industry.

2. Industry Defined & Current Condition.

a. The U.S. trucking industry has roots dating back to the early 20th Century. The motor transport industry has a history of supporting national defense and was heavily utilized during World War I and World War II. With the construction of the interstate highway system in 1957, the trucking industry really started to grow. The trucking industry now enabled manufacturers, distributors, and customers to decrease their reliance on railroad and still obtain direct delivery service.⁷⁴

b. There are four segments within the trucking industry, long-distance freight, long-distance specialized freight, local freight, and local specialized freight. The long-distance freight provides trucking between metropolitan areas and regions that may cross North American country borders.⁷⁵ The local freight provides trucking within a metropolitan area that may cross state lines, and trips are typically same-day/next day return.⁷⁶

c. Today, the trucking industry moves roughly 71.4 percent of the nation's freight by weight. The gross freight revenues from trucking are \$796.7B, representing 80.3 percent of the nation's freight bill in 2018.⁷⁷ The industry employs a labor force of 8.9 million employees, including 3.5 million professional drivers.

3. Issue. The major issue within the U.S. trucking industry is a shortage of qualified drivers. According to the American Transportation Association (ATA), the trucking industry's current driver shortage is over 60,800. If conditions do not change or drastically improve the trucking industry could be short just over 100,000 drivers in five years and 160,000 drivers by 2028.⁷⁸

4. Background & Government Challenges.

- The driver shortage within the trucking industry became more pronounced since 2005 due to an increase in the volume of freight and the industry required an additional 20,000 drivers. The shortage decreased during the great recession of 2008 due to less demand, however, the demand for drivers ramped again as the economy recovered in 2011.⁷⁹
- The primary factors contributing to the driver shortage are age, gender, lifestyle, and job alternatives.⁸⁰ According to surveys by ATA, the average driver age in the over-the-road truckload industry is 46.⁸¹
- Women make up 47 percent of all workers in the U.S., but only comprise 6.6 percent of truck drivers.⁸² This percentage has remained steady for the past 18 years.⁸³

- Another contributing factor is the trucking lifestyle. Many drivers are assigned to extended routes and are away from their families for a long period of time.
- The final contributing factor is the amount of alternative jobs available within the U.S. Since the 2008 recession, the U.S. economy has grown significantly, and firms have been able to hire a lot more people. The construction industry has also been strong. This provides a great alternative from being a truck driver, which does not require extensive travel and has much less responsibility.⁸⁴

5. National Security Implications. The national security of the United States and the ability of the Department of Defense (DoD) to quickly mobilize forces and project military power could be impacted due to commercial driver shortages. DoD is reliant upon commercial trucking companies to ensure equipment and supplies are transported daily to ports, bases, depots, and industrial base facilities to ensure the U.S. military has the readiness to respond to a mobilization, crisis, or natural disaster. Any disruption in the trucking industry would also cause economic disruptions within all sectors of the economy, which could put U.S. national security at risk.⁸⁵

6. Recommendations.

a. Recommendation 1: Pass the Drive Safe Act which directs the Department of Transportation (DoT) to promulgate regulations to implement an apprenticeship program for licensed commercial motor vehicle drivers under the age of 21.⁸⁶ This would allow CDL licensed drivers under 21 to operate in interstate commerce, they already can drive intrastate. **Risk/Tradeoff:** The risk would be that drivers under the age of 21 would have the ability to operate trucks across state lines. This is a risk that must be mitigated with proper training, technology, improved safety standards conducted through the DoT apprenticeship program.

b. Recommendation 2: Develop incentive programs to focus driver recruitment efforts towards the 18-25-year-old population. Recruitment efforts and outreach programs need to focus on high school students, community college students, and women. Incentive programs can be focused on bonuses, college education funds, college loan repayment, or free CDL licensing. Six percent of truck drivers are women and carriers have now started to focus on women recruitment but must be focused on issues that concern women such as safety, job flexibility, and female driving teams.

Risk/Tradeoff: The risk associated with this recommendation would mean that the commercial trucking industry would have to invest more money on incentive programs and outreach, but their efforts could drastically pay dividends in the future.

7. Long-Term Outlook. If conditions do not change, the trucking industry could be short just over 100,000 drivers in five years and 160,000 drivers by 2028.⁸⁷ This could negatively impact the U.S. economy, supply chains, DoDs ability to project military power, and ultimately U.S. national security.

G. Warehousing Industry: Lack of Infrastructure for Mobilization

1. BLUF. A need exists for the USG to develop a mobilization policy that includes the warehousing industry to ensure the defense industrial base has dedicated resources available to support the DoD during mobilization and contingency operations.

2. Industry Defined & Current Condition. Warehousing is the process to store goods for resale or distribution. Warehouses provide short and long-term storage solutions ideally located near strategic transportation nodes. Manufacturers, importers, exporters, wholesalers, and transportation businesses purchase or lease warehouse space to store raw materials, spare parts, and components used in manufacturing. The warehousing industry is also critical infrastructure needed to support the defense industrial base.

3. Issue. The commercial warehousing industry does not have dedicated infrastructure earmarked for DoD to support mobilization during a crisis or protracted conflict with a great power competitor.

4. Background & Government Challenges. During World War II, a long period of strategic warning enabled the mobilization of the industrial base. This is unlikely to occur in a future conflict with a great power competitor. Currently, foreign competition and investments from Asia and China exacerbate the current decline in the defense industrial base and the need for DoD warehouses to store materiel in support of contingency operations. Within the DoD, programs exist where commercial carriers dedicate air, sea, and rail capabilities and personnel to support DoD strategic mobility requirements during a time of crisis or contingency operation. Such programs do not exist in the warehousing industry to meet national security commitments to the USG or DoD.

Commercial warehousing is a thriving and profitable industry due in large part to e-commerce and the growing recognition of the value of supply chain management to increase business competitiveness. However, current, and future commercial capacities may not be readily available to support DoD requirements. Because DoD has failed to identify warehouse storage requirements to support mobilization, it is likely that the commercial warehousing industry cannot support without severely impacting their current business operations and the U.S. economy.

5. National Security Implications. In the 2017 National Security Strategy, President Trump stated, “a healthy defense industrial base is a critical element of U.S. power and the National Security Innovation Base.”⁸⁸ The warehousing industry is a vital segment of the industrial base that supports U.S. national security by stockpiling and prepositioning strategic stocks.

6. Recommendations:

a. Recommendation 1: Develop a strategic mobilization policy that includes the warehousing industry and aligns with the National Security Strategy, National Defense Strategy, and outlines DoD mobilization requirements.

Risk/Tradeoff: The commercial warehousing industry does not have the capacity to support DoD mobilization requirements. A trade-off could be dual use of existing commercial warehouses to

store both commercial and DoD material. DoD could also aggregate the amount and type of material forward positioned in warehouses to ensure it is efficiently providing a buffer against potential supply chain risks and demand surges needed to meet mission requirements.

b. Recommendation 2: Develop incentives for the warehousing industry to support DoD mobilization efforts (funding, tax breaks, etc.).

Risk/Tradeoff: Lack of funding if the DoD uses monetary incentives to acquire support from the industry.

7. Long-term outlook. If the USG, and specifically DoD do nothing to address this issue, there is a high risk that DoD will not be able to leverage the industry to augment its warehousing capacity and meet their requirements without impacting their commercial business. While the USG could ultimately force companies to secure or dedicate un-forecasted capacity for DoD requirements; likely, commercial companies will not be able to sustain commercial operations while supporting DoD's mobilization efforts. Maintaining commercial operations if possible, even in times of war, is critical to sustaining the U.S. economy, especially during a protracted conflict.



Amazon Fulfillment Center Baltimore, February 7, 2020

III. Mobilization Annex

How Global Agility Supports U.S. Mobilization

The Global Agility industries are vital to U.S. national security and facilitate the mobilization of the Joint Force to deter or defeat a great power competitor. Under the auspices of the U.S. Transportation Command (USTRANSCOM) and its subordinate commands, primarily the Air Mobility Command (AMC) and the Military Sealift Command (MSC), each industry plays a role in the movement or support of personnel and materiel.

Personnel and High-Value Goods

The air freight industry is vital to the movement of personnel and high-value goods as air freighters can move units and their most essential equipment quickly from home stations to forward operating locations and final destinations. In peacetime, the AMC operates a sizeable inventory of military transport aircraft that are supplemented by contracted aircraft, but during mobilization or wartime, the AMC aircraft are bolstered by civilian aircraft from the Civil Reserve Air Fleet (CRAF) which comprises 433 aircraft from 25 different carriers who have signed Charter Airlift Services contracts. Charter Airlift Services contracts are an agreement to make their aircraft available when needed in exchange for payments and preferential contract considerations when not required for use by the military. The CRAF can be activated in three different stages of incremental activation: Stage I —minor regional crises, Stage II —major theater war, and Stage III —periods of national mobilization. USTRANSCOM, with approval of the Secretary of Defense, is the activation authority for all three stages of CRAF.⁸⁹ Activating CRAF is not free, but for the annual payment of approximately \$1.5B, the U.S. has access to aircraft that otherwise costs \$15B to \$50B to purchase and maintain as a comparable fleet.⁹⁰

Military Equipment and Supplies

Military materiel not traveling overseas by air invariably goes by ship and very often travels through some, if not all, of the remaining Global Agility industries as it moves from its point of origin to its destination. Intermodal movement is especially common for containerized items that could be moved by barge, rail, or truck, either before or after an ocean voyage.

MSC, under the direction of USTRANSCOM, is responsible for providing ocean transportation for all military branches, as well as other government agencies, and has three different sources to provide this capability.

1. MSC owned vessels – Approximately 130 vessels that include tankers, dry cargo ships, hospital ships, special-mission ships, and others.
2. Ready Reserve Force (RRF) – 46 Roll-on/Roll-off cargo ships, crane ships, aviation repair vessels, and a tanker. These vessels, which are owned by the Maritime Administration (MARAD) and maintained by commercial ship managers, are expected to be ready for use within five or ten days.⁹¹

3. The U.S. flagged fleet of 60 deep water commercial ships available under MARAD's Maritime Security Program (MSP) or Voluntary Intermodal Sealift Agreement (VISA) programs. MSP provides a monetary incentive for carriers to maintain their U.S. designation and be available for war or national emergency⁹² and VISA provides peacetime contract preferences in exchange for their war or national emergency availability.⁹³

If additional capacity is still required after these resources are exhausted, MSC can also charter foreign-flagged vessels for use if necessary subject to policy limitations.

The U.S. Inland Waterways System (ILWS) consists of 12,000 navigable miles of inland waterways and is a valuable resource that contributes to the mobilization of cargo through strategic sealift. ILWS vessels provide a protected and secure means of transportation for cargo and raw materials to strategic ports within the U.S. and are a more efficient and economical alternative to rail or highway. As the ILWS is currently underutilized, it maintains the capacity to support increased transport during a surge or national mobilization, for bulk cargo such as petroleum, steel, etc. necessary to support war efforts and increased manufacturing of war materials. Additionally, MARAD's VISA program provides sealift capabilities, including tug and barge services, when government capabilities are not sufficient. All major U.S. flag carriers are enrolled in VISA and it constitutes more than 90 percent of the U.S. flag dry cargo fleet.⁹⁴ Additionally, an often-overlooked aspect of the ILWS is the Atlantic and Gulf Intracoastal Waterway (ICW), which runs approximately 3,000 miles along the Atlantic Ocean and the Gulf of Mexico. The ICW provides a protected alternative for transiting up the Eastern seaboard. It can be accessed by barge and smaller littoral vessels to provide supplies and relief efforts or transport other critical cargo during a hurricane when open-ocean transit is unsafe, or during a national security event when coastal seaports might be secured or restricted.

The railroad industry is an integral part of the U.S. mobilization and supports national security by transporting large and bulky military weapon systems for planned exercises and full-scale mobilization deployments. The U.S. freight rail system includes the Department of Defense (DoD) Strategic Rail and Connector Network (STRACNET), which consists of 38,800 miles of rail lines important to national defense and provides service to 193 defense installations whose mission requires rail service. STRACNET allows defense and civil rail planning to be more easily coordinated. STRACNET also allows for prioritization of restoration of rail service in the event of any emergency that causes large-scale loss of rail lines. The rail system offers an efficient movement of heavy equipment during both peacetime and mobilization. The military employs the use of 89-foot flat rail cars to carry multiple units of heavy equipment, such as armored tanks and vehicles. Rail transportation also minimizes coordination requirements across the shipment, from pick-up to delivery, and eliminates additional logistical considerations, like road congestion. It is for this very reason that Surface Deployment and Distribution Command Transportation Engineering Agency and the Department of Transportation, via the Federal Railroad Administration, review the rail lines within STRACNET to verify that track density does not decline by more than 10 million gross tons. Such declines lead to reduced maintenance investments, which affect the performance and reliability of rail transport. Not only is it essential to maintain the health of the railroads in STRACNET for military mobilization, but also to prepare for such an event, when and if it should occur. It is for that reason that "Army vehicles

moving by rail across the country is a normal part of training operations and equipment deliveries.”⁹⁵

Trucking is one asset that the U.S. has in abundance. It is more agile, efficient, and resilient, and it continues to grow all the time, becoming a comprehensive and robust asset for the nation to mobilize. The industry is poised to mobilize the land forces promptly and effectively in record time compared to the World War II era. The industry places the U.S. at a competitive advantage in delivering forces to the theater in time to make a difference over the adversary. Trucking sustains the U.S. Industrial Base, the military services, and ultimately the delivery of goods during mobilization, especially since many military bases, depots, ammo plants, and arsenals are in small towns around the U.S., and, in some cases, in very rural areas without access to rail or barge services. Every single day, truckloads of supplies, food, equipment, and repair parts are delivered to military bases and government agencies worldwide and USTRANSCOM, with very limited organic trucking capacity, relies very heavily upon the commercial industry to provide assets and assist with planning, coordinating, and executing all modes of transportation. Unlike other forms of strategic lift, the trucking industry also plays an important role in connecting transportation components and keeping units and supplies moving forward. Convoys of vehicles can move supplies to the limits of air, water, or rail transportation for embarkation or pick them up at debarkation points and move them directly to the area of employment as far forward as possible.

Infrastructure

Connecting the various modes of mobilization transportation are the infrastructure waypoints that provide holding and transshipment locations for the considerable quantities of materiel being moved throughout the U.S. and around the world. Warehouses can accumulate, hold, and modulate the flow of goods, while ports and harbors provide the equipment facilities to stitch transportation modes together. Neither accomplishes much on its own, but little moves through the system without them.

Military warehousing systems serve to optimize the flow of goods and services to combat forces in the field, at the right place, at the right time and the right cost. To accomplish this mission, DoD relies on both an organic and commercial defense industrial base. Having access to a robust private warehousing industry helps DoD in achieving its military sustainment goal by leveraging the industry’s capacity, expertise, standard, and technology innovations. Having a more extensive base also provides DoD with a diversity of options to choose from if extra warehousing capacity is required.

The ports and harbors industry plays a critical role in the DoD’s ability to deploy forces and equipment globally. Ninety percent of military cargo projected in war plans will move by sealift.⁹⁶ Ports and harbors are well-organized to support U.S. National Security requirements when the DoD must surge to project forces. Nevertheless, changes under compressed timeframes could limit ports and harbor’s capacity to handle military equipment while maintaining unit integrity. Furthermore, many ports and harbors are specialized in their facilities to support the rapid transshipment of containerized commodities, which does not consider unique military equipment freight mobilization.

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