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RIGHTING THE SHIP: POSITIONING THE U.S. MARITIME INDUSTRIAL BASE TO MOBILIZE IN THE 21ST CENTURY STRATEGIC COMPETITION

ES 6774: Industry Studies – Maritime Domain

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MARITIME DOMAIN INDUSTRY STUDY – SPRING 2022

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INDUSTRY STUDY OUTREACH AND FIELD STUDIES

Field Studies – Washington D.C., Maryland, Virginia – Local Travel

- Center for Naval Analyses, Arlington, VA
- Combined Joint Operations from the Sea Centre of Excellence, Norfolk, VA
- Congressional Research Service, Washington D.C.
- House Navy Office of Legislative Affairs, Washington D.C.
- National Surface Warfare Center (NSWC) Carderock, Bethesda, MD
- Navy Yard – Naval Museum, Washington D.C.
- Professional Staff Member (HASC), Washington D.C.
- SubCom LLC, Baltimore, MD
- U.S. Maritime Administration, Washington, D.C.
- U.S. Navy, Naval Research Laboratory, Washington D.C.
- U.S. Navy, Naval Sea Systems Command, PEO Submarines, Washington D.C.
- U.S. Navy, Naval Sea Systems Command, Program Manager for Constellation Class Frigate, Washington D.C.
- U.S. Navy, Vice Commander, 2nd Fleet, Norfolk, VA

Field Studies - Pennsylvania

- Cleveland-Cliffs, Coatesville, PA
- Philly Shipyard Inc, Philadelphia, PA
- Rhoads Industries, Inc. Philadelphia, PA

Field Studies – Great Lakes

- Fairbanks-Morse, Beloit, WI
- Fincantieri, Marinette, WI

Field Studies – Gulf Coast

- Austal, Mobile, AL
- Bollinger Marine Fabricators, Lockport, LA
- Edison Chouest Offshore Companies (ECO), Houma, LA
- Ingalls Shipbuilding, Pascagoula, MS
- Ocean Aero, Gulfport, MS
- Stennis Space Center, Kiln, MS
- Textron Systems, Sea Systems, New Orleans, LA
- University of Southern Mississippi, Marine Research Center, Gulfport, MS
- VT Halter Marine, Pascagoula, MS

Field Studies – New England

- General Dynamics Electric Boat, Groton, CT
- General Dynamics Electric Boat, Quonset Point, RI
- L3 Harris, Saint Fall River, MA
- Massachusetts Maritime Academy, Buzzards Bay, MA
- Teledyne, Woods Hole, MA
- ThayerMahan Inc., Groton, CT
- U.S. Navy, Naval Undersea Warfare Center, Newport, RI
- U.S. Navy, Submarine Force Museum, Groton, CT
- U.S. Navy, Undersea Warfare Development Center, Groton, CT
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Field Studies – Virtual

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EXECUTIVE SUMMARY

Since the turn of the twenty-first century, China's maritime interests (the People's Liberation Army Navy (PLAN), Chinese Coast Guard, and Maritime Militia) have rapidly accelerated on a path to challenge United States' naval supremacy. As a result, the United States is moving to modernize its Naval Service, defined collectively as the U.S. Navy, the U.S. Marine Corps, and the U.S. Coast Guard, into an integrated all-domain force that excels in Distributed Maritime Operations to maintain the advantage at sea and enforce foreign policy objectives.

What does success look like for a Maritime Nation? Mahan would argue it includes a robust, domestic Maritime Industrial Base (MIB), trade partners overseas, and merchant and military shipping, which he termed sea power.[1] This paper focuses on the unprecedented challenges and pressures facing the MIB that impede innovation and the country's ability to mobilize during a crisis. Unfortunately, the MIB has been in decline since the end of World War II, and its downturn has only accelerated since the early 1980s. Post-Cold War MIB consolidation has further reduced the number of private shipyards building ships and submarines, and decades of Base Realignment and Closure decisions have reduced the number of public shipyards capable of performing warship and submarine maintenance. As the risk of conflict with strategic competitors is higher than at any time since the end of the Cold War, the United States faces an important strategic question – Can the MIB mobilize during a time of crisis to defeat a near peer strategic competitor by transitioning from peacetime production to a wartime effort?

The Maritime Industry Study Seminar, comprised of 16 uniformed military officers, Department of Defense (DOD) civilians, interagency fellows, and international partners, spent the last five months visiting shipbuilders, material suppliers, research facilities, and educational institutions in New England, the Mid-Atlantic, the Gulf Coast, and the Midwest to frame the wicked problems facing the MIB. Additionally, the seminar examined published literature and met with different components of the U.S. Government, Department of Defense, U.S. Navy, and senior executives in the private sector. The seminar members' diverse backgrounds and experiences produced valuable insight and diverse ideas regarding the challenges facing the country's maritime interests and the MIB. These challenges include inconsistent shipbuilding demand signals to industry, a dwindling workforce of skilled laborers, supply chain fragility, and an uncompetitive domestic, commercial shipbuilding market. The seminar found no immediate, easy, or painless fixes to right the ship. These collective challenges will be difficult to overcome in the next decade without a whole-of-nation approach that builds on the strengths of our country and the power of innovation. Overall, the seminar determined that the current MIB lacks sufficient mobilization capacity to quickly meet the wartime requirements of a protracted war against a strategic competitor.

The seminar determined four lines of effort to solve the nation's MIB challenges incrementally. These proposed lines of effort include (1) resolving the skilled labor shortfall, (2) increasing ship affordability, (3) increasing commercial shipbuilding competitiveness, and (4) developing a coordinated MIB strategy with partners and allies. All four lines of effort interconnect and are essential to revitalizing the MIB so it can sustain United States naval supremacy and better mobilize in a time of crisis.

Alexis de Tocqueville noted in 1832 that Americans "are born to rule the seas…." In the final analysis, reaching our nation's minimum naval goals will demand substantial investment in refurbishing old yards and establishing new ones, and partnering more with trusted allies who want to invest in the U.S. shipbuilding base. More broadly, a renewed commitment to reinforcing America's place as the world's leading maritime nation will, as it always has, lead to jobs, workers with skills that will be useful to a variety of other domains …that loom large in America's future.

-Department of Defense's FY20 Industrial Capabilities Report[2]

INTRODUCTION

America's Defense Industrial Base (DIB) was a mainstay of peace and freedom for over half a century after World War II.[3] Today, however, the DIB faces mobilization challenges that require national focus over the coming decade. This report explores the challenges facing the maritime segment of the DIB and offers recommendations for improvements that will help better position the United States if it needs to mobilize within the next decade. For the purposes of this analysis, this report focuses on the shipbuilding industry aspect of the maritime industrial base and not the ship repair industry.

The maritime industrial base (MIB) cannot increase the production of U.S. Navy, U.S. Coast Guard, or merchant marine ships to fight a protracted conflict against China, the U.S.'s most consequential strategic competitor and pacing threat.[4] A wide variety of issues threaten the MIB, including unclear demand signals, an insufficient skilled labor workforce, supply chain fragility, and a lack of a competitive commercial shipbuilding market. These challenges will be extraordinarily difficult to overcome in the next five to ten years.

To frame the complex problem facing the MIB, the Maritime Industry group visited shipbuilders, suppliers, research organizations, and educational institutions. In addition, the group reviewed published literature and participated in discussions with different components of the U.S. Government and an array of private sector senior executives. Most importantly, the group's diverse background brought valuable perspectives to the discussion. In the end, the

group determined there is not a single solution to fix the complex challenges facing the MIB. However, the group identified several incremental changes to bolster nationwide skilled labor, commercial shipbuilding, military vessel affordability, and acceptance of building maritime capacity through alliances and partnerships that could help better position the United States if it must mobilize within the next decade.

BACKGROUND

Mobilization is the process of assembling and organizing national resources to support national objectives in time of war or other emergencies.[5] The United States is largely unpracticed at large-scale mobilization. Other than small-scale military mobilizations to fight stateless terrorist organizations after 9/11, the United States has not mobilized for a war against a near-peer competitor since World War II. During and leading up to World War II, the United States stimulated the defense industrial base to transition factories from peacetime industries into manufacturing plants for munitions and military equipment.[6] This approach yielded 5,171 ships of over 2,000 gross registered tons between 1939 and 1945.[7] This nationwide industrial mobilization effort equipped the United States and Allied forces with the weapons and equipment to defeat the Axis powers and win the war.

Over the subsequent seventy-five years, technology advanced exponentially, the character of war evolved, and domestic priorities shifted, which morphed the requirements needed for a major mobilization. The definition of mobilization remains the same, but the U.S. organic industrial capabilities are significantly different. Instead of the heavy-industry based economy that fueled mobilization during World War II, the United States now has a predominately service-based economy. This transition has crippled the U.S. defense industrial base's ability to supply "essential" goods during war or other emergencies. For example, the

personal protective equipment shortage during the COVID-19 pandemic demonstrated the damage to the U.S. that resulted from moving operations overseas for financial gains.[8] Many U.S. companies could not pivot quickly to meet national personal protective equipment and medical needs.

The U.S. is a maritime nation with a globally deployed Navy and Coast Guard to maintain free and open access to the world's oceans.[9] The security and prosperity of the seas result from the MIB's ability to build the future fleet while maintaining the current fleet of U.S. naval and commercial ships. Naval combatants and cargo ships will be required to transport military personnel, equipment, weapons, airpower, and long-range fires to our adversaries while defending the U.S.'s maritime sea lanes of communication. As such, mobilization of the MIB during a protracted war will be more important than ever before.

STRATEGIC ENVIRONMENT

The global political environment is causing a strategic competition between the United States, China, and Russia. The 2021 Interim National Security Strategic Guidance states:

> We must also contend with the reality that the distribution of power across the world is changing, creating new threats. China, in particular, has rapidly become more assertive. It is the only competitor potentially capable of combining its economic, diplomatic, military, and technological power to mount a sustained challenge to a stable and open international system. Russia remains determined to enhance its global influence and play a disruptive role on the world stage.[10]

In response to China's and Russia's increased assertiveness, one of the four priorities in the 2022 National Defense Strategy is "deterring aggression, while being prepared to prevail in conflict when necessary, prioritizing the PRC [People's Republic of China] challenge in the Indo-Pacific, then the Russa challenge in Europe."[11] As a maritime nation, the environment can be split into the Atlantic region for Russia and the Pacific region for China.

ATLANTIC ENVIRONMENT

Russia's unprovoked attack on Ukraine's sovereignty beginning with the February 20, 2022 invasion raises concerns about a broader war in Europe. President Putin's aggression and irrational behavior call for significant global concern because of Russia's considerable nuclear arsenal and military forces, including substantial naval capacity. However, the North Atlantic Treaty Organization (NATO) is a powerful and reliable defense alliance composed of European nations with strong militaries. The United States' vast economic, weapons, and equipment support to Ukraine is a testament of the goal to limit Russia's ability to disrupt peace and sovereignty in Europe and across the globe.

PACIFIC ENVIRONMENT

Across the vast Pacific Ocean, China is quietly modernizing and growing its Navy and military forces through leveraging its infrastructure, labor force, and economic power to produce ships faster than any other country. China's military modernization efforts aim to develop capabilities for militarily addressing the situation with Taiwan and to reinforce its nine-dashed line claim in the South China Sea.[12] With a larger and modernized naval force, China can effectively claim nearly all the South China Sea for its own economic exploitation while simultaneously threatening regional maritime sovereignty.

There is no NATO or specific defense alliance in the Indo-Pacific region. Japan, Taiwan, and South Korea all have strong navies, but China is superior in size. To successfully execute the DoD's priority of deterring Chinese aggression and prevailing in a conflict in the Indo-Pacific region, the United States needs to provide a presence and maintain an advantage at sea. Naval combatants and cargo ships are vital in projecting and delivering necessary power to the region.

A strong U.S. MIB is essential in building required naval combatants and commercial ships to promote national prosperity during peacetime and ensure maritime dominance in wartime.

HEALTH OF THE U.S. MARITIME INDUSTRIAL BASE

Unfortunately, the U.S. maritime industrial base is struggling, including military shipbuilders, commercial shipbuilders, and the merchant marine fleet. The U.S. maritime industry reached its pinnacle during World War II when a large demand created financial incentives for shipbuilders and merchant mariners to supply the required resources for war. After the Cold War and the collapse of the Soviet Union, the United States largely ignored its maritime industry without the need to mobilize toward a conventional world war. Protective government policy and financial mechanisms, such as Construction Differential Subsidies, are no longer in effect, and their removal marked a distinct downturn in shipbuilding capacity. These subsidies, before being eliminated by the Reagan Administration in the 1980s, allowed shipbuilders in the United States to cover the difference in cost between building ships in the United States versus less expensive foreign shipyards up to a maximum of 50 percent[13] Subsidies and the ability to capitalize on economies of scale represent the two largest factors between powerful shipbuilding nations and nations that are struggling to maintain shipbuilding relevance.

The Jones Act plays a crucial role in U.S. commercial shipbuilding policy by prohibiting the use of foreign-built vessels on routes between U.S. ports, protecting U.S. shipbuilders from foreign competition.[14] This cabotage requirement is propping up the U.S. commercial shipbuilding industry as it forces companies that trade between U.S. ports to build and register ships in the United States. The Jones Act supports U.S. commercial shipbuilders in constructing barges and transport vessels that operate within U.S. borders and energy companies who build ships to drill in the U.S. Exclusive Economic Zone (EEZ) and transport to U.S. ports. U.S.

commercial shipbuilding companies are heavily reliant on the oil and gas market to service all the domestic oil and gas resources in the EEZ.[15]

Unlike the commercial shipbuilding market, Naval shipbuilding dominates the U.S. shipbuilding market, with almost 80 percent of new construction dedicated to military vessels and the remainder 20 percent allocated towards the commercial sector.[16] Even with the declining U.S. shipbuilding industry, the U.S. Navy continues to field the most technologically advanced vessels globally, demonstrated by its formidable nuclear-powered aircraft carrier and submarine fleets.[17] However, the U.S. Government plays a critical role in the naval shipbuilding industry as the monopsonic ship buyer with recent budgeting constraints leading to industry consolidation, increased costs, and a lack of incentives for innovation. This has left the industry with several top-tier shipyards focused primarily on constructing large U.S. Navy and Coast Guard vessels that have recently produced vessels over cost, behind schedule, and in several cases, not meeting original contract requirements.[18] The U.S. naval and commercial shipbuilding industries have reached a perilous intersection and must consider innovative adjustments to remain relevant in a strategic competition.

MARITIME INDUSTRIAL COMPARATIVE ANALYSIS

How do global strategic competitors compare if the defense shipbuilding market dominates in the United States with the commercial shipbuilding market barely held together by the Jones Act? China and South Korea, a close ally of the U.S., maintain a robust maritime industry and represent the world's two largest shipbuilding nations in terms of shipyard capacity. Their strategic rise in shipbuilding is not tied to entrepreneurship alone but stems from various forms of government intervention, including subsidies, policy reforms that incentivize shipbuilding, capital growth, and labor policies that affect the domestic shipbuilding industry.

Using Porter's Diamond for competitive advantage, detailed in Appendix B, this section will analyze, compare, and contrast the health of U.S., Chinese, South Korean, and Russian maritime industries.

CHINA'S MARITIME INDUSTRIAL ANALYSIS

China has become the leading commercial maritime power globally and now dominates most sectors of the world's maritime industry utilizing robust government financing and subsidies resulting in the decline of much of the world's maritime industries.[19] Since the 1980s, China's commercial shipping and shipbuilding growth has been unprecedented. China currently owns and operates more than 5,000 merchant ships engaged in international trade compared to only about 80 U.S.-flagged vessels.[20,21] China is also the number one shipbuilder globally and over 40 percent of the world's commercial ships are now built in China.[22] As Christopher McMahon, in his piece *The Middle Kingdom Returns to Sea*, notes, "There is a strong prospect that within little more than a decade, or even sooner, China virtually will control the world's seagoing supply chain."[23] This is true, if China remains unopposed on its current trajectory.

Chinese government largely controls the strategic direction of its industrial base, which contrasts with the United States. China can best be described as a bureaucratic authoritarian state with a centralized government and decentralized execution.[24] While the state is an authoritarian regime, its economy is mainly market-driven but with centralized direction and control. This element of centralized planning facilitates a centralized strategic vision for both government functions and the national economy.

SOUTH KOREA'S MARITIME INDUSTRIAL ANALYSIS

As the world's largest shipbuilding nations, over the last decade China and South Korea have been locked in competition for the top spot in terms of global ship production by

commercial tonnage. Currently, South Korea represents the second highest producer of commercial vessels behind China, with 31 percent of global ship orders in 2020.[25] This growth in shipbuilding coincides with South Korea's rise as a technology hub and its industrial revolution over the past 20 years. Like China, Korea utilizes a mix of government tools to assist with its commercial shipbuilding ventures, such as a medium and long-term shipbuilding plan, large subsidies, and a state-owned bank that finances shipbuilders at reduced rates compared to the open market.[26]

While South Korea utilizes government-owned banks to finance its shipbuilding industry, only 8 percent of new builds were purchased domestically from Korean companies. This is in stark contrast to China, which builds, sells, and purchases the bulk of its vessels domestically. This influx of currency from foreign nations contributed to economic growth, whereas China's shipbuilding industry operates more like a Ponzi scheme. This economic growth in the shipbuilding industry allowed Korean government-owned banks to provide more funds for capital improvements in the form of research and development incentive programs and lower loan rates in comparison to the open market.[27] Additionally, government-owned banks, such as the Export-Import Bank of Korea (KEXIM), offer export loan guarantees to shipbuilders, allowing shipbuilders a promise to pay back loans for exported ships even if the price of the vessel falls below the cost of the loan.[28] These loan guarantees serve as a de facto subsidy to the shipbuilding industry and allow them to mitigate risk in an internationally competitive environment. Korea has extremely friendly financial vehicles to promote international trade, invest in capital improvements, and ensure high rates of employment.

RUSSIA'S MARITIME INDUSTRIAL ANALYSIS

Although Russia has a strong history of shipbuilding dating back to the early 20th Century, Russia's commercial shipbuilding industry, like most of Russia's industrial base, has declined since the collapse of the Soviet Union.[29] Since Vladimir Putin rose to power, attempts to reform Russia's industrial base have been relatively unsuccessful.[30] Commercial shipyards are plagued by long lead times and high production costs, lack clearly defined design and architectural shipbuilding plans, and suffer from limited modernization resulting in production imbalances.[31] Similar to the United States, naval shipbuilding dominates the Russian maritime industry and accounts for 80 percent of shipbuilding production.[32]

Also like the United States, the Russian commercial shipbuilding industry experiences limited demand in the international market. However, most firms are state-owned and operate under the same construct as the Chinese and South Korean shipbuilding industries.[33] Competition, innovation, and modernization are limited in Russia, even with recent government initiatives to revive the industry.[34] Similar to China and South Korea, the Russian government plays a significant role in the shipbuilding industry, including controlling most of the shipyards and purchasing the majority of the ships built in Russia.[35] Shipyards rely on government financing and subsidies to remain open, and the majority of new ship construction is delivered back to the state. Without significant changes to the Russian shipbuilding industry, it will continue its decline that began after the fall of the Soviet Union.

China and South Korea will remain dominant in the commercial shipbuilding industry for the foreseeable future based on robust government subsidies and financing. Russia will continue to decline as a maritime power and recent sanctions after its invasion of Ukraine will further impact Russia's ability to compete in a strategic competition with the U.S. The United States

will remain stagnant with its current commercial shipbuilding industrial base without significant changes to government policy, particularly the Jones Act. In order for the U.S. to remain the world's most sophisticated naval shipbuilder over the same period, it must revitalize the maritime industrial base.

CAN THE U.S. REVITALIZE THE MARITIME INDUSTRIAL BASE?

> America's Naval Service defends our Nation by preserving freedom of the seas, deterring aggression, and winning wars. For generations, we have underwritten security and prosperity and preserved the values our Nation holds dear. However, China's behavior and accelerated military growth place it on a trajectory that will challenge our ability to continue to do so. We are at an inflection point. Our integrated Navy, Marine Corps, and Coast Guard must maintain clear-eyed resolve to compete with, deter, and, if necessary, defeat our adversaries while we accelerate development of a modernized, integrated all-domain naval force for the future. Our actions in this decade will shape the maritime balance of power for the rest of this century.[36]

The preceding statement from the *Tri-Service Strategy, Advantage at Sea*, aligns with the group's analysis. The U.S.'s MIB is not developing at the same trajectory or operating at the same efficiency as China's MIB. In Whitehurst's book on the U.S. Shipbuilding Industry, naval dominance is predicated on a strong maritime industrial base. Whitehurst states, "…it is the responsibility of the government to ensure that there is a sufficient shipbuilding base on which to build in a war or a national emergency."[37] The 2021 IBISWorld Industry Report on Global Military Shipbuilding and Submarines also drives this point home, highlighting that maintaining a shipbuilding industrial base for both commercial and military ships ensures trade exports get to foreign markets and there is a means to replace merchant or naval fleets in a time of a national emergency.[38] The U.S. has the most complex and technologically advanced naval fleet in the world and a strong, yet inefficient and costly, defense MIB. However, the commercial MIB is stagnant. Can the MIB be revitalized to keep pace with China and develop the naval force of the

future to maintain an advantage at sea? Simply put, yes. A deliberate, iterative approach is the best way to invigorate the MIB.

The problem is extremely complex, with many identified challenges, as shown in Figure 1. There is no simple solution. The most significant observation is that all of these challenges overlap and affect each other. For example, demand fluctuations are impacted by difficulties in recruiting skilled labor and maintaining a viable supplier base. The labor shortage and sole source suppliers drive up costs, which consequently impacts demand. Each of these challenges has some degree of interconnectedness with the others and are characteristic wicked problems without easy or straight-forward solutions. Further, elements of the "Iron Triangle," the struggle between Congress, special interest groups, and government agencies are contributory factors to many of the challenges depicted in Figure 1. These relationships often choke the growth and sustainability of the shipbuilding industry,

Figure 1: Concept Map – Maritime Challenges

Following the review and analysis of the myriad of challenges facing the maritime industrial base, there are four lines of efforts, including policy recommendations and areas of focus, to help shepherd change. The recommended lines of effort include (1) Labor, (2) Affordability, (3) Commercial Shipbuilding Market, and (4) Partners and Allies. All four areas interconnect in different ways and are essential to the incremental revitalization of the MIB. What follows is a deeper look into these lines of effort and how they can propel change in the stagnant and troubled industry.

LINE OF EFFORT – LABOR

The labor force, often overlooked in capital-intensive industries such as shipbuilding, is an essential element of the industry's survival. Lee Iacocca, famous for successfully reviving Chrysler Corporation in the 1980s, once described his approach to business as, "In the end, all business operations can be reduced to three words: people, product, and profits. People come first."[39] The United States finds itself in a position where labor policies must be addressed for its shipbuilding industry to survive. In November 2019, the Ronald Reagan Institute issued a report on U.S. manufacturing competitiveness related to national security. The report describes the U.S. as being "confronted with significant dislocation in the workforce and an ever more complex strategic competition with the People's Republic of China…We must adapt to maintain our competitive edge."[40] The report prescribes a goal to "bring two million new or retrained workers into strategic manufacturing sectors by 2030 to address the critical skills gap in the current workforce, prepare for future manufacturing needs, and ensure a broad base of inclusive economic growth."[41] The United States must expand its investment in those sectors of the American workforce that play a role in national security. In 2019, a panel of shipyard officials and engineers at the American Society of Naval Engineers' annual Technology, Systems, and

Ship symposium reported that "the search for new shipyard workers must overcome the constant pressure for high school graduates to go to college, as well as the lack of experience in today's youth in the kinds of skills the industry needs."[42] U.S. Congressional members and political candidates have put forward policy recommendations for canceling student college debt, with Senator Bernie Sanders of Vermont proposing tuition-free college.[43,44] There is no doubt that the skyrocketing cost of college tuition is a problem in the United States. However, a bigger problem in national security is the labor shortfall that the Defense Industrial Base is experiencing and will continue to face with an aging workforce. An over-emphasis on four-year college degrees in the United States has contributed to the shortage of tradespeople to replace the aging industrial workforce. Proposals for cancelling college debt or tuition-free college should include, if not focus on, trade school. There is a technical skills gap in the U.S. workforce, specifically in the shipbuilding industry.

Senior leaders within the DoD recognize the impact of the skills gaps within the defense industrial base on national security. They also acknowledge that the department needs to spearhead training programs to address it. In taking steps to do that, the Office of the Secretary of Defense (OSD) announced an Industrial Base Analysis and Sustainment (IBAS) project in November 2021. This project aims to develop two- and four-year engineering and technical associate programs where industry and academia will collaborate to focus on electronics manufacturing, customizable to serve local industry needs. The OSD press release announces, "This prototype effort demonstrates an approach DoD can cost-effectively deploy to address the defense electronics industry's persistent skilled workforce gaps."[45] The project charges that local consensus is built on the most critical near-term electronics manufacturing staff needs. Post-secondary educational organizations then team with the industry to generate curricula to address

the requirements. Mr. Jesse Salazar, Deputy Assistant Secretary of Defense for Industrial Policy, exclaims, "The Electronics Manufacturing Technical Education pilot project can address a critical gap in the U.S. electronics supply chain and reduce dependence on foreign sources for sensitive electronic components."[46] The program created a model for the maritime industry to follow, which it did with the Pennsylvania Pipeline Project.

Managed under the IBAS program, the Pennsylvania Pipeline Project addresses a shipbuilding labor shortfall. Naval Sea Systems Command (NAVSEA) senior leadership is concerned about the shipbuilding industry's commitment to meet the Navy's requirement of constructing one Columbia-class nuclear-powered ballistic missile-carrying submarine (SSBN) and two Virginia-class nuclear-powered attack submarines (SSNs) per year.[47] For that reason, the Navy is keeping a close eye on all issues that could cause project delays. The labor shortage in critical industries has already been identified as a significant problem. The Pennsylvania Pipeline Project addresses the labor shortfall by aligning vital workforce and trade skill opportunities across the academic and shipbuilding communities. According to the program policy, the Philadelphia pilot aims to involve the region by "creating and sustaining a defense-focused workforce pipeline designed to meet the maritime demand signal and requirement for highly specialized trades now and in the future."[48] The Navy chose Philadelphia for the pilot because the public school system was an untapped resource for providing candidates. Additionally, the Navy's industry partners have significant footprints in Philadelphia: Philly Shipyard, Cleveland Cliffs Steel Mill, and Rhoads Industries, to name a few. If the program succeeds, the Navy intends to expand it across the state. [49]

The U.S. is facing a critical time for addressing labor in the defense MIB. As NAVSEA senior leadership phrased it, "We must use this opportunity to build on best practices for the

ways we recruit, train, and retain our current and future maritime trade workforce. Welders, machinists, fitters, electricians, and quality assurance technicians are as much a part of the Navy and Nation's critical readiness infrastructure as any facility or technology."[50] The viability of building the Columbia-class submarine, the Navy's next nuclear ballistic missile submarine, and the Constellation Class Frigate depends on solving the labor shortfall in the defense MIB.

LABOR POLICY RECOMMENDATIONS

Provide federal education grants to high school graduates to earn credentialed skills in high-demand trades.

While some companies have begun building out their talent pipelines, including partnerships between defense companies and technical and community colleges, a shortfall of these programs is that they are often local and not shared between regions or industries. Programs like the Pennsylvania Pipeline Project need to be expanded to strengthen shipbuilding and related industries. Recommend the U.S. Department of Education provide federal education grants to high school graduates to earn credentialed skills in high-demand trades. This program could further be extended to the college level to encourage workers to pursue STEM-related degrees. In exchange for tuition funding for a STEM-related degree, graduates would owe an employment commitment in the defense MIB industry. This would create an educational path for skilled workers as well as address the labor shortage being faced by the maritime industry.

Recommend Congress rewrite the country's immigration laws.

Recommend the U.S. increase the admissions target under each of the existing four immigration categories.[51] The current U.S. immigration system has a bias towards those who already have family in the U.S. While that emphasis has strengths, it is not formatted to meet the country's economic needs.[52] Canada and Australia have more economically responsive

immigration systems. They use a point system where prospective immigrants receive points for education, special skills, and the degree of English they speak (and French in Canada). Those with scores that meet a threshold are allowed to proceed to the border, are allowed entrance and immediately allowed to work.[53] Recommend addressing the wage grade worker shortage with a similar program. In addition, recommend the U.S. increase the number of skilled laborers allowed into the country annually under the Employment-Based Immigration program (EB-3) by adding the maritime industry as a line item. This program targets skilled workers and professionals. Thoughtful immigration reform addresses the labor shortfall by making American citizenship more accessible and more desirable for those with skills needed in the shipbuilding industry.

LINE OF EFFORT – AFFORDABILITY

The unaffordable spiral of Naval shipbuilding is a reality for the U.S. Navy. A 2018 Naval Shipbuilding GAO report summarizes continued cost and delay impacts:

> Challenges in meeting shipbuilding cost, schedule, and performance goals have resulted in a less capable and smaller fleet today than the Navy planned over 10 years ago. While the Navy is continuing to accept delivery of ships, it has received $24 billion more in funding than originally planned but has 50 fewer ships in its inventory today, as compared to the goals it first established in its 2007 long-range shipbuilding plan. Cost growth has contributed to the erosion of the Navy's buying power with ship costs exceeding estimates by over $11 billion during this time frame.[54]

Shipbuilding is not typical defense procurement, underscoring the importance of affordability initiatives. RAND's assessment "Are Ships Different? Policies and procedures for the Acquisition of Ship Programs" cites, "shipbuilding programs often have compressed early phases, contract awards that define program phases as well as the sequence of activities, relatively small total quantities, low annual production rates, a significant portion of the total quantity on contract before testing of the lead ship is complete, and a more significant role for the industrial base in influencing program structure and contract activity."[55] Additionally, the

study noted that industrial base considerations play a more critical role in shipbuilding than in other acquisition programs.[56] These unique factors put shipbuilding program offices in a league of their own and drives them to stretch each program dollar.

The Navy is already taking proactive steps with affordability initiatives by tailoring acquisition strategies to reduce technology development risk and increase design stability before construction. A prime example is the Constellation Class Frigate (FFG-62) program. During the Seapower and Projection Forces Hearing, when asked by Congressman Michael Gallagher (R-WI, 8th District) about committing to minimizing change to the existing hull and machinery on the proven hull design (The FFG-62 is based upon the "parent" design of the Italian-French FREMM (Fregata Europea Multi-Missione) frigate), the Honorable Jay Stefany said, "That is part of the acquisition strategy; minimize change, actually eliminate change if we can, and deliver ten ships in the contract."[57] In addition to using a parent-design approach, the FFG-62's acquisition strategy is to use systems and technologies that already exist or are already being developed for use in other programs. This strategy is an additional measure for reducing cost, schedule, and technical risk while building the FFG-62 program of record.[58]

Demand signal is also an important component to affordable naval shipbuilding. It tells industry what the Navy plans to buy, how much they expect to buy, and when they will want delivery. The two primary avenues for demand signal are the Navy's 30-year shipbuilding plan and individual ship contracts. However, the 30-year shipbuilding plan is notoriously out of date within months of its release due to strategic force laydown changes or resource challenges. Mr. Dave Heebner, the executive vice president of General Dynamics, in a hearing before Congress on 'Efforts to improve shipbuilding effectiveness' described impacts of lagging demand signals for government ship contracts: "…capital investment and facility improvements lead to cost

reductions. These investments are more justifiable when there is reasonable assurance of a sustained and predictable workload that supports the business case for return on invested capital."[59]

AFFORDABILITY POLICY RECOMMENDATIONS

Amend 10 USC § 231[60] from a 30-year shipbuilding plan to a five-year fixed National Shipbuilding Strategy and 15-year flexible plan.

The latest 30-year shipbuilding plan offers certainty for the next five years while outlining three alternative paths beyond that period. This is a deviation from past 30-year shipbuilding plans. This approach gives the Navy flexibility to develop and test technology and should mitigate potential future demand shocks when the plan is revised based on technology maturity and Distributed Maritime Operations concept refinement. Absent significant changed circumstances, the plan should stay static for the next five years, promulgated as the National Shipbuilding Strategy five-year plan, to give industry a clear near-term outlook to plan and a longer-term glimpse into how the Navy proposes to achieve desired force level goals.

Attach the 5-year portion of the National Shipbuilding Strategy to the annual Defense Appropriations Act.

The 30-year shipbuilding plan is obsolete once the Navy submits it to Congress because no resources are attached. The Navy submits the plan annually per law. Still, it is not binding as changes in administrations' National Security Strategies, the character of war, technology, and global adversaries alter the Navy's future force needs over the 30-year time horizon. As such, the plan's legitimacy is significantly diluted. Shifting to a fixed five-year plan and attaching it to the Defense Appropriations Act will legitimize the plan. It will allow the Navy stability and flexibility in acquisition strategies through block buy or multiyear procurement strategies to help

drive down ship procurement costs by an average of five to fifteen percent.[61] A resource-informed plan also provides a defined demand signal to the MIB to innovate and invest in infrastructure improvements to meet the Navy shipbuilding needs of the future.

Recommend Congress direct the Navy to use American Bureau of Shipping (ABS) standards on all non-combatant vessels absent a finding by the Joint Requirements Oversight Council that certain classes of non-combatants justify Navy survivability standards.

One way to lower the cost of Navy ship designs is more extensive use of commercial shipbuilding standards for non-combatant surface ships. A hull built to military survivability standards has more internal compartmentalization and armoring than a hull built to commercial ship standards, making it more expensive to build than a commercial-like hull.[62] In the 2009 hearing before the Seapower and Expeditionary Forces Subcommittee, titled 'Efforts to Improve Shipbuilding Effectiveness', Senator Stackley, the Assistant Secretary of the Navy, pointed to Vice Admiral McCoy, "who owns the technical authority and the specifications to identify ways that, within our specifications, we can enable the shipbuilders to design a more affordable ship."[63] However, the affordability from "within our specification" has not been realized. The long-established commercial standards bode well for cargo ships and tankers; perhaps there is an opportunity to apply those same standards to Naval support ships and realize some cost savings.

To encourage the Naval technical authority community to drive affordability "within the specification," recommend Congress enact language mandating the use of the American Bureau of Shipping (ABS) standards for non-combatants. The Coast Guard has used this model for over a decade.[64] However, the integrity of the Naval technical standards that make U.S. warships elite must not be compromised, so standards should be tailored (with a mix of commercial or military where appropriate) depending on the class of ship and the threat level it will operate.

Additionally, the Navy can leverage the third-party ABS surveyor to save the Navy on SUPSHIP onsite shipyard inspection, as the ABS surveyor could complete those inspections on the Navy's behalf. Finally, recommend the Navy and ABS expedite a process to evaluate 3D printed parts and update the corresponding standards and specifications to facilitate their use across the fleet.

LINE OF EFFORT – COMMERCIAL SHIPBUILDING MARKET

The stark reality of the domestic commercial shipbuilding industry is that high labor costs combined with strict industrial build standards lead to higher ship costs than foreign countries that heavily subsidize their commercial shipbuilding markets. As a result, the United States cannot compete with countries like China, South Korea, or Japan, nor should it attempt to compete. Instead, the United States should try to revitalize a segment of the commercial market to build the capacity to hedge over-reliance on foreign markets. This would be especially important during a time of war. A limited approach to rebuilding the commercial market would enable potential market entrants to build dual commercial and military use facilities. Additionally, this would facilitate a focus on partially rebuilding a limited domestic merchant marine fleet. Without this effort the United States would be relegated to relying upon outdated domestic built vessels for merchant marine activities or dependence upon partners for commercial transport who may be within the weapons engagement zone of a foreign adversary.

Applying Industrial Policy is another approach to revitalizing the commercial shipbuilding market. Industrial Policy focuses more on capital allocation and labor practices vice more well-known applications such as demand-side or supply-side economics.[65] This is an area where the United States should focus its efforts and revitalize the Maritime Administration (MARAD) with people and financial instruments as its means. To grow shipbuilding capacity and revitalize the industry, the United States should emulate similar functions from China and

Korea; specifically investing in shipbuilding and large vessel maintenance companies via state-owned enterprises or government-sponsored banking institutions. Additionally, it is recommended that the United States reconsider the Jones Act and amend it to permit foreign-built vessels. Finally, the United States should consider a tax incentive plan that benefits the labor force and financially incentivizes capital improvements for the maritime industry.

COMMERCIAL SHIPBUILDING POLICY RECOMMENDATIONS

Reform and potentially repeal the Jones Act

Based on staunch opposition in Congress, reforming the Jones Act will be a difficult but necessary endeavor. The current state of U.S. commercial shipbuilding and the domestic build requirement of the Jones Act has, as Colin Grabow from the CATO Institute notes, "utterly failed to produce either a sizable or competitive commercial shipbuilding industry."[66] The domestic built requirement of the Jones Act should be repealed. In many cases, Jones Act shipbuilders are already utilizing creative solutions to circumvent the Act. The recently delivered Jones Act ship Matsonia features imported anchors, boilers, cranes, elevators, generators, engines, and propellers.[67] The ship was designed by a South Korean company using technology developed by German and Dutch shipbuilders. Although the ship was assembled in the United States, much of the value-added labor occurred overseas.[68] Repealing the domestic build requirement of the Jones Act would allow U.S. shipbuilders to utilize international suppliers to reduce costs and make U.S.-produced commercial ships more competitive in the international market. This would lead to greater competition in the U.S. domestic market, increase the industrial shipbuilding base, and add additional jobs through the expansion of the sector.

Recommend providing favorable loans to maritime commercial companies via State-Owned Enterprise (SOE)

The concept of SOE may appear to be exclusive to authoritarian regimes such as China or even Russia with their majority ownership of the United Shipping Corporation.[69] However, SOEs are common practice in multiple democratic nations, including Korea and the United States. The United States aims to provide stability and liquidity in the housing market with SOEs created by Congress, Fannie Mae, and Freddie Mac.[70] The federal government fully or partially owns select critical infrastructure sectors and financing institutions in the United States, including the Farm Credit Bank, the National Fish and Wildlife Foundation, the National Park Foundation, and the Federal Deposit Insurance Corporation.[71] These institutions serve as safeguards to critical infrastructure within the nation and provide financial safeguards to critical institutions. The United States would be best served to create a financial institution similar to Korea that provides favorable loans and financial guarantees to shipbuilders and ship maintenance services. MARAD currently provides similar services, but the amount of money it provides is small compared to the industry size. While this does not guarantee shipbuilder profitability, a government-sponsored enterprise under MARAD would provide financial mechanisms that would provide affordable financing in an industry with small profit margins.

Providing government-backed loans lowers the barriers to entry by reducing the financial risk to potential entrants. Similar to South Korea, a government-owned maritime lender could offer discounted loans at the federal funds rate. A lower interest rate would enable shipbuilders to better compete in the international market via a lower pricing strategy. A state-owned bank that offers financial risk deferment options for prospective shipbuilders would represent a

powerful mechanism for prospective market entrants. While risk is one component of the equation in the shipbuilding market, another factor to consider is the cost of capital and labor.

Recommend establishing tax incentive plans for labor and capital improvements

The United States has higher labor rates when compared to many countries, including China. Additionally, the great resignation, or the exodus of people from the workforce during the COVID-19 pandemic, is forcing shipbuilders to compensate skilled labor with large salaries. Salaries are only part of the labor cost; health insurance, social security, and Medicare all which are paid for by the hiring agent. A potential mechanism for reducing costs and incentivizing employees to join the maritime industry is a tax exemption for the maritime industry. This could be done in various ways, including income tax exemptions, social security tax exemptions, or Medicare tax exemptions. These exemptions would target both the employer and the employee, attracting skilled laborers to the maritime labor market and reducing labor costs in an industry with high wages. Firms could then reinvest these savings in capital improvements that are badly needed in the aging infrastructure of shipyards. This exemption is similar to a strategy used in Korea and Japan that offsets income taxes for seafarers.[72] While this is not a direct subsidy to the shipbuilding industry, it serves the same purpose in terms of financial incentives to enter the market without the stigma of a subsidy label. Another mechanism to address the high labor costs and upgrade shipbuilding infrastructure is to provide financial incentives to innovate and automate parts of the construction process.

LINE OF EFFORT – BUILD MARITIME CAPACITY THROUGH ALLIANCES AND PARTNERS

The United States MIB does not have the private shipyard capacity to increase the size of the fleet or the public shipyard capacity to maintain its current fleet. As previously discussed, the United States MIB is struggling to recruit and retain younger workers after decades of American

society's emphasis on attending college instead of professional trade schools. The COVID-19 pandemic also revealed widespread international supply chain and resourcing vulnerabilities that directly impact the MIB. Although the United States has not been a global shipbuilding powerhouse since World War II,[73] decades of underinvestment in the MIB has resulted in an inability to surge or mobilize in a time of crisis.

In his *Interim National Security Strategic Guidance*, President Biden stated that the United States "will reinvigorate and modernize [its] alliances and partnerships."[74] Strategic and fully aligned alliances and partnerships can be key to restoring maritime capabilities. However, today's international naval partnerships are piecemeal. For example:

- The United States shares submarine-launched ballistic missile and cruise missile technology with the United Kingdom (U.K.) and submarine-launched torpedo technology with Australia, but the U.K. is not privy to torpedo technology while Australia is not privy to missile technology.
- There are U.S. warship designs that are based on foreign ships, such as the future *Constellation*-class frigate that is based on the Italian-French *Fregata Europea Multi-Missione*.[75]
- The U.S. Navy has awarded prime contracts for the construction of warships to subsidiaries of foreign companies, such as awarding the *Constellation*-class frigate contract to Italian Fincantieri S.p.A's American subsidiary Fincantieri Marine Group.[76]
- The recently signed AUKUS trilateral security pact between Australia, the U.K., and the United States lays the groundwork for increasing integration of submarine industrial bases, supply chains, interoperability, and commonality.[77]

A coordinated strategy across the entire spectrum of ship and submarine design, construction, and maintenance is required to reinvigorate and modernize alliances and partnerships that increase maritime capacity. This is a challenging proposition, but it is achievable. As discussed above, the United States has already based warship designs on allied platforms, shared weapons with allies, and awarded naval shipbuilding contracts to subsidiaries of allied nation companies. Each of these individual efforts should be integrated to enable the joint design, construction, and maintenance of naval vessels. To do so the United States must

rescind or amend the following three laws – repeal the prohibition on the construction of naval vessels in foreign shipyards (10 U.S.C. § 8679), revise the restrictions on the overhaul and repair of naval vessels in foreign shipyards (10 U.S.C. § 8680), and streamline the Arms Export Control Act of 1976 (22 U.S.C. §2751 et. seq.).

PARTNERS AND ALLIES POLICY RECOMMENDATIONS

Recommend repeal of 10 U.S.C. § 8679 Prohibitions on Construction of Naval Vessels in Foreign Shipyards

10 U.S.C. § 8679 states that "no vessel to be constructed for any of the armed forces, and no major component of the hull or superstructure of any such vessel, may be constructed in a foreign shipyard" unless waived by the President for national security reasons.[78] The United States already allows the use of foreign designs to be used for U.S. warships, and it already allows subsidiaries of foreign companies to build U.S. warships on U.S. soil. Recommend Congress repeal this law to allow foreign shipyards to construct U.S. warships on their own soil and coordinate with the U.S. Department of State to negotiate security agreements.

Recommend revising 10 U.S.C. § 8680 Restrictions on Repair of Naval Vessels in Foreign Shipyards

10 U.S.C. § 8680 states that any "naval vessel the homeport of which is in the United States or Guam may not be overhauled, repaired, or maintained in a shipyard outside the United States or Guam."[79] Although there are numerous exceptions, this law overly constrains options available to the U.S. Navy. During peacetime, allowing foreign shipyards to conduct maintenance and repair on U.S. warships could prevent the need for private U.S. shipyards to provide a surge capacity for public shipyard maintenance backlogs. This would maintain private shipyard focus on building new ships and submarines instead of maintenance and overhaul.

During wartime, the partner nations' shipyards and workers would already be familiar with U.S. warships to enable more efficient battle damage repairs. Congress should revise this law, and the U.S. Department of State should negotiate security agreements that enable foreign workers in foreign shipyards to perform maintenance and repairs on U.S. naval vessels.

Recommend streamlining the Arms Export Control Act of 1976

In addition to enabling additional AUKUS-style partnerships, the U.S. MIB could benefit from the United States streamlining the process for Foreign Military Sales and Direct Commercial Sales. Current complicated and lengthy procedures may push allies and partners to buy ships from other countries and sometimes from U.S. adversaries. If allies and partners were able to purchase U.S. warships more efficiently, it could contribute to the sustainment of the U.S. MIB. Additionally, it could help the United States and its allies reduce reliance on potential adversaries. Congress should revise 22 U.S.C. §2751 et. seq. and streamline the Arms Export Control Act of 1976.

CONCLUSION

Today, the MIB is unable to mobilize in a time of crisis. From suppliers to shipyards, it does not have the capacity to increase the production of military or commercial ships to the rate that would be required to win a protracted war against a strategic competitor such as China. After conducting in-depth studies across the MIB, investigating external analyses, and applying industry-level economic models, the seminar determined that several federal policy choices fail to promote a healthy and robust MIB. These policy choices negatively impact warship affordability, commercial shipbuilding resilience, and the nation's ability to effectively leverage the maritime resources of allies and partners. Key macroeconomic factors further challenge the MIB, such as the nationwide shortage of skilled workers. Improving MIB strength and resiliency

requires modernizing or eliminating harmful underlying policies and a whole-of-nation approach to recruit, train, and retain skilled workers. This will require coordination and cooperation across the Iron Triangle. Congress, the Department of Defense, and industry partners must collaborate to tackle these challenges to increase MIB health and resiliency to promote national prosperity during peacetime and ensure maritime dominance in wartime.

APPENDIX A – MARITIME INDUSTRY SUPPORT TO UKRAINE

Russia's unprovoked and unjustified invasion of Ukraine was an attack on the established international order. Sovereign, freedom-loving nations should feel obligated to support the Ukrainian people in challenging Russian aggression, its unwarranted military advances into Ukraine, and its presumed aspirations for further action in the region. While Ukraine's cause is just, complex geopolitical implications significantly complicate the level of support nations may be willing to provide directly or indirectly to Ukraine. Since Ukraine is not a member of the North Atlantic Treaty Organization (NATO), nations of the alliance are not required to defend Ukraine through financial, military, or humanitarian support. Similarly, Ukraine is not a member of the European Union (EU) and its collective support agreements. Despite the EU's foundational values of human dignity, freedom, democracy, equality, the rule of law, and human rights to promote peace and the well-being of its citizens,[80] the EU is not required to defend Ukraine.

As a prominent member of NATO, the United States has maintained a significant military footprint in Europe to prevent another World War and protect NATO nations from Russian ambitions and aggressions. With the largest economy and military in the world, the United States should work closely with its allies in Europe to collectively lead regional security assistance, including humanitarian aid, military assistance, and eventually rebuilding efforts in Ukraine.

Ukraine is a maritime nation that borders the Black Sea, with approximately half of its coast along the Sea of Azov (Figure A-1). When Russia annexed Crimea in 2014, it also took control of the Kerch Strait (spelled Kirch Strait in Figure A-1) that connects the Sea of Azov to the Black Sea. Russia's actions nearly decimated Ukraine's maritime resources and significantly decreased the competitiveness of its maritime industry. Crimea housed almost 75 percent of

Ukraine's naval personnel and critical naval services like signals intelligence, training, administration, maintenance, and logistics infrastructure.[81] Russia's control over the Kerch Strait significantly limits Ukraine's access to its coastal cities along the Sea of Azov in the Black Sea. The Sea of Azov has historically been vital to Ukraine's economic well-being and military strength. Additionally, Ukraine has historically maintained a healthy shipbuilding industry. In fact, many of the Soviet Union's capital ships were built in Ukraine including the Russia Navy's flagship, the Moskva, which sank during the conflict when it was hit by Ukrainian antiship missiles.

Along this coastline lies Mariupol, Ukraine's tenth largest city and one of the country's leading trade ports.[82] Since the fall of the Soviet Union, the Sea of Azov has been shared territorial waters between Russia and Ukraine as connected through the Kerch Strait. However, the earlier conflict in Crimea and Russia's latest war of aggression have limited Ukraine's ability to freely transit through the Strait as Russia maintains a beachhead on both landmasses. As it stands now, Ukrainian vessels in the Sea of Azov are effectively trapped until the conflict ends. Against this backdrop, Ukraine scuttled its own flagship, the Hetman Sahaidachny, a 3,500-ton Krivak III-class frigate, to keep it from falling into Russian hands.[83] Despite fierce resistance, as of May 18, 2022, Mariupol is under Russian control as Ukraine's last fighters surrendered.[84] Russia's seizure of Mariupol is a significant blow to Ukraine's economy and maritime presence in the Sea of Azov. As a result, Russia maintains an obvious advantage over Ukraine at sea through its strong naval presence in the Black Sea and by controlling Ukraine's sea lines of communication for trade and maritime defense.

Figure A-1: Source Black Sea Political Map (ontheworldmap.com)

As alluded to previously, maritime options for the United States and its allies to assist Ukraine are extremely limited based on historical considerations and complexities of geopolitics that constrain maritime access to the Black Sea. Under the 1936 Montreux Convention Regarding the Regime of the Straits, Turkey maintains control over warships entering the Black Sea through the Turkish Straits during hostilities.[85] Ironically, Russia had planned to seize the Straits in 1917; however, domestic conflicts in Petrograd diverted its attention.[86] In 1945-1946, the Soviets again pressured Turkey to abandon sole control of the Straits by revising the Montreux Convention so that the Soviets could maintain a permanent military presence in the Black Sea by jointly controlling access to the Straits.[87] Hence, Russia has long cited the

importance of controlling the greater Black Sea region as a key to its survival. This constant pressure by the Soviets was a key reason for Turkey finally joining NATO in 1952.[88]

While maritime options are limited, the United States and its allies have two viable options to assist Ukraine in its quest to survive as an independent nation. First, the United States could expedite the transfer of Excess Defense Articles (EDA) to Ukraine, including decommissioned U.S. Navy or U.S. Coast Guard ships, and encourage its allies to do the same. Second, the United States and its allies could push to increase port infrastructure throughout Europe to degrade Russia's economy further and reduce its stranglehold over the European energy sector. Building additional liquid natural gas (LNG) terminals in Europe and specialized LNG vessels are ideal solutions for increasing European energy independence from Russia. These efforts effectively weaken Russia's ability to pressure Ukraine and others in the region.

Providing ships through the EDA is a proven solution to quickly offer maritime assets to the Ukrainians. Before the invasion, the United States transferred several former U.S. Coast Guard Island-class 110-foot patrol boats to Ukraine through the EDA program. United States Foreign Military Funds and Ukrainian investment were used to refurbish the patrol boats before delivering them to Ukraine.[89] Unfortunately, during the current conflict, Russians sank one of these former U.S. Coast Guard patrol boats with a missile.[90] The United States can expedite the replacement of that sunk patrol boat and provide additional vessels by providing EDA. The U.S. Coast Guard is currently replacing its Island-class 110-foot patrol boats stationed in Bahrain with Sentinel-class 154-foot Fast Response Cutters (FRC). Thus, recently decommissioned 110-foot patrol boats in Bahrain are readily available to be transferred to Ukraine to reinforce its naval presence. As a bonus, Ukrainian naval personnel are already experienced in operating and maintaining those patrol boats, so that further training would be minimal. Any repair or

necessary upgrades could be conducted in a shipyard in Bahrain before transferring them to Ukraine. The U.S. Fifth Fleet could also escort the patrol boats in international waters from Bahrain through the Mediterranean to Istanbul. Based upon Turkish consent, NATO Maritime Forces could escort the patrol boats to appropriate ports in Ukraine to increase its coastal defense against Russian maritime attacks.

Surplus Oliver Hazard Perry-class frigates and Ticonderoga-class guided-missile cruisers are also possible EDA options to transfer to Ukraine. However, as Ukraine has no previous experience with these classes of ships, it would take considerable training to enable the Ukrainian Navy to operate them effectively during an active conflict. Also, the vessels would need to be restored to be safe to operate, which requires precious time and funding. Given the current flow of events in Ukraine, it is unlikely that Ukraine could bring these ships to the fight during the fast-moving conflict. Consequently, it is best to provide Ukraine with familiar vessels like the former U.S. Coast Guard Island-class 110-foot patrol boats that could immediately be put into service.

Russia's economy depends on exporting oil and natural gas to Europe and Asia. Stiff sanctions are already negatively impacting Russia's ability to export oil and natural gas to European and other allied nations. Consequently, significant reductions in oil exports from Russia due to sanctions and Europe's high energy demands have caused oil prices to rise rapidly. The United States could focus maritime industry investments on developing domestic LNG port infrastructure and building LNG ships to increase the exportation of LNG to European nations. These efforts would help drive global oil prices lower, negatively impacting Russia's economy and further isolating them from the world economy. According to the Federal Energy Regulatory Commission (FERC), the United States currently has seven existing LNG export terminals in

operation, three terminal locations approved by FERC and under construction, and 12 additional locations approved by FERC for future construction.[91] Shifting resources to expedite construction of these three terminals and starting the other 12 locations would drastically increase global supply while driving down prices and further punishing Russia for its aggression.

Unfortunately, building additional LNG ships is not a quick solution, especially if such shipbuilding occurs in the United States. Reprioritizing a portion of the $17 billion allocated under the Bipartisan Infrastructure Law (BIL) for maritime port infrastructure improvements and waterways could help expedite the completion of those three LNG terminals and fast-track construction of additional LNG ports.[92] However, these actions also must compete with other national priorities. For instance, the Biden Administration has also committed to cutting United States greenhouse emissions in half by the end of the decade to achieve net-zero emissions by 2050.[93] Hence, national politics may influence the reallocation of resources for developing further LNG assets. If the United States desires to impact Russia's wealth and influence over Europeans and the region, recommend the President and Congress increase domestic LNG production and encourage other allies to do the same. Increasing LNG exports to Europe will economically cripple Russia and hamper its ability to sustain hostilities against Ukraine or other future quests of aggression.

Besides the options of assisting Ukraine, the United States should also consider the effects of Russian aggression on national maritime actions. As both Russia and Ukraine are significant steel exporters (each is in the top ten globally), steel users should expect sudden price increases due to significant changes on the supply side.[94] Besides elevating prices, supply chain challenges may also increase during the short term. The worldwide shipbuilding industry will also feel those effects as supplies shrink and costs correspondingly increase. Another possible

effect of the current conflict is the changing character of modern maritime warfare. By destroying several Russian warships, Ukraine has proven naval ships are vulnerable to attack and difficult to protect even against a relatively weak adversary with limited maritime assets.

Unfortunately, any security assistance to Ukraine is not without risks. Russian President Vladimir Putin feels NATO's actions directly target his country. Thus, talk of Ukraine joining NATO was the last straw from Putin's point of view, necessitating the devastating invasion of Ukraine. Putin believes the United States is directly impeding Russia's national growth through imposed sanctions, forward basing its troops and military equipment throughout Europe, and strongly supporting Ukraine and other eastern European nations interested in joining the NATO alliance. As such, security assistance from the United States and its allies needs to be calculated, essentially balancing risks with desired effects. Of course, equipping the Ukrainian military to defend its homeland is a much lower risk than directly providing United States boots on the ground in Ukraine. Having NATO or a United States-supported no-fly zones around Ukraine or providing troops could quickly escalate tensions and would likely dilute the will of NATO member nations, given the alliance's defensive-only posture of member nations. If the United States or NATO directly defend non-NATO nations, it will disincentivize current or potential NATO members from allocating funding for their national defense. Freeloading is not a lasting strategy for confronting and challenging future Russian ambitions. There is also a real risk that the conflict with Russia could trend hot uncontrollably, with Putin feeling compelled to utilize nuclear weapons to enforce his will. The dangers of directly engaging Russian forces are a serious challenge for the United States and its NATO allies.

Defense of sovereignty is the fundamental basis for the United States, NATO, the EU, and surrounding European nations to provide Ukraine humanitarian aid and security assistance.

This moment is of tremendous consequence to the future stability of the international order and the inviolability of sovereign borders. If Ukraine fails in its efforts, it simply encourages Russia and other nations to aggressively inflict their will on others without needing to fear the full repercussions of their actions. Fortunately, in the fight for freedom, the United States and its allies have channeled vast resources and facilitated vital security assistance to help Ukraine maintain its sovereignty. The United States and its allies should continue to judiciously equip Ukraine while also strengthening NATO's defensive posture to enhance NATO protection against potential future attacks by Russia. Although there are limited options for the maritime industrial base to directly assist Ukraine during this crisis, the United States and its allies could provide excess defense articles to strengthen Ukraine's Navy and leverage expanded LNG production to indirectly reduce Russia's national wealth and its ability to export oil and gas to Europe.

APPENDIX B – PORTER'S DIAMOND

In 1990, Harvard Business School Professor Michael Porter published the book "The Competitive Advantage of Nations," creating a diamond-shaped framework to explain how nations can support or impair the international competitiveness of different industries. As Porter states, "A nation's competitiveness depends on the capacity of its industry to innovate and upgrade".[95] This is especially true for the commercial shipbuilding industry; for a nation to be competitive in the global market, it needs to be healthy across the four quadrants and two components of government and chance. There are significant differences between strategic competitors that are critical to analyze to determine the health of a nation's maritime industry.

Firm Strategy, Structure, and Rivalry capture the conditions in the nation governing how companies are created, organized, and managed, as well as the nature of domestic rivalry.[96] *Demand Conditions* include the nature of home-market demand for the industry's product or service.[97] *Related and Supporting Industries* capture the presence or absence in the nation of supplier industries and other related industries that are internationally competitive.[98] *Factor Conditions* are the nation's position in factors of production, such as skilled labor or infrastructure, necessary to compete in a given industry.[99] The *Government* component includes how the government encourages companies to higher levels of competitiveness while *Chance* refers to external and random events leading to advantages and disadvantages to industries.[100] For the purpose of this paper, each of these components was evaluated for the United States., Russia, South Korea, and China as shown in figures B-1 through B-4.

PORTER'S DIAMOND (UNITED STATES)

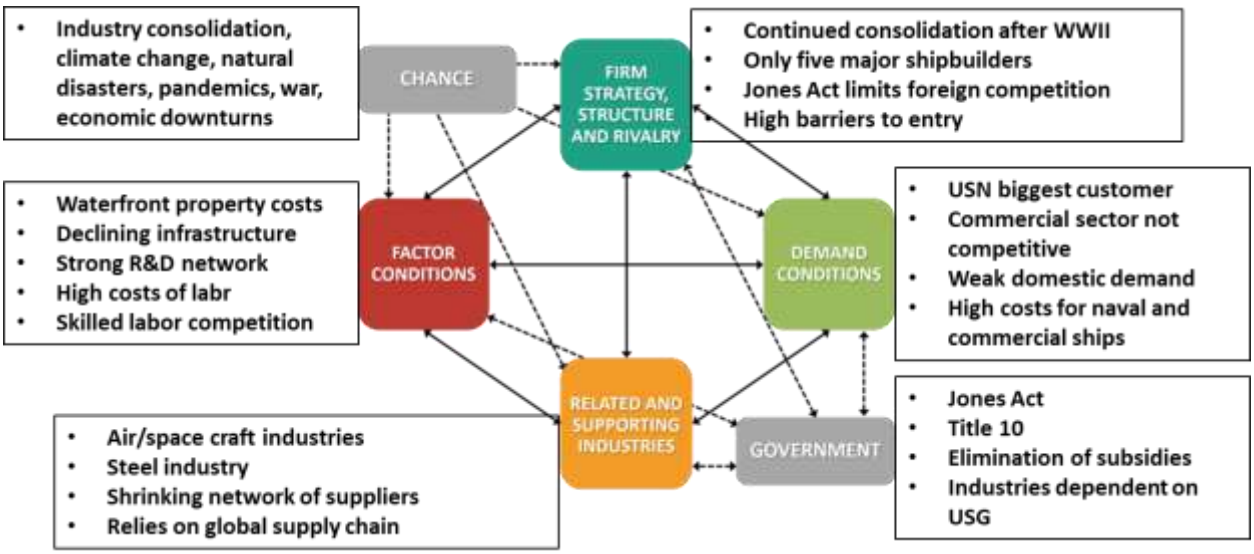

Figure B-1: United States Porter's Diamond Evaluation

PORTER'S DIAMOND (SOUTH KOREA)

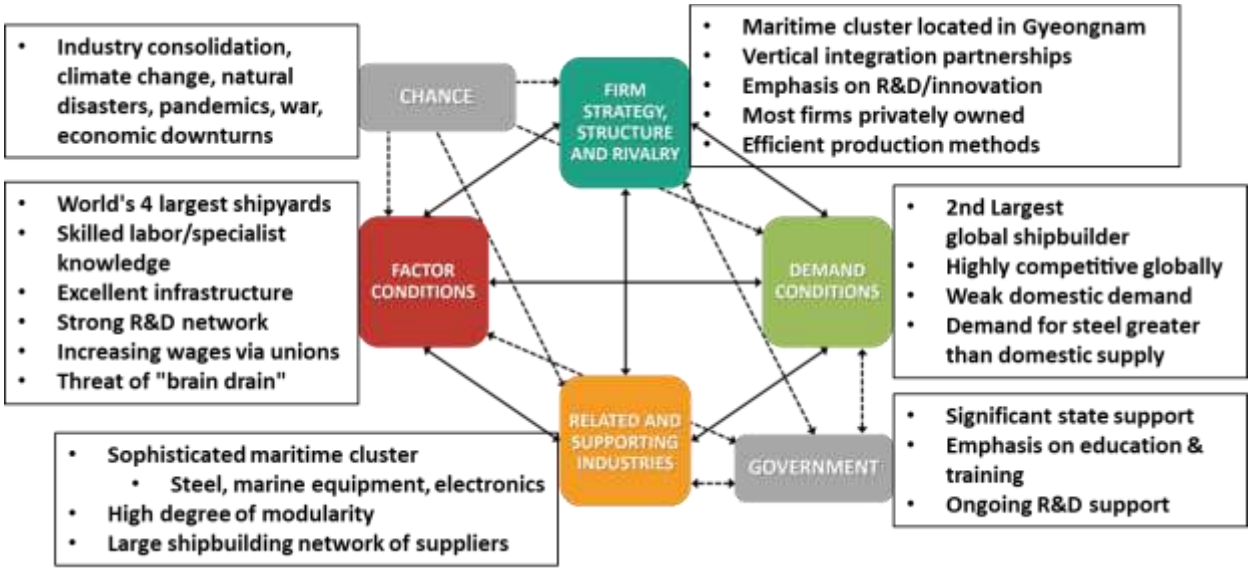

Figure B-2: South Korea Porter's Diamond Evaluation

PORTER'S DIAMOND (CHINA)

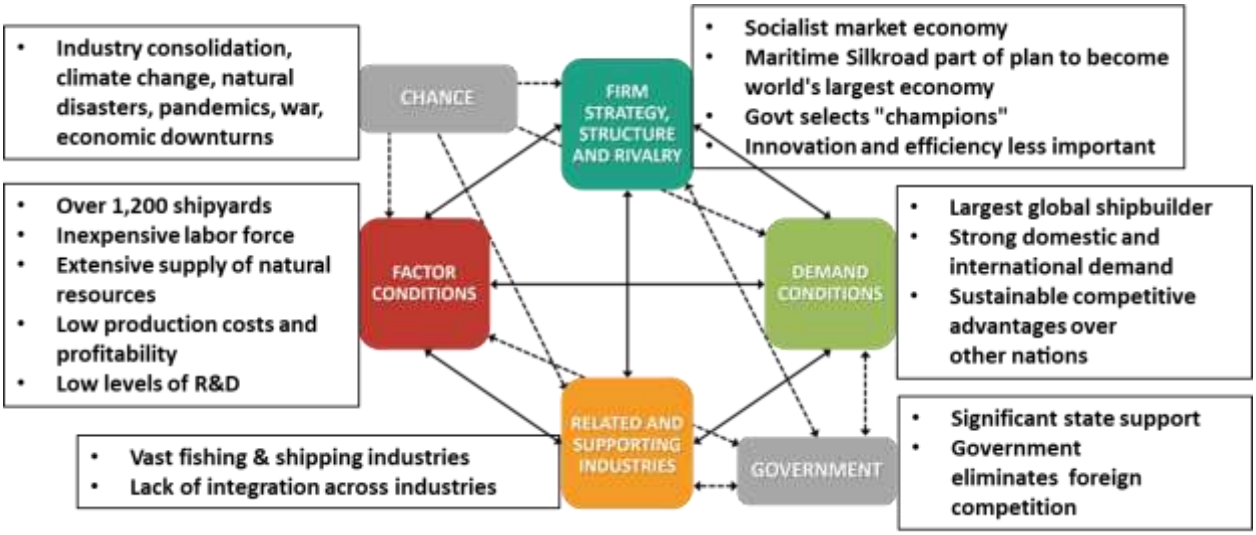

Figure B-3: China Porter's Diamond Evaluation

PORTER'S DIAMOND (RUSSIA)

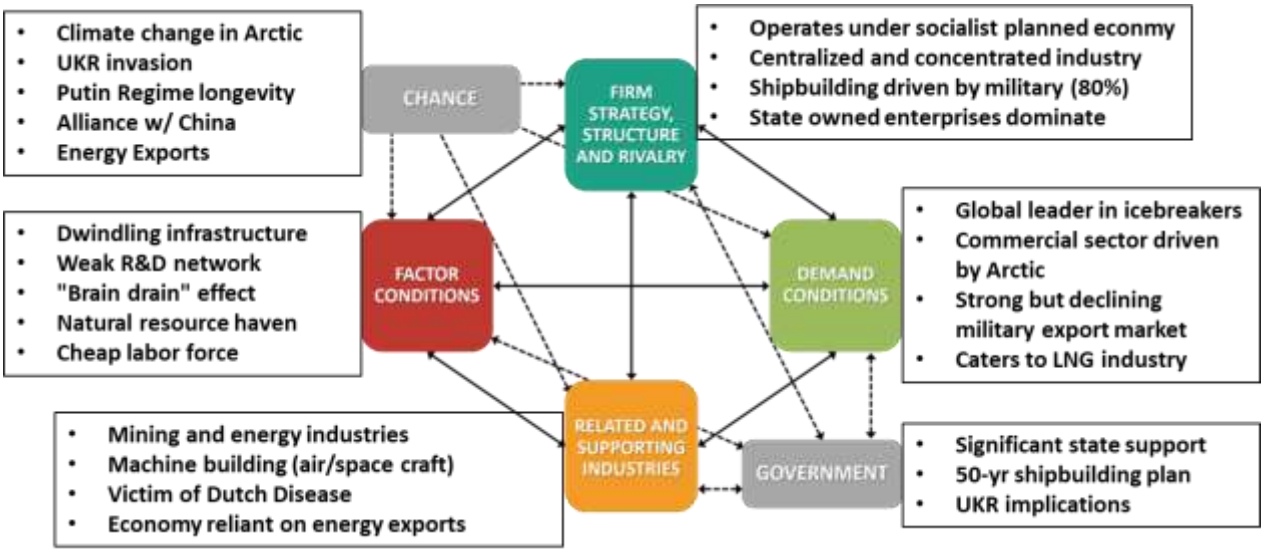

Figure B-4: Russia Porter's Diamond Evaluation

PORTER'S DIAMOND ANALYSIS

Shipbuilding plays an integral role in the strategic competition of the 21st Century and the United States is currently disadvantaged against state-controlled shipbuilding nations including

China, South Korea, and Russia. However, based on Russia's declining economy, largely due to crippling sanctions in response to their invasion of Ukraine, Russia's MIB will likely continue its decline into the future. Conversely, South Korea, a close ally of the U.S., maintains a robust maritime industry. South Korea and China are the world's two largest shipbuilding nations in terms of shipyard capacity. South Korea's strategic rise in shipbuilding is not tied to entrepreneurship alone but stems from various forms of government intervention including subsidies, policy reforms that incentivize shipbuilding, capital growth, and labor policies that affect the domestic shipbuilding industry. Government-backed financing and subsidies artificially inflate Chinese and South Korean commercial shipyards while the U.S. has virtually eliminated similar subsidies over the past 40 years.

The U.S. MIB is struggling. After the Cold War and the collapse of the Soviet Union, the U.S. largely ignored its maritime industry absent the need to mobilize for a conventional world war. Protective financial mechanisms such as Construction and Operating Differential Subsidies are no longer in effect and their removal marked a distinct downturn in shipbuilding capacity. Subsidies and the ability to capitalize on economies of scale represent the two largest factors between large shipbuilding nations and nations which are struggling to maintain shipbuilding relevance.

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