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Introduction

China's Military Shipbuilding Industry Steams Ahead, On What Course?

"IN RECENT YEARS, China's navy has been launching new ships like dumping dumplings [into soup broth]."¹ This phrase has circulated widely via Chinese media sources and websites. Accompanying it are increasingly impressive analyses and photographs, most recently of China's first indigenous aircraft carrier, now under construction in Dalian. The driving force behind all this, China's shipbuilding industry (SBI), has grown more rapidly than any other in modern history.

One of this century's most significant events, China's maritime transformation is already making waves. Yet China's course and its implications, including at sea, remain highly uncertain—triggering intense speculation and concern from many quarters and in many directions. Beijing has largely met its goal of becoming the world's largest shipbuilder. But progress is uneven. Military shipbuilding leads overall, but military and civilian applications alike suffer from significant weakness in propulsion and electronics. It has thus never been more important to assess the quality and quantity of ships with which China is and will be able to supply its navy and other maritime forces, today and in the future. Yet until now, no book had focused on this topic and addressed it from a U.S. Navy perspective.

To bridge that gap, a diverse group of some of the world's leading sailors, scholars, analysts, industry experts, and other professionals convened at the Naval War College (NWC) on May 19–20, 2015, for a two-day conference on “China’s Naval Shipbuilding: Progress and Challenges.” Hosted by NWC’s China Maritime Studies Institute (CMSI), it was cosponsored by the U.S. Naval Institute (USNI). This resulting book is the sixth volume in the CMSI–USNI series, *Studies in Chinese Maritime Development*.

CMSI was formally established on October 1, 2006. Its research and analysis of China’s maritime capabilities help to inform U.S. Navy leadership and support NWC in its core mission of helping to define the future Navy. The annual CMSI conference is a principal function of the institute, supporting focused examination of the full range of Chinese maritime developments.

This conference, the tenth in a series, focused on a topic of great interest to Navy leaders: China’s naval SBI. “Shipbuilding” includes construction of new vessels, the repair and modification of existing ones, and the production and repair of shipboard and associated equipment.² Paper presenters, discussants, and other attendees analyzed China’s shipbuilding capacity in order to deepen understanding of the relative trajectories of Chinese and U.S. naval shipbuilding and the possible corresponding challenges and responses for the U.S. Navy. The overarching questions, of paramount importance to the Navy and other observers, included:

- What are China’s prospects for success in key areas of naval shipbuilding?
- What are the likely results for China’s navy?
- What are the implications for the U.S. Navy?

As the self-designated target year for China to become the world’s largest shipbuilder, 2015 was a particularly appropriate time for the conference.³ In some respects, China has already accomplished its goal, yet major problems and uncertainties remain as we look forward over the next thirteen years through 2030—the rough time frame for this volume’s analysis.

This is an exciting time to observe the fruits of Chinese naval shipbuilding, perhaps even a significant inflection point. As part of its unprecedented overall emphasis on maritime issues, China’s 2015 Defense White Paper states: “The traditional mentality that land outweighs sea must be abandoned. . . . [G]reat importance has to be attached to managing the seas and oceans and protecting maritime rights and interests.”⁴ The U.S. Office of Naval Intelligence’s 2015 report concludes:

China is only in the middle of its military modernization, with continued improvements planned over the following decades. As we view the past 20 years of [People's Liberation Army Navy/PLAN] modernization, the results have been impressive, but at its core the force has remained essentially the same . . . built around destroyers, frigates and conventional submarines. As we look ahead to the coming decade, the introduction of aircraft carriers, ballistic missile submarines, and potentially a large-deck amphibious ship will fundamentally alter how the PLA(N) operates and is viewed by the world.⁵

Over 150 attendees participated in CMSI's conference. They hailed from such institutions as Harvard, Yale, Princeton, Massachusetts Institute of Technology, Johns Hopkins, University of California, and Virginia Tech, such organizations as the RAND Corporation, National Bureau of Asian Research, and IHS *Jane's*, such commercial enterprises and consultancies as *China SignPost*™, as well as such U.S. Navy entities as the staffs of the Chief of Naval Operations, U.S. Pacific Command and Pacific Fleet, and the Office of Naval Research. There were also distinguished attendees from the navies and governments of such important U.S. allies as Japan, South Korea, Canada, France, and the United Kingdom.

The resulting volume thus assembles insights from some of the world's leading experts and analysts concerning one of the most important global dynamics today. China's military data disclosure continues to fall short in important respects, but CMSI's well-established investigative approach brings transparency for Asia-Pacific policymakers tasked with responding to China's rising naval presence. Given the complex, interdisciplinary nature of the subject at hand, CMSI sought to pair technical and industry specialists with Chinese-language-capable subject matter experts. Chapter authors have commanded ships at sea, led shipbuilding programs ashore, toured Chinese vessels and production facilities, invested in Chinese shipyards and advised others in their investments, and produced and presented important assessments to top-level decisionmakers during critical events. In synthesizing their collective insights with those of the other conference participants, this book fills a key gap in our understanding of China, its shipbuilding, its navy, and what it all means. As with all CMSI conferences and related volumes, all views expressed by the contributors are theirs alone.

Volume Structure and Contents

This book addresses the impact of Beijing's substantial economic resources, growing maritime focus, and uneven but improving defense industrial base on its prospects for success in key areas of naval shipbuilding; the likely results for China's maritime forces, particularly its navy; and the implications for the U.S. Navy. It is divided into five thematic parts.

The first part surveys the foundation and resources for Chinese naval shipbuilding. Christopher P. Carlson and Jack Bianchi examine how evolving ways of war and missions have shaped over time the design, development, outfitting, and deployment of PLAN ships—the literal embodiment of Beijing's naval strategy. Morgan Clemens and Ian Easton then survey the role and requirements assigned to China's SBI by its civilian and military masters: the Chinese Communist Party (CCP), the Chinese state, and the People's Liberation Army (PLA). They include a case study on amphibious vessel development and production. Gabe Collins and Eric Anderson follow with an analysis of the diversifying sources and increasing extent of financial resources available to China's state shipbuilders. They highlight Chinese shipyards' dynamism, innovation, and mounting incentives to seek naval contracts to compensate for depressed civilian demand. This provides a broad context and framework for the next three parts, which examine specialized subsets of China's SBI: infrastructure, architecture and design, and remaining impediments.

Part two, on shipyard infrastructure, surveys China's vessel construction facilities and their production and evolution. Sue Hall and Audrye Wong provide important context by outlining SBI dynamics and global production trends. Drawing on Hall's years of experience as an international consultant on SBI issues, they trace Chinese facilities and activities over the past decade-plus boom and recent consolidation. They conclude by outlining challenges facing China's SBI and metrics for measuring its progress. Next, Alex Pape and Tate Nurkin survey in detail China's extant and projected military SBI production from the early 2000s through 2030, offering overviews of specific vessel classes and estimates concerning funding and order of battle. Sean O'Connor and Jordan Wilson then employ satellite imagery analysis to elucidate specific developments at three major naval shipyards: Shanghai Jiangnan Changxing Shipbuilding Company Ltd. (hereafter Jiangnan Changxing); Dalian shipyard, with its growing aircraft carrier experience; and Huludao, China's only yard that currently produces nuclear-powered vessels. Daniel Alderman and Rush Doshi conclude this part by examining ongoing two-way civil-military integration (CMI) efforts in China's SBI. While many Western experts remain

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skeptical of the extent and efficacy of such approaches, CMI enjoys long-standing, growing emphasis in China. One must understand implications of the apparently ongoing merger of China's two major state shipbuilders, China Shipbuilding Industry Corporation (CSIC) and China State Shipbuilding Corporation (CSSC), as well as of broader efforts to consolidate the SBI into fewer facilities of greater quality and capability.

The third part covers Chinese naval architecture and design, from standards to production processes to civil-military disparities, and China's prospects for narrowing them through its preferred centralized approach. Mark Metcalf begins by offering path-breaking analysis of a vital but obscure topic: national, military, and industrial technical standards for China's SBI. These standards, which Metcalf outlines systematically, quite literally inform each Chinese warship's course from conception to delivery. Kevin Pollpeter and Mark Stokes follow with in-depth analysis of that course, formally known as the research, development, and acquisition (RDA) process. They examine China's RDA system and the key organizations involved by tracing the Chinese concept of "integrated innovation" as practiced by CSIC, to date the primary builder of surface ships and submarines for the PLAN. Julian Snelder subsequently draws on personal commercial experience, together with industry interviews and data typically unavailable to scholars, to examine the civilian industrial underpinnings of Beijing's effort to become a great maritime power. Because privately owned Chinese shipyards remain weak compared to their Korean and Japanese counterparts, Snelder predicts that large state-owned enterprises will lead Beijing's maritime strategic-industrial transformation. If China succeeds in enhancing market-oriented performance while strengthening centralized oversight, Snelder judges, it will have the wherewithal to deploy a formidable navy indeed.

Part four addresses remaining shipbuilding challenges for China. These are substantial, particularly concerning information technology, propulsion, and aviation and other complex systems. Common to these bottlenecks is the centrality of sensitive, high-performance components that must work together as a sophisticated system-of-systems. This makes it particularly difficult for China to successfully pursue its preferred hybrid approach: obtaining critical foreign technologies and other inputs,⁶ developing indigenously those unavailable from abroad, and integrating the results on a "good enough" basis. Leigh Ann Ragland-Luce and John Costello establish the importance of shipboard electronics to the PLAN's desired upward trajectory in sophistication, scope, and scale of operations. In part through in-depth examination of the Type 054A *Jiangkai II* frigate's electronics suite, they find that—despite

increasing prioritization—organizational parochialism, insufficient coordination, and other inefficiencies continue to impede Chinese progress in this vital area. Andrew S. Erickson, Jonathan Ray, and Robert T. Forte next examine power and propulsion for China's conventional and nuclear naval vessels. These capabilities quite literally determine how fast and far Chinese warships can go, and what they can accomplish in many respects, yet they remain one of the PLAN's key weaknesses. It is, in every sense of the word, underpowered. Erickson, Ray, and Forte find that China is working hard to master relevant technologies, and they highlight the most important determinants of progress (such as the degree of Russian assistance) but emphasize that improvements will be slow, difficult, and expensive. Andrew Scobell, Michael E. McMahon, Cortez A. Cooper III, and Arthur Chan conclude the part by examining China's aircraft carrier program and the motivations and choices informing it. Citing the difficulties inherent in upgrading propulsion, power, and launch technologies, their analysis suggests an evolutionary design path for Chinese deck aviation.

The final part returns to the strategic level by weighing alternative futures, offering overall conclusions, and suggesting key takeaways. Charged by the editor with exploring what maximally favorable peacetime SBI conditions and production might yield the PLAN by 2030, James E. Panell and Scott Cheney-Peters outline a possible path to a much larger, more capable navy with a much greater mission set. Such a realization of the "China Dream" at sea would entail a global presence characterized by a credible sea-based nuclear deterrent, multiple carrier strike groups, and an ever-present network of ships at sea. Asked by the editor to consider what more moderate assumptions might mean for the PLAN between now and 2030, Michael McDevitt notes that strong strategic demand signals and guidance from civilian authorities, combined with solid SBI capability, are already driving rapid progress. He projects that by 2020, China will have impressive far seas-relevant naval forces second only to those of the United States. This growing Chinese distant waters fleet will increasingly resemble a smaller version of the U.S. Navy. Paul Scharre and Tyler Jost next examine technologies that might change naval warfare dramatically and consider related Chinese thinking. Future outcomes, they contend, will be affected by four key competitions susceptible to disruptive technology advances—hiding versus finding, understanding versus confusion, network resilience versus degradation, and hitting versus intercepting. Advances in China's technology base, shipbuilding, and design will have an impact on all four areas. Ronald O'Rourke concludes with specific policy implications and recommendations for the U.S. Navy and the civilian authorities who oversee it. For over a decade,

he explains, China's military maritime modernization effort (including its shipbuilding output) has affected requirements for U.S. Navy capabilities, particularly by renewing focus on high-end warfare. He traces resulting ongoing debates concerning strategy, budgets, and force architecture.

Summary of Conference Discussion

While the aforementioned chapters contain specific insights and nuances that merit readers' attention, in the editor's personal view the conference yielded the following key findings overall—none of which may be attributed in any way to a specific participant or organization:

- The growth of China's SBI is more rapid than any other in modern history, with a thirteen-fold increase in commercial shipbuilding output from 2002 to 2012. Although advancements in recent years are substantial in aggregate, they vary significantly by subfield.
- Through a process of "imitative innovation," China has been able to leapfrog some naval development, engineering, and production steps and achieve tremendous cost and time savings by leveraging work done by the United States and other countries.
- Fleet design and quality improvement efforts are driven by two factors. PLAN shipbuilding choices are informed by a combination of technological and strategic analysis produced by the PLAN's two main research organizations. Ship construction is increasingly subject to a detailed set of national and navy military standards.
- China's SBI is poised to make the PLAN the second largest navy in the world by 2020, and—if current trends continue—a combat fleet that in overall order of battle (i.e., hardware-specific terms) is quantitatively and even perhaps qualitatively on a par with that of the U.S. Navy by 2030.
- By 2030, the PLAN would still be in the early stages of increasing operational proficiency and its ability to engage in high-intensity operations in distant waters, but could nevertheless—together with other PLA forces—develop tremendous ability to actively oppose U.S. Navy operations in a zone of contestation for sea control in the near seas (Yellow, East China, and South China seas), while extending layers of influence and reach far beyond.

- By 2020, China is on course to build ships that will be able to deploy greater quantities of antiship cruise missiles (ASCMs) with greater ranges than those systems used by the U.S. Navy.

Additional Findings

In the editor's judgment, the conference also yielded the following specific insights.

Chinese Shipyards

The CCP has assigned the SBI a key role in China's development as a great power, including support for China's geostrategic endeavors. The state-owned shipyards also offer a major job and skills development program serving larger CCP economic objectives. Simultaneously, however, China's spate of recent construction necessitates the rapid development of the supporting and maintenance infrastructure for in-service vessels—a difficult task even for the far more experienced U.S. Navy. When maintenance, repair, and overhaul are factored in, a navy ends up paying a warship's initial purchase price at least two more times over its lifecycle. (As naval engineering specialists say, "You buy the boat [roughly] three times.") Mid-life maintenance will be a big "shoe to drop" for the PLAN, particularly as it increases its operational tempo and wears out its ships more rapidly. Thus far, China's approach has been similar to that of the Soviet Union: building new vessels hastily without adequately considering upkeep costs or related personnel and infrastructure requirements (e.g., the need for sufficient numbers of specialized workers and dry docks). Beijing may thus "reap the whirlwind" as programs initiated in flush fiscal times enter a costlier phase, yet command less robust discretionary funding.

State-owned versus Private Shipyards

In aggregate, and increasingly together, CSIC and CSSC possess great resources and capacity but retain tremendous inefficiencies. Their institutional culture is still influenced by legacy values, norms, and incentives. Their monopoly structure remains one of the central impediments to improving efficiency and innovation. On the other hand, private yards are oriented toward short-term, profit-minded thinking and are not funded to engage in long-term research and development (R&D)-intensive projects. While CSIC and CSSC have increasingly undertaken naval and para-naval business to absorb excess yard capacity after commercial "Peak Ship" construction occurred around 2012, private yards have largely been left to fend for themselves. Throughout the industry, bureaucratic barriers to efficiency and effectiveness remain a

problem, especially for propulsion and shipboard electronics systems and their integration into ships.

Chinese Shipbuilding Standards

Specific Chinese shipbuilding plans and military standards are derived from the Weapons and Armament Development Strategy, a highly classified document drafted by the General Armament Department and approved by the Central Military Commission. It includes sections assessing the international security environment, military equipment requirements, analysis of the strengths and weakness of Chinese armaments in relation to naval objectives, and assessments of science and technology development. One of China's most important national military shipbuilding standards is the 国家军用标准 (Guojia Junyong Biaozhun/GJB) 4000-2000 publication series, *General Specifications for Naval Ships*, a massive compendium focused on new and planned construction. It represents a major advance from China's copycat assimilation of thousands of U.S. standards during the 1980s and 1990s.

Programmatic Decisionmaking

To drive requirements, PLAN leadership integrates the analysis of its two main research entities—the technically focused Naval Armament Research Institute, and the strategically focused Naval Research Institute—to rationalize ship and weapons system design with naval strategy. The increasing diversity of PLAN mission areas (e.g., massive expansion of area air defense) is having a significant effect on Chinese naval ship design. Increasing capabilities demand increased processing power and sensor load. Greater payloads and supporting systems drive increases in ship size.

Naval Ship Design

New design and production technologies—as previously with computer-aided design and manufacturing software from Japan and Europe—are being imported into China, adapted, and deployed for military use. Advances in ship design are achieved through “imitative innovation,” an official technology transfer policy based on a process of introduce/digest/absorb/re-innovate. This process takes existing technology and adds value to it by making it cheaper, better suited to Chinese needs, or otherwise improving it. Modular construction is expanding for both commercial and military ships. Modularity improves production efficiency—by enabling standard modules to be constructed and stored to better accommodate shipbuilding schedules—and also reduces uncertainties by employing common systems and subcomponents.

Military-Civil Disconnect

The greatest variation across China's uneven but improving SBI stems from its military-civil bifurcation. While subject to the aforementioned inefficiencies, the naval side appears to have by far the better funding, infrastructure, research institutes, designers, and workers. State-owned shipyards on the Ministry of Industry and Information Technology's favored "white list"—the ones building most of China's warships—receive not only preferential treatment, but also preferential support. The advantages enjoyed by military shipbuilding may be further enhanced as state shipbuilders seek to compensate for recent declines in commercial orders by securing contracts for naval and coast guard ships, the latter of which are being built even more swiftly and numerous. Learning is occurring rapidly. It typically takes ten to twenty repeats to double labor efficiency, and the PLAN is ordering longer production runs of fewer series, facilitating advancements in shipbuilding knowledge and competence. That said, China's military SBI still faces challenges in subcomponents (especially propulsion/power) and some sensors (e.g., antisubmarine warfare versions). On the commercial side, in marked contrast, many private shipyards risk bankruptcy and closure. The civilian shipbuilding workforce remains undereducated. Worker quality, lower than in South Korea and Japan, remains a major drag on productivity and high-end achievement. With regard to commercial shipbuilding, therefore, China has a massive capacity to build small, less complex ships and large, noncomplex ships but has demonstrated less capacity to build large, complex ships. However, even the commercial side is improving over time. For instance, partnerships between shipyards and "feeder" technical schools are being created to help enhance workforce capacity, in part by offering guaranteed jobs for graduates.

Particular Propulsion Weakness

Compared to the United States, China retains pronounced shipbuilding limitations in propulsion, some electronics, and certain advanced weapons systems. Propulsion is the single biggest shortcoming and is unlikely to progress until China's precision manufacturing capability improves. Conventional propulsion in submarines is moving toward advanced lithium-ion batteries, possibly as an alternative to air-independent power systems. Nuclear propulsion advances—especially in power density and acoustic quieting—remain difficult to ascertain, but a key variable affecting future progress will be the degree of Russian assistance.

Points of Contention

To be sure, in keeping with CMST's rigorous academic approach, the conference generated significant debate. In the editor's assessment, the most important areas of disagreement included:

- Will Chinese state-owned shipyards merge again in a *substantive* fashion? CSIC and CSSC were unified until 1999 and then were divided along geographic and functional lines so as not to compete directly (CSIC controls the majority of R&D centers, for instance). Some believe true reintegration will occur—as widely reported in Chinese and foreign media before this volume went to press—to increase efficiency and available resources and to reach a State Council-mandated reduction in the number of commercial shipyards from several hundred to sixty. Those doubting that meaningful mergers will occur observed that most unions to date aimed to maximize geographical efficiencies and have been completed. They also note that CSIC and CSSC naval yards have already been reduced to only seven major facilities between them.
- What are China's prospects for reducing organizational barriers and increasing technological diffusion and absorption? Beijing is responding to organizational and technological impediments by emphasizing integration of commercial and naval shipbuilding processes, which some industry experts believe could improve quality and efficiency. Others maintain that this will actually reduce efficiency and increase challenges because of the fundamentally different natures of naval and commercial shipbuilding.
- Are Chinese shipbuilding standards effective design and construction tools, given cultural barriers to standardization and regulation? Some highly knowledgeable experts believe that overall, they "offer a workable road" to improved future construction. Others believe they are "hopelessly convoluted," outdated, and probably used selectively. Of note, in China's space industry it took top-level leadership intervention before program managers actually started to follow standards consistently. Several observers well versed in naval affairs emphasized that whatever the specifics, China is clearly putting sophisticated, capable warships to sea. Developments causing concern for U.S. and regional observers have been accomplished in spite of the limitations on Chinese shipbuilding raised by presenters, primarily those focusing on commercial issues (where Chinese shipbuilding is weaker than on the

military side). To the extent that China can reduce or overcome these limitations, its accomplishments will be even greater.

Subsequent Developments

Between the conference and this volume's publication, new details emerged that inform the aforementioned debates but in no way resolve them.

With regard to organization, while there was no conclusive evidence of an imminent CSIC-CSSC merger, internal consolidation of each conglomerate was already well under way.⁷ In May 2016, CSIC announced a plan to amalgamate key shipbuilding activities, including in leading naval shipyards. Three pairs of major shipbuilding subsidiaries, with military-related responsibilities as noted, are slated for mergers:

- Dalian Shipbuilding Industry Company (first indigenous aircraft carrier) with Tianjin Xingang Shipbuilding (fast attack craft)
- Bohai Shipbuilding Heavy Industry (nuclear submarines) with Shanhaiguan Shipbuilding Industry (repair)
- Qingdao Wuchuan Heavy Industry with Qingdao Beihai Shipbuilding Heavy Industries (unmanned surface vessels).⁸

In doing so, CSIC is attempting to clean up its internal operations and eliminate overlap and internal competition. This administrative measure does not change competition, capacity, or capability writ large, but rather is an incremental move in an ongoing consolidation process overseen by a Xi Jinping administration that firmly believes in the power of mergers and super-monopolies to serve key bureaucratic-economic functions.

As for technical specifications, in June 2015, a new joint PLA-China Classification Society standard (GJB) levied certain requirements on new construction of commercial ships in support of military mobilization needs. These requirements are strongly advocated by national security stakeholders but have subsequently triggered pushback from ship builders and owners, complicating their implementation.⁹

Implications for the U.S. Navy

CMSI conferences are designed to offer insights and policy recommendations specifically useful to the U.S. Navy. From the editor's perspective, the conference yielded the following takeaways:

- Chinese ship design and building advances are helping the PLAN to contest sea control in a widening arc of the western Pacific.

- Experts generally agreed that by 2020, the PLAN will be the world's second most powerful navy, with assets dedicated to far seas missions greater in capability than those of the United Kingdom, France, Japan, or India. Given the likelihood of continued government investment, cost advantage, and pursuit of integrated innovation, China's SBI appears to be on a trajectory to build a combat fleet that could be, *in hardware terms*, quantitatively and qualitatively on a par with that of the U.S. Navy by 2030.
- Whether China can stay on this build-out trajectory, given downside risks to its economy and the mounting costs of maintaining the existing fleet, is another question. Indeed, Beijing may face a looming inflection point, after which it is confronted with tradeoffs and difficult choices concerning resource allocation unprecedented in China's post-1978 era of economic and military expansion.
- Regardless of China's precise economic future, the PLAN—together with other PLA forces—will be increasingly capable of contesting U.S. sea control within growing range rings extending beyond Beijing's unresolved feature and maritime claims in the near seas. Experts generally agreed that by 2020, China is on course to deploy greater quantities of missiles with greater ranges than those systems potentially employed by the U.S. Navy against them. China is on track to have quantitative parity or better in surface-to-air missiles and ASCMs, parity in missile launch cells, and quantitative inferiority only in multi-mission land-attack cruise missiles. Retention of U.S. naval superiority hinges on next-generation long-range ASCMs (the Long-Range Antiship Missile [LRASM] and the vertical launch system-compatible Naval Strike Missile variant)—which are still “paper missiles” not yet fielded on U.S. Navy surface combatants. Additionally, new U.S. ASCMs may be unable to target effectively under contested anti-access/area denial conditions. Failing to fill this gap would further imperil U.S. ability to generate and maintain sea control in the western Pacific.

The Way Forward

At the CMSI conference and beyond, the aforementioned dimensions of China's maritime rise have rightly attracted growing attention. Directed by civilian authorities, the U.S. Navy, Marine Corps, and Coast Guard have taken notice. The current U.S. Maritime Strategy, issued in 2015, states: “China's naval

expansion into the Indian and Pacific Oceans presents both opportunities and challenges." It adds: "The U.S. Sea Services, through our continued forward presence and constructive interaction with Chinese maritime forces, reduce the potential for misunderstanding, discourage aggression, and preserve our commitment to peace and stability in the region."¹⁰

Like its five predecessors, this volume continues the CMSI tradition of both addressing challenges from and pursuing opportunities with China. Increasingly, the U.S. and Chinese navies are meeting at sea and ashore. While the two sides will not always agree, to ensure avoidance of worse outcomes than the current peacetime mix of cooperation and competition, they must always understand each other clearly. It was in that spirit that NWC welcomed PLAN Commander Admiral Wu Shengli to represent his navy for the first time ever at the Twenty-First International Seapower Symposium in September 2014. Admiral Wu is clearly focused on enhancing professional military education for his service.¹¹ In February 2015, twenty-nine "fast-track" Chinese naval officers participated in a six-day exchange program with U.S. counterparts, including visits in Newport, Rhode Island, to NWC, with which the editor assisted, and the Surface Warfare Officers School. In July 2015, the editor was honored to accompany a delegation of twelve NWC students and NWC's deans of international programs and domestic and foreign student programs to reciprocate with visits to the PLAN Headquarters in Beijing and to China's Naval Command College in Nanjing.

On a subsequent visit to Nanjing, the editor visited the Zheng He Memorial Shipyard. Here, in the central Gulou district of what was once the Ming Dynasty's capital along the Yangzi (Yangtze) River, lie the Treasure Boat Factory Ruins. A world-leading shipyard six centuries ago, the facility produced many vessels for the maiden fleet of Zheng He, a Chinese Columbus who made seven Indian Ocean voyages from 1405 to 1433, reaching as far as Mombasa, Mogadishu, and Mecca. In a testament to the scale of the enterprise, this included Zheng's flagship vessel, which may have been as long as 136 meters (448 feet).¹² A smaller replica welcomes visitors today. Walking its expansive (if creaky) decks one sunny afternoon, the editor could not avoid the questions that lie at the heart of this volume: To what extent, and to what end, is China going to sea? Is China once again poised to engage in world-class shipbuilding? And if so, what use will Beijing make of this historic opportunity?

Whatever the ultimate answers, the U.S. Navy must understand its Chinese counterpart and where it is heading. Assessing what ships China can supply its navy and other maritime forces with, today and in the future, can help to point the way.

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1. Widely circulated quotation published by *Duowei*, a New York City Chinese-language newspaper owned by a Hong Kong media businessman. "美国备战南海 中国海军急召退伍士官复役" ["U.S. Preparing for War in the South China Sea, Chinese Navy Recalls Retired NCOs for Service"], 多维新闻 [*Duowei News*], June 17, 2015, <http://global.dwnews.com/news/2015-06-17/59661331.html>.
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