Sea Power in the Age of Artificial Intelligence (AI): China's Naval Modernization as a Pacing Threat for The United States

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Abstract

In the intricate landscape of global politics, sea power serves as a defining factor in a nation's path towards leadership. This research navigates historical trajectory, highlighting the United States' epochal reign as a maritime powerhouse, underpinned by its resounding naval supremacy. However, a shift in tides becomes evident with the rise of China's navy, an emerging force that poses a substantial challenge to the established superpower-the US. Beyond traditional paradigms, this study ventures into the realm of technological transformation. It explores the role of artificial intelligence as a compass, guiding naval forces towards enhanced strategic command and operational efficiency. As the digital winds of change gather momentum, the incorporation of AI charts a new course in shaping and sustaining naval dominance. This research employs qualitative research method to provide analysis. Lastly, the paper provides an analysis in terms of AI based maritime competition and assess that China has attained bigger naval fleet with naval modernization over past few decades, but still, US outpaced and outplayed bigger Chinese fleet with more technologically advanced and powerful naval vessels and platforms.

Keywords: *PLAN, Sea Power, Naval Modernization, Artificial Intelligence, USV, UUV.*

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Introduction

In the realm of sea power, where the tides of technology and strategy converge, this research casts a discerning eye on the evolving dynamics in the age of artificial intelligence. This study unveils a pivotal narrative of AI-driven vessels by exploring the competition between two giants, the United States and China, in their quests for naval modernization. With autonomous capabilities, these vessels redefine the rules of engagement, operating with precision, stealth, and efficiency, hence, revolutionizing naval warfare. It also underscores the significance of both the number of vessels and the level of technology in the race to gain a strategic advantage. This research brings into sharp focus the nexus between artificial intelligence, naval modernization, and strategic advantage. By exploring the technical aspects and the strategic implications of AI integration, this study opens doors to a deeper understanding of the future of naval power.

Oceans serve as crucial spaces for leading and emerging powers in the global geopolitics. In the same vein, sea power is deemed as a major pillar for power preponderance and a decisive factor in attaining global hegemony. It is a key determinant to shape and influence global affairs. The oceans are the high grounds of global system and exercise of sea power provided unmatched strategic leverage. The holding sway offers great utility in the times of peace and war. Against this backdrop, navies have been a formidable asset for leading powers. State's geopolitical and security prowess along the aspirations of world leadership heavily depends on supremacy of naval strength. The nations with global interests and status seek command and control of sea and subsequently emerge as the drivers of global order. For the past seven decades, the US has held the title of world's leading naval force as its naval size and sophistication have earned an unrivalled influence.

However, the dynamics shift with the rise of People Liberation Army Navy (PLAN) in the second decade of the 21st century has challenged the US naval supremacy. China not only aspires to be a continental power but is also on the march to become a first-order sea power. China's efforts of building a larger naval fleet and a forward presence could erode

the supremacy of US naval might. It is almost at par with the US in terms of overall naval force strength.

In the 21st century, utilization and integration of AI in weapon systems and military platforms have triggered the competition to gain strategic leverage over others. States are underlying the strategies for naval modernization with the integration of AI to gain influence in blue water oceans. In this arena, technological progress maintains sea power at the forefront of major powers that intend to shape the geopolitical landscape of the world. Against this backdrop, AI-based naval modernization gains the spotlight to acquire maritime dominance. The US and China are expanding their influence in the naval domain through AI-powered naval vessels to gain control over blue water oceans.

The core proposition of this research is as follows: China's rise has posed a threat to the historical naval supremacy of the United States, the latter endeavours to maintain its leading position as a sea power with capabilities and strategic advantage. This research study is structured into the following sections: at first it traces the evolution of general conception of sea power and the historical trajectory of the US as a prominent naval force. The second section provides an overview of China's naval modernization efforts with a comparison of both naval fleets. Moreover, it points out the anticipated utilization of AI in unmanned/autonomous surface and underwater vehicles with operations tactics purported in detail. The last section deals with a debate about naval fleet size, its high-tech capabilities and prescribed measures to preserve the naval supremacy status of the US.

The Concept of Sea Power in the 21st Century

The concept of sea power has evolved with the changing nature of geostrategic environment, military tactics and technological developments. In general terms, it is defined in relevance of naval forces, naval power and maritime strategies. The concept of sea power has evolved over time, and various thinkers and strategists have contributed to its development. Alfred Thayer Mahan, however, played a significant role in popularizing and

shaping the modern understanding of sea power. He viewed sea power as a tool to engage in a decisive battle and repel any organized military threats from other states with a clear-cut victory.[1] The control of oceans is equivalent to securing commercial interests and control of international markets. At that point in time, strong economy was a decisive factor in the wars. So, Mahan's thinking influenced naval expansion programs for almost half of a century.[2] Scholars succeeding Mahan came up with an increasingly broad perspective of sea power.

For instance, Charles W. Koburger, research analyst of naval affairs, pointed out sea power as a military capability to influence maritime affairs and control onshore affairs from the sea.[3] Another prominent naval expert, Sam J. Tangredi, Navy captain and surface warfare officer, defined sea power as the sum of abilities to conduct maritime trade, harness marine resources, deploy naval forces and control onshore affairs from the sea.[4] Geoffrey Till, British naval historian, illustrated that sea power comprises navy, coastal patrol, maritime forces and combined assistance from air and land forces. It is basically a marine oriented capability of utilizing resource and controlling other's activities at sea, thus influencing onshore and offshore affairs.

However, in the current dynamics of 21st century, evolution of traditional and non-traditional security challenges have called for an extensive definition of sea power that includes all the aspects of relationship between the state and the sea.[5] The former Commandant of the US Coast Guard, Admiral Thomas H. Collins, described sea power as expansive concept that upholds safety, freedom and maritime sovereignty. He said, sea

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[1] Barry M. Gough, "Maritime Strategy: The Legacies of Mahan and Corbett as Philosophers of Sea Power," *RUSI Journal* 133, no. 4 (March 2008): 55-62. https://doi.org/10.1080/03071848808445330.

[2] Ronald D. Parker, "Mahan for the Twenty First Century: His Principles Still Apply to National Power," *Defense Technical Information Center* (January 2003). https://apps.dtic.mil/sti/citations/ADA526258#:~:text=Mahan%20was%20not%20able%20to,space%20power%2C%20and%20information%20dominance.

[3] Charles W. Koburger, *Narrow Seas, Small Navies, and Fat Merchantmen: Naval Strategies* (New York: Preager, 1990), xiv.

[4] Sam J. Tangredi, *Globalization and Maritime Power* (Washington D.C: NDU Press, 2002), 2-5. https://www.files.ethz.ch/isn/110803/fulltext.pdf.

[5] Geoffrey Till, *Maritime Strategy and the Nuclear Age* (London: Macmillan, 1982), 33.

power in the 21st century is the ability of a nation to use the seas safely, securely, fully, and wisely to achieve national objectives. He pointed out the maritime power that speaks for timeless interests of security, safety and preservation, not only a mounted capability of war fighting.[6] Some scholars such as David Gompert, argued that sea power is not only retained by the great maritime powers but also almost every state has a certain degree of sea power. He illustrated the sea power as a product of politics, economy, technology and geography. These factors enabled and shaped the sea power of any state.[7]

Maritime realm is a crucial space for leading and emerging powers to shape the regional dynamics. Naval forces have historical prominence in dealing with great power competition. Navy consists the complete set warships including personnel and equipment that depict sea power of a nation. It comprises aircraft carriers, amphibian ships, warships, armoured surface or underwater vehicles and submarines. Navy also works in multidimensional ways like land and air forces. Navy works at two fronts: it protects the sea lanes during wartime by defending against other navies and protects trade channels and ports during peace time by maintaining security in territorial waters.

A report titled "Maritime Security and Great Power Competition: Maintaining the US-led International Order" accentuates the importance of maritime dominance.[8] High-end naval capabilities along high-tech integration would require deterring and countering America's powerful competitors at sea. The littoral areas, Exclusive Economic Zones (EEZ), trade channels and global commons are the front line of great powers. The ongoing friction in the seabed exploration of natural resources depicts the prime interest of nations to gain dominance at sea and build powerful presence of navy. Technological revolution came up with novel and intricate factors that ultimately enhanced the power projection capabilities. The development and spread of technology made it difficult for an established power such

[6] Andrew T. H. Tan, *The Politics of Maritime Power*: *A Survey* (London: Routledge, 2007), 5.
[7] Geoffrey Till, *Sea Power: A Guide for the Twenty-first Century*, 3rd ed. (Routledge, 2013), 25.
[8] Joshua Tallis, "Maritime Security and Great Power Competition: Maintaining the US-Led International Order," May 1, 2020, https://apps.dtic.mil/sti/citations/tr/AD1101486.

as the US to maintain sea control and tackle emerging challengers like China. The global command and control is being denied and disrupted under the hostile cyber and electromagnetic spectrum conditions. Artificial Intelligence is at the forefront of technological development as it has far-reaching and revolutionary impacts in naval domain. Artificial intelligence ensures superior operational capabilities by enhanced understanding of situation with improved decision making ability providing proactive and resilient security in the untethered environment of sea.[9] The hardening of this competition has directed the attention of the leading states to build AI based naval vessels to achieve an unremitted amount of sea power.

Evolution of US Naval Influence over Time

The United States Navy stands out among all the navies of the world with maximum capabilities. It has emerged as one of the most powerful and the largest navies of the world since World War II. The US navy maintains its global presence and sizeable deployment in substantial waters such as the Western Pacific, the Mediterranean, and the Indian Ocean. The US had an overwhelming sea power that totally lived up to Mahan's idea of immense sea power. Along with sea command, sea control was obtained through high-tech warships and aircraft carriers.

The US naval force was dominant enough to deny, disrupt and eliminate any threat at sea.[10] In 1992, a report was issued by the naval department, "From the Sea: Preparing the Naval Service for the 21st Century", which covered these key points: It emphasized joint operations by backing up the land and air forces rather than independent large scale naval operations, preferring the operation from the sea over operating on the sea, ensuring forward

[9] "Advantages of AI in the Maritime Battlespace: Enhancing Naval Operations", May 30, 2023, https://systematic.com/en-gb/industries/defence/news-knowledge/blog/advantages-of-ai-in-the-maritime-battlespace-enhancing-naval-operations/.
[10] R. B. Watts, "The End of Sea Power," *Proceedings Magazine*, September 2009, Vol.135/9/1,279. https://www.usni.org/magazines/proceedings/2009/september/end-sea-power.

presence of the US and its dealing in regional affairs.[11] The US navy possessed 11 air craft carriers, operated top tier classes of amphibious warships, possessed double the number of aircraft at sea compared to the rest of the world and surpassed the combined naval fleet of all other navies.[12]

Hence, the US navy has been unmatched in power projection capabilities until PLAN of China altered the landscape. The US presented budget control act to alleviate the ongoing burden of significant public debt and defense spending and was the first to face the impact. The US naval fleet has shrunk, possibly the lowest since 1917, as number of vessels decommissioned and not replaced.[13] The rapid increase in China's naval vessels and its aspiration of becoming great maritime power as China's Dream, can be witnessed in the second decade of the 21st century.

Brief Overview of China's Naval Modernization Effort

China's unprecedented naval modernization efforts since mid-1990s, made it one of the largest naval forces of the world. China has made its navy a formidable military force in near-seas region and conducted a number of operations far from home that encompass the distant waters of the Western Pacific, the Indian Ocean, and waters around Europe. Peoples Liberation Army Navy (PLAN) was large navy in East Asia and is now numerically the largest navy as it surpassed the US navy in total number of ships within past few years.[14] Department of Defense mentioned PLAN is the largest navy of world consisting of 355 platforms for battle force that include aircraft carriers, surface combatants, submarines, patrol combatants, fleet auxiliaries, amphibious ships and many more. PLAN's number of

[11] Department of the Navy Washington DC, "From the Sea - Preparing the Naval Service for the 21st Century," September 1, 1992. https://apps.dtic.mil/sti/citations/ADA338570.
[12] Hope Hodge Seck, "Active Ships in the US Navy", June 23, 2021, https://www.military.com/navy/us-navy-ships.html.
[13] Zacharey Cohen, "Size Matters: Is the U.S. Navy Really Too Small?" September 08, 2015, https://edition.cnn.com/2015/09/08/politics/us-navy-size-military-election-2016/index.html.
[14] Ronald O'Rourke, China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress. *Congressional Research Service*, 2023. https://sgp.fas.org/crs/row/RL33153.pdf.

ships expected to grow to 420 by 2025 and to 460 ships by 2030.[15] The latest annual report to Congress 2023, states that the PLAN is the largest navy in the world with a battle force of over 370 platforms.[16] Moreover, China has the largest coast guard and a sizeable maritime militia (force of fishing vessels engaged in commercial fishing usually in disputed waters) to defend its near-sea claims. The capabilities of anti-access/area and sea denial signalled the rise of a leading competitor in sea power in the Western Pacific. The 'restricted access' concept of China is a vigilant threat to the US freedom of movement and constraining its worldwide presence. PLAN has modern multifunctional platforms comprising sensors and weapons for air, surface and underwater detection and annulation of any threat. Naval vessels and arsenal of China are much more advanced, modern and capable in comparison to 1990s and now analogous to many advanced western navies.[17]

Tipping the Balance: U.S. and China's Naval Fleet

The Department of Defence annual reports on military and security developments shed the light on PLAN's successive growth over the years from 2005 to 2021. This gives a detailed overview of PLAN's increasing number of ships and also how it bridged the gap and surpassed the US navy. It includes various types of navy ships such as destroyers, frigates, cruisers, corvettes, missile-armed coastal patrol craft, amphibious ships (tank landing or transport dock), aircraft carriers and submarines of varying capabilities. Following Table gives an overview of China's growing number of ships as compared to the US.

[15] Xavier Vavasseur, "*US DoD's 2021 China Military Power Report: PLAN Is the Largest Navy in the World*," 2021.
[16] "Military and Security Developments Involving the People's Republic of China," *US Department of Defense*, 2023. https://media.defense.gov/2023/Oct/19/2003323409/-1/-1/1/2023-MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA.PDF.
[17] "How is China Modernizing its Navy?" *China Power*, April 20, 2022. https://chinapower.csis.org/china-naval-modernization/.

Year of Department of Defense Report	**Total Number of PLAN Ships (various types and functions)**	**Total number of US Navy Ships**
2005	216	291
2010	276	285
2015	294	289
2021	318	296
Change Since 2005	+132	+5

Table 1. Growth of Naval Ships Numbers

Source: Report to Congress on Chinese Naval Advancements

Table 1 depicts that PLAN's ships have been increasing numerically with every passing year. Since 2005, 65% of increase in almost all the types of ships has been witnessed and surpassed the US navy. Number of ships is a one-dimensional measure to assess the relative naval capabilities of both navies. The important thing to take into account is the difference of composition between these two navies.[18]

The US Navy has more advanced and powerful form of naval vessels such as nuclear-powered submarines, cruises, destroyers and aircraft carries in number. PLAN has more diesel attack submarine, frigates and corvettes in number.[19] World Directory of Modern Military Warships (WDMMW) employs *True Value Rating'* (TvR) that takes into account the quality, logistic support, modernization and a general mix of inventory. In the annual ranking of WDMMW 2023, the US gained the highest TvR score that is 323.9 and China falls to second with 319.8 TvR score.[20] So, in terms of combat capability, logistic support and technology, the US navy is still the most. powerful.

[18] O'Rourke, China Naval Modernization: Implications for U.S. Navy Capabilities, 7.
[19] Ibid, 8.
[20] WDMMW, Global Naval Powers Ranking (2023), https://www.wdmmw.org/ranking.php.

The Next Wave: Role of AI in the Naval Modernization

Various states have underlined the formidable uses of Al in terms of military to maintain its superiority in battle space and daily life operations. Al-based technologies have profound implications in the military domain to perform complex and challenging missions. The execution Al capabilities are preferred in hostile and unpredictable environments such as maritime space. Oceans are usually difficult to navigate and sometimes unmapped. Al-based systems can be used to augment existing capabilities of naval vessels by detecting, tracking, calculating and outlining the whole plan to execute the best actions. Many areas in operation require constant intelligence, surveillance and reconnaissance (ISR) of ocean environment, and Al-based systems function above the hostilities of marine physics.[21] Moreover, navies can harness the Al systems to detect, map and encounter adversaries' vessels as well. The Al-based unmanned systems have become an indispensable asset for the naval force. The maritime space is expected to be the first battle space where autonomous weapons can be deployed. The Al-based autonomously capable lethal systems are gaining greater salience in the military sector.

- **AI-based Naval Vehicles**

The deliberate use of Al has become part and parcel of naval operations.[22] First, it is important to differentiate Al-based naval combat systems and Al-based naval vehicles. These two Al systems augment the naval capabilities in a distinguished manner. Al-naval combat systems are developed to supplement nautical operations and usually run by human-machine collaboration. Navies prefer the Al application in naval combat systems to upgrade the operational capability and assistance in the decision making in complex scenarios. Al-based

[21] Tuneer Mukherjee, "Securing the Maritime Commons: The Role of Artificial Intelligence in Naval Operations," 159, *Observer Research Foundation,* 2018. https://www.orfonline.org/research/42497-a-i-in-naval-operations-exploring-possibilities-debating-ethics/.
[22] Mehak Dhiman, "The Role of Artificial Intelligence in The Navy," *Centre for Security Studies*, 2021. https://jgu.s3.ap-south-1.amazonaws.com/jsia/Mehak+Dhiman+-+Role+of+AI+and+the+Navy.pdf.

naval vehicles can perform their functions at their best without human supervision. The use of AI in unmanned naval vehicles has been developed from general navigational support to full scale autonomy. These vessels include unmanned surface vehicles (USVs) and unmanned underwater vehicles (UUVs). Most of these vehicles have less autonomy and are operated by tele-piloting by the use of satellite links. A subgroup of these unmanned vessels is categorized as Autonomous Underwater Vehicles (AUVs) and Autonomous Surface Vehicles (ASVs). These autonomous vehicles have a certain degree of autonomy and perform the tasks without any human intervention.[23]

- **AI in Unmanned Naval Vehicles**

In the modern day naval structures, the degree of human control is decreasing and AI-based autonomy is progressively increasing to carry out sophisticated naval missions. Primarily, these vessels are employed for non-lethal missions such as Intelligence Preparation of the Operational Environment (IPOE), Intelligence, Surveillance and Reconnaissance (ISR) and Mine hunters and sweepers. Sean Welsh, security automaton and ethics expert, asserted that complete mission autonomy in naval vessels acts as a force multiplication in maritime domain awareness.[24]

The AI based technology enables the vessels to execute more complex missions with a high autonomous level and interface with other vessels. For instance, Unmanned Surface Vehicles (USVs) provide an optical view of the surface to the submarine in a video communication. The USVs also launch the Unmanned Aerial Vehicles (UAVs) that engage a submarine in surveillance without having to submerge to laparoscopic depth. The best illustration of such a complex system is depicted by the Raytheon Submarine over the

[23] Dr. Alex Valenti, Understanding Artificial Intelligence in a Naval Context, 2022. https://www.armadainternational.com/2022/11/understanding-artificial-intelligence-in-a-naval-context/#:~:text=Automation%2C%20as%20enabled%20by%20simple,critical%20maintenance%20and%20operations%20support.

[24] Sean Welsh, "Lethal Autonomy in Autonomous Unmanned Vehicles," *Center for International Maritime Security,* 2015. http://cimsec.org/lethal-autonomy-autonomous-unmanned-vehicles/16732.

Horizon Organic Capabilities (SOTHOC).[25]

- **ACTUV by DAPRA USA**

In the category of Autonomous Surface Vehicles (ASV), the US Navy's Sea Hunter - best performed the surface level operation. It is called the Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) developed by the Defense Advanced Research Projects Agency. It has participated in the Rim of Pacific 2022 exercises.[26] Such vessels are deployed for large area reconnaissance. It operates to track the submarine and then passes the information to nearby vessels or base stations.[27] China is also aiming to develop autonomous vehicles to counter the US Navy's modernization. The unmanned surface vessel is being developed by China as a rendition of the Sea Hunter (US Navy autonomous surface ship). This information emerged online from Maritime China magazine. It is said that the first trial of the unmanned vessel was conducted near Zhoushan Island. China is aiming to patrol in those areas where enemy's adversarial activities or submarines are expected to be. Moreover, China has developed an unmanned vessel named Zhu Hai Yun that functions as a drone ship for research and exploration. The War Zone magazine suggests using it in military context as a hub of unmanned weapons and for surveillance activities.[28]

- **USA's LOCUST**

Swarming is also a significant development in unmanned systems revolutionizing

[25] "Raytheon, U.S. Navy Demonstrate Unmanned Aircraft System Capability for Submarines," *RTX*, September 10, 2022. https://raytheon.mediaroom.com/index.php?s=43&item=1113.
[26] Megan Eckstein,"US Navy injects first-of-kind unmanned experiments into multinational exercise," *Defense News*, August 19, 2022. https://www.defensenews.com/naval/2022/08/08/us-navy-injects-first-of-kind-unmanned-experiments-into-multinational-exercise/.
[27] Sam LaGrone, "2 Navy Ghost Fleet Unmanned Ships Now in the Western Pacific," *USNI News*, September 22, 2023. https://news.usni.org/2023/09/21/2-navy-ghost-fleet-unmanned-ships-now-in-the-western-pacific.
[28] Emma Helfrich, "This Is Our Best Look Yet at China's Knockoff of the U.S. Navy's Sea Hunter", *The War Zone*, June 9, 2022. https://www.thedrive.com/the-war-zone/this-is-our-best-look-yet-at-chinas-sea-hunter-drone-ship-knock-off.

naval warfare. Swarming implies a group of drones possessing individual autonomy but remotely operated as a whole. It usually involves the mini-tasks of large missions. The US has initiated a research program named "Low Cost Unmanned aerial vehicle Swarming Technology" (LOCUST) to develop this capability.[29] The autonomous and unmanned vessels are constantly learning and adapting from the environment with enhanced capabilities to execute missions.

If such autonomous vessels carry out lethal missions with lethal autonomous weapon system, it would mark an unmatched revolution in the history of technology deployment. The untethered ocean environment is deemed a suitable place for the deployment of Lethal Autonomous Weapons (LAWs). The autonomous underwater and surface vehicles can increase the bandwidth of naval functions by accurately detecting and engaging the enemy targets. Such AI systems provide an undeniable advantage in protecting maritime space against any potential threat.

Competition in Operational Landscape for AI-Based Naval Systems and Unmanned Vehicles

The US and China are the leading competitors in the development and deployment of AI-based naval systems to augment nautical and surveillance capabilities by introducing unmanned maneuvers. The US is directing its attention to a new strategy of building blocks of unmanned tech. It aims at making unmanned surface vehicles in the coming years.[30] Xi Jinping stated at the 20th National Congress of the Chinese Communist Party (CCP) to utilize artificial intelligence in advancing China's military. He was determined to make China a world class military and elevate it on equal footing with the heavy weights of the world. Xi Jinping mentioned the word intelligence three times emphasizing its significance in the use

[29] Irving Lachow, "The Upside And Downside Of Swarming Drones," *Bulletin of the Atomic Scientists,* 73:2 (February 2016): 96-101, https://www.tandfonline.com/doi/full/10.1080/00963402.2017.1290879.
[30] Megan Eckstein, "US Navy Adopts New Strategy Prioritizing 'The Building Blocks' Of Unmanned Tech," *Defense News,* August 19, 2022, https://www.defensenews.com/.

of weapon systems.[31] Moreover, China is harnessing AI technology to detect and trace adversaries' vehicles. China seized an unmanned underwater vehicle in the international waters of South China Sea in 2016. Pentagon officials declared that underwater drone was entitled to collect oceanographic data autonomously.[32] The US Bowditch (US oceanographic survey ship) was retrieving the underwater drone named as ocean glider while the Chinese warship headed to seize the UUV of the US.[33] The Department of Defense calls upon China to return the UUV. The seizure of the glider in international waters is a violation of freedom of navigation norms in compliance with international law.[34] This scenario demonstrated the escalating competition between the US Navy and the PLAN to gain dominance in the international waters.

The US has embarked on integration of AI in military under the Third Offset Strategy aiming to maintain the battle-space superiority. This strategy was formulated under the Obama administration and then successive administrations focus on developing leading-edge technologies to maintain upper hand over potential adversaries.[35] China concentrates on technological innovation to play on the same level with its US counterparts. Under the Xi Jinping administration, prioritized AI-based development and deployment in the military sector. Both Washington and Beijing are trying to develop cost-effective high probability autonomous vehicles that make targeting difficult and overwhelm the capabilities of the

[31]*Koichiro Takagi*, "Can China Build a World-Class Military Using Artificial Intelligence?," *Hudson Institute*, February 7, 2023. https://www.hudson.org/defense-strategy/can-china-build-world-class-military-using-artificial-intelligence.
[32] "Chinese Warship Seizes US Underwater Drone In International Waters," *The Guardian*, December 16, 2016, https://www.theguardian.com/world/2016/dec/16/china-seizes-us-underwater-drone-south-china-sea.
[33] "Pentagon: Chinese Naval Ship Seized an Unmanned U.S. Underwater Vehicle In South China Sea," *The Washington Post*, December 17, 2016, https://www.washingtonpost.com/news/checkpoint/wp/2016/12/16/defense-official-chinese-naval-ship-seized-an-unmanned-u-s-ocean-glider/.
[34] Helnee Cooper, "U.S. Demands Return of Drone Seized by Chinese Warship", *New York Times, 2016. https://www.nytimes.com/2016/12/16/us/politics/us-underwater-drone-china.html.*
[35] Cheryl Pellerin, "Deputy Secretary: Third Offset Strategy Bolsters America's Military Deterrence," US Department of Defense, 2016, https://www.defense.gov/News/News-Stories/Article/Article/991434/deputy-secretary-third-offset-strategy-bolsters-americas-military-deterrence/.

adversary.

Harnessing Power of AI in Naval Vessels

The major powers are exploring the means to incorporate artificial intelligence technologies in their naval fleets that will ultimately increase their effectiveness. It requires long-range sensors, weapons integrated with high speed, and connection between air, surface, and undersea domains. The world's leading navies are progressively cultivating AI to enable their naval vessels and war utensils to operate with high situational awareness and surveillance capability. Viewing rising China as a threat, the Department of Defense emphasizes the use of AI to gain an economic and military competitive advantage. As Lorin Selby, chief naval researcher describes, the potential of artificial intelligence is going to leave a transformative impact, and mastering it is directly proportional to enhancing capabilities.[36]

China's growing naval size grabs most of the attention and concern of its rivals. It has surpassed the US in terms of size (as mentioned in Table 1) and harnessing of a wide range of advanced technologies. It is claimed that PLAN has progressively become comparable in capability to the US. Rob Wittman, Ranking Member on the Sea power and Projection Forces Subcommittee, asserted that only the modern elements of PLAN are concerning for the US. The thing that matters is that they are capable of comparing their ships to the US rather than the total number of ships. The gap between the US and China in quantity (larger navy) is growing by quality.[37] Table 2 enlists highly capable AI-based unmanned or autonomous vessels of both China and the US.

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[36] Rear Admiral Lorin Selby, "Chief of Naval Research Talks about Quantum Tech, Lasers, Basic Research, and STEM Education," *US Naval Institute*, 147/5/1,419, 2021. https://www.usni.org/magazines/proceedings/2021/may/chief-naval-research-talks-about-quantum-tech-lasers-basic-research.

[37] "The Future of U.S. Naval Power: A Conversation with Congressman Rob Wittman," *Hudson Institute*, 2018, https://www.hudson.org/national-security-defense/full-transcript-the-future-of-u-s-naval-power-a-conversation-with-congressman-rob-wittman.

Table 2. Integration of AI in Naval Vessels [38]

State	Vessels Name	Types	Specifications	Range
United States of America	Orca UV	Extra-large Unmanned Undersea Vehicle (XLUUV)	Silent hunter for submarines	6500 nautical miles (autonomous navigation)
	Sea Hunter	Class-III Medium Displacement Unmanned Surface Vehicle (MDUSV)	Anti-submarine Warfare (ASW)	10000 nautical miles
	Sea Hawk	Medium Displacement Unmanned Surface Vehicle (MDUSV)	Upgraded version of Sea Hunter ASW ASuW	12000 nautical miles
People Republic of China	Zhu Hai Yun	AI-Operated Mother Drone Ship	Seaborne drone carrier (touted as maritime research tool)	Scan a 3D Section of Ocean up to 54 nautical miles
	A45 USV	Unmanned Surface Vehicle	Autonomous, High Swarming Capability, Not Easily Detectable	280 nautical miles
	JARI-USV-A	Unmanned Surface Vehicle	Anti-submarine, Anti-missile, Over-the-horizon strike	Search and Strike Submarine within Range of More than 7 kilometers

[38] Data from Four prototype unscrewed surface vessels participate in RIMPAC-22, https://www.naval - technology.com/news/four-uncrewed-surface-vessels-rimpac22/; Orca XLUUV, https://www.naval-technology.com/projects/orca-xluuv/; SEA HUNTER: INSIDE THE US NAVY'S AUTONOMOUS SUBMARINE TRACKING VESSEL, https://defence.nridigital.com/global_defence_technology_may18/sea_hunter_inside_the_us_navys_autonomous_submarine_tracking_vessel; China Showcases New A45 USV At NAVDEX 2023, https://www.navalnews.com/event-news/navdex-2023/2023/02/china-showcases-new-a45-usv-at-navdex-2023/; China's AI-Powered Drone-Ship and Super-Carrier, https://www.spsnavalforces.com/experts-speak/?id=516&h=Chinas-AI-Powered-Drone-Ship-and-Super-Carrier; China's JARI-USV unmanned ship has its first trial: detailed characteristics, https://www.china-arms.com/2020/01/jari-usv-first-trial/.

Table 2 elucidates AI-based vessels of the US and China. There is a broad range of naval vessels and platforms with integrated high-tech and AI-based autonomous systems. While only highly proficient and recently launched vehicles are described. The powerful unmanned vessels have defensive capability while China embarked on the journey of introducing AI-based autonomous systems as scientific research tools. The above-mentioned view is contradicted by researchers who warned the US over a bigger fleet of China. Sam J. Tangredi, former US navy captain, asserted that large fleets facilitate the navy for extensive training, high operational capability and have potential to gain strategic edge over smaller technological fleets.[39] The bigger naval fleet is recognized as a pacing threat to the US. There are 167 state of the art warships highly capable of performing multiple tasks in the unfettered ocean environment. The total number of larger and smaller warships is 340 in 2022 and is expected to project 400 in the next four years. While the US comprised 300 ships in 2022 and aimed to build 350 ships until 2045. Counting on technology is not enough to compete with such a large fleet. The integration of technology with larger fleet size tends to give an upper hand over others.[40] However, AI is still in the nascent stage in the navy and many research programs are underway to test the capabilities and deploy them in the case seas.

Measures to Preserve the US Naval Supremacy

The United States unveiled new maritime strategy (2020) named as "Advantage at Sea" that placed Sea Services at the center of great powers competition. It mentions that security landscape has dramatically changed in the last few years that hostile nations are disturbing balance of power to establish great influence.[41] The high-tech advancement and

[39] Sam J. Tangredi, "Bigger Fleets Win", *US Naval Institute*, 149/1/1,439, 2023, https://www.usni.org/magazines/proceedings/2023/january/bigger-fleets-win.
[40] Brad Lendon, "Expert's Warning to US Navy on China: Bigger Fleet Almost Always Wins," January 17, 2023, https://edition.cnn.com/2023/01/16/asia/china-navy-fleet-size-history-victory-intl-hnk-ml/index.html.
[41] "Advantage at Sea: Prevailing with Integrated All-Domain Naval Power," US Department of Defense, December, 2020. https://media.defense.gov/2020/Dec/16/2002553074/-1/-1/0/TRISERVICESTRATEGY.PDF.

its incorporation in military illustrates the cycles of aggressive modernizations. The unfettered access of the US to the world's oceans is eroding by the rise of powerful high-tech adversaries. The Tri-Services of this maritime strategy watch over the day-to-day competition, conflict or any crisis and closely observed the sophistication of naval vessels of adversaries.

These sea services kept an eye on the growing influence of China and aggressive behavior of Russian federation since the beginning of the 21st century. It specifically mentions the growing sophistication and aggressiveness of China. It locked China and Russia as determinant rivals instead of responsible big powers. The most pressing political, economic and strategic threat is People's Republic of China. The growing naval might of PLAN is threatening the US hegemonic position at the global stage.[42]

Michael Esper (former Secretary of Defense) mentioned AI as the top priority of the Department of Defense for technological modernization. AI is a game changer and an essential tool to gain the mastery of any field.[43] The statements of Russian President Vladimir Putin and China's President Xi Jinping accentuated the importance of artificial Intelligence as the cornerstone of development and advancement.[44]

The view of other competing big powers leads the US to harness AI in competitive military paradigm. That's the compelling reason for the US to introduce AI and autonomy in its weapon system to knock out its adversary before time. The rival powers are leapfrogging in integration of unmanned systems based on AI in military sector. The DoD also set the overarching vision and a road map (FY 2017-2047) to accelerate the integration of unmanned systems. The Department of the Navy has set ambitious goals to develop the rapidly emerging unmanned systems and autonomous systems for naval upgradation. James Geurts,

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[42] Andrew Erskine, "The Dragon and the Tides*," Journal of Indo-Pacific Affairs* (2023): 75-86, https://media.defense.gov/2023/Feb/02/2003154182/-1/-1/1/06%20ERSKINE_FEATURE.PDF.
[43] Dr. Mark T. Esper, "Winning The Future with Artificial Intelligence," Modern War Institute, 2021, https://mwi.westpoint.edu/winning-the-future-with-artificial-intelligence/.
[44] Simon Sharwood, "Xi, Putin declare intent to rule the world of AI, infosec," *The Register*, March 22, 2023, https://www.theregister.com/2023/03/22/russia_china_joint_statement/.

assistant secretary of the Navy for Research, Development and Acquisition, accelerated the high-tech deployment and ensures to maintain naval development at the forefront of emerging capabilities.[45]

Analytical Overview

At the turn of the 21st century, incessant technological development has been witnessed. Countries that are advancing in emerging tech, predominantly in AI, will be able to build political, economic and military muscle for decades. The deliberate use of AI in advancing military technologies generates unremitting competition among the heavyweights of the world. Leading powers of the world are using AI as a tool to increase their global influence. Even smaller states can punch above their weight by leading in AI technology. States that undervalue the potential of AI may jeopardize their national security, economic growth and military competitiveness.

The deliberate use of AI in advancing military technologies generates unremitting competition among the heavyweights of the world. The US and China are at the forefront in integration of AI in military platforms. In this era of renewed great power competition, China's formidable military force development has become the center of focus of America's Department of Defense. China's navy emerged as key challenger to the long-standing status of the US since the end of the Cold War. The pace of PLAN's naval development is viewed as a potential threat to the naval might of the US.

It is leaving aggressive footprints of an expansive navy and is estimated to be the largest naval fleet. China is making obstinate claims to defend its foreign military activities in distant waters. It is making its navy an anti-access/area-denial (A2/AD) force capable of deterring the intervention of the US in its near-seas area. The attempts to displace the US

[45] George Galdorisi and Sam Tangredi, "The Importance and Applications of Artificial Intelligence to Naval Operations," 2021, https://mscconference.com/wp-content/uploads/2021/04/Galdorisi-Tangredi-Naval-Applications-of-AI.pdf.

influence in order to become an indisputable power are threatening the US superior status in the region. In spite of substantially improved naval capabilities, PLAN has limitations and shortcomings in certain areas. Maritime powers have limited capacity to entail territorial aggressions while continental powers are more hostile in this regard. China has both maritime and continental disputes adding fuel to fire. China lacks the conventional global power projection capabilities required to become an undisputed sea power. It has loops and holes in conducting the successful joint operation with military forces of China. It has limited capacity to resupply combatant ships in distant waters and also limited number of overseas bases. It needs to overcome the limitations to fulfill the big dream of China in order to become a greater maritime power. The US has taken number of steps and steeled itself to counter China's growing naval influence. A greater percentage of fleet constituting most capable warships, aircraft and high-tech weapons have been shifted to the Pacific. The US is enhancing the engagement, exercises and cooperation with allied navies to make its presence influential in the region.

Conclusion

Sea power is deemed as an essential attribute to gain great power status. The state that has command and control of the sea will ultimately command the riches of the world and become a claimant of world leader. Maritime choke points hold geo-strategic and geo-economic significance for a nation's interests. Controlling the strategic choke points enables a state to exert its influence and even constrain the functioning of maritime transits. The blockage or forcing the sea vessels to take alternative routes result in economic turbulence of the supplier and recipient economies. Apart from this, the subjacent marine choke points entail the risks of maritime congestion, piracy, terrorism or the control of hostile power. So, geostrategic players struggle to secure the control and command the sea.

This research provides valuable insights into the evolving landscape of sea power in the age of artificial intelligence. The significance lies in the analyses of the competition

between the United States and China through their naval modernization endeavors and lays bare the high-stakes for maritime supremacy. A particular segment revolves around the integration of AI into unmanned naval vessels – a technological marvel that promises to reshape naval warfare. These AI-driven vessels hold the key to maritime supremacy, enabling unparalleled strategic advantage through their autonomous capabilities. The intersection of AI and naval operations provides a novel comprehension of the growing importance of oceans for gaining supremacy. The comparison of vessel advancements and fleet sizes between the US and China showcases their aspirations to become world innovative leaders. This aspect is not only relevant for military strategy but also for technology transfer, innovation, and economic implications, making the research relevant beyond military circles.

This research unravels the narrative of the United States' historical naval supremacy and China's ascent on the maritime stage, depicting a knit of technology, ambition and power. At the crossroads of high end technologies and sea power dynamics, this study goes beyond just stating facts and delves into the implications of these biggest and smartest ships. It deals with the understanding of how these elements shape the very course of nations' standing in the international arena. This study lays the groundwork for future research in multiple fields. It offers to delve deeper into other aspects like AI ethics in naval warfare, the socio-economic impact of naval modernization, and the influence of AI on strategic decision-making.

Disclosure statement

No potential conflict of interest was reported by the authors.