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Uncrewed and Undersea: China's XLUUV Fleet and the Contest for Seabed Surveillance

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Executive Summary:

China is currently threatening the United States' undersea superiority in the Pacific through its development of Extra Large Unmanned Underwater Vehicles (XLUUVs) as part of its broader Transparent Ocean Strategy. The People's Liberation Army Navy (PLAN) has operationalized or is actively developing at least 5 XLUUV models. China intends to use these unmanned platforms to degrade the United States' undersea surveillance system and submarine forces in the Pacific through three primary mission sets: Intelligence, Surveillance, and Reconnaissance (ISR) operations, Mine countermeasures (MCM)/Mine-laying operations, and Anti-submarine warfare (ASW). The open-source synthesis and analysis of China's XLUUV capabilities reveal three key implications for U.S. policymakers:

1. China leads the United States in the development and deployment of XLUUV weapon systems, and the gap is growing.
2. China is the global leader in scaled UUV weaponization.
3. The survival space for U.S. manned and unmanned systems within the First Island Chain is and will continue to shrink.

Problem Statement

Chinese XLUUVs will execute autonomous ISR, MCM/Mine-laying, and ASW missions that will threaten U.S. submarines in the Pacific and deteriorate the U.S. undersea surveillance system. The continued development and deployment of XLUUVs by the PLAN will give them an asymmetric undersea advantage in the Pacific, as the U.S. doesn't currently field them. ***China's program has overtaken those of Western navies and is unmatched globally. In particular, the PLAN fields the most advanced UUVs in greater quantity than all other competing navies combined.ⁱ***

Background:

China's UUV Program:

China's state-sponsored UUV development has expanded exponentially since it began in 1996. In 2015, at least 15 major universities and institutes were conducting research on UUVs.ⁱⁱ By 2019, that number had grown to over 40 universities and institutes with a combined 159 undersea vehicle research projects under development.ⁱⁱⁱ As of 2021, at least 48 Chinese universities and 45 enterprises are conducting major UUV and AUV projects.^{iv} Increases in the Chinese government's investment in UUV and AUV research have directly translated to advancements in military technology. After unveiling its first large UUV in 2019, the PLAN was viewed by analysts as being far behind its competitors in autonomous undersea warfare. In September 2025, China's military parade celebrating the 80th anniversary of the end of World War 2 showcased eight Extra Large Unmanned Underwater Vehicles (XLUUVs).^v This demonstrates not only that China now has more operational large UUVs than all of the world's navies combined, but also that its research and development model is extremely effective.

Transparent Ocean:

Unmanned Underwater Vehicles are a crucial part of an emerging technologies package that enables and complements China's strategy to erode the United States' undersea superiority and help ensure its own maritime dominance in the Pacific. The Transparent Ocean Strategy specifically targets the ability of U.S. and allied submarines to maneuver and go silent in the Pacific. This strategy includes a five-layered sensor architecture from the seabed to space, consisting of a satellite ocean observation constellation, Air-Sea surface observation platforms, a water column observation platform, an undersea grid of cables and sensors, and an AI-enabled data fusion layer known as the "Deep Blue Brain."^{vi} China's ultimate goal is to build a more resilient kill chain within the Pacific. Chinese literature characterizes the Transparent Ocean as a "maritime adaptive kill web" that improves on traditional linear kill chains by allowing multiple paths from sensor to weapon.^{vii} The strategy is still far from maturity but provides much of the impetus for China's drive to develop and procure UUVs.

China's Current Capabilities:

The PLAN's XLUUV program consists of at least five models that have either been fielded or are currently being tested. Other UUVs used by commercial and research enterprises are also relevant given their dual-use nature; however, they are not included here.¹

HSU-001 UUV²: The HSU-001 was the first-ever large UUV unveiled by the PLAN. It was first shown publicly in 2019 at the People's Liberation Army's 70th Anniversary Parade. With a length of 5 meters and an approximate width of 1.5 meters, this vessel is classified as a Large UUV; however, it is the smallest that the PLAN has displayed to date. The vessel is diesel-electric-powered, and its size suggests it will primarily be used for intelligence, surveillance, and reconnaissance (ISR) purposes. However, Chinese analysts suggest it can carry externally mounted weapons, such as torpedoes and mines.^{viii} The vessel has two distinct sensor masts that can be reclined and folded down into the hull. The forward mast houses an "advanced electro-optical detection system," along with cameras and sensors. The rear mast is taller but thinner and acts as a communications mast.

UUV300 XLUUV³: The UUV300 is a class of UUVs first exhibited at the 2024 Defense Services Asia (DSA) Conference in Kuala Lumpur, Malaysia. Within the UUV300 class, the UUV-300CB model was presented and classified as an XLUUV due to its 11.5-meter length and 2-meter width. This size is considered particularly advantageous because the UUV can be launched from a truck rather than requiring port facilities. Weighing 50 tons, the vessel has an operating depth of 300 meters, an approximate range of 450 nautical miles at 5 knots, and a top speed of 12 knots. Powered by an electric engine, the UUV has a relatively low acoustic signature, emitting less than 140 dB. The UUV-300 class is described as a "multifunctional underwater drone" capable of autonomous reconnaissance, mine-laying, and anti-submarine warfare. It can be armed with both torpedoes and mines, and some variants appear to be capable of launching land-

¹ See Appendix A & B for more on XLUUVs and research UUVs.

² See Appendix D, Image 1.

³ See Appendix D, Image 2.

attack missiles; however, this hasn't been explicitly stated by Poly Technologies or the PRC.^{ix} Regardless, the UUV300 XLUUV is a weaponized system.

*HSU-100 XLUUV*⁴: The HSU100 underwater drone was first introduced at a Chinese military parade in early September 2025, celebrating the 80th anniversary of the end of World War 2. Imagery from the parade indicates that the PLAN has at least 3 operational HSU-100 UUVs.^x With an approximate length of 15 meters and a diameter of 3 meters, the vessel is classified as an XLUUV. For propulsion, the UUV uses X-form rudders at the stern with a ducted propeller, suggesting relatively high maneuverability. While not explicitly stating a range, Chinese analysts characterize the HSU-100 as capable of executing long-term, long-distance reconnaissance and seabed mapping missions.^{xi} To this end, the vessel has a thorough sensor suite. The hull includes a flank array sonar and two retractable masts equipped with electro-optical and electromagnetic sensors. The vessel's large bow enables heavier payloads and long-term missions, and it likely contains a passive sonar array.^{xii} This system has not been weaponized and appears to be a UUV primarily dedicated to ISR.

*AJX002 Underwater Drone*⁵: Along with the HSU-100, the AJX002 underwater Drone was originally introduced at a Chinese military parade in early September 2025. Imagery from the parade indicates that the PLAN has at least 5 operational AJX-001 UUVs.^{xiii} With an approximate length of 18 to 20 meters and a diameter of 1-1.15 meters, the vessel is classified as an XLUUV. Analysts state that this XLUUV model has an approximate range of at least 1,000 nautical miles based on its size and the previous performance of similar models used by other countries. Extended autonomous missions will be enabled by lithium-based batteries, which account for about half of the hull.^{xiv} For propulsion, it uses a Pump-jet system, which the United States' Virginia-class SSNs also use for its significantly lower acoustic noise compared to conventional propeller systems.^{xv} The vessel has four lifting lugs on the hull, suggesting it is deployed by crane and can be launched from a surface vessel or a port. Official Chinese commentary has confirmed that these vessels are weaponized and will serve as dedicated mine-laying systems.^{xvi}

China's XLUUV Fleet's Concept of Operations

China's UUV programs will be applied to three primary Concepts of Operations: ISR, Mine Countermeasures, and Anti-Submarine Warfare.

Intelligence, Surveillance, and Reconnaissance (ISR):

China's intent to employ XLUUVs for ISR, enabling surveillance and seabed mapping, underscores the importance of all its UUV programs. Often described by Chinese media outlets as the "vanguard of underwater reconnaissance and surveillance", China has procured UUVs for this purpose from the very beginning. Chinese defense literature indicates that ISR CONOPS are currently the PLAN's most mature application of UUVs.^{xvii} Unmanned platforms can provide both independent ISR functions and operate within an ISR network. According to research from the PLAN Command College, specific application scenarios that China may implement include

⁴ See Appendix D, Image 3.

⁵ See Appendix D, Image 4.

autonomous observation and measurement of complex sea environments or key waterways, screening of key enemy ports or coasts, and comprehensive reconnaissance of specific targets.^{xviii} This aligns with the previously stated purposes of the PLAN's operational UUV fleet. For example, the first large UUV operationalized by the PLAN, the HSU-001, was designed to remain on the ocean floor for extended periods whilst providing observations and measurements of its surroundings.^{xix}

Mine Countermeasures/Mine Laying Operations

China intends to use XLUUVs for both mine countermeasures (MCM) and covert mine-laying operations. Chinese research and commercial institutions have been publishing on the potential of UUVs for MCM and mine deployment since 2013.^{xx} Today, China has at least five XLUUVs dedicated to this mission. PLAN XLUUV MCM operations will likely take two forms. First, XLUUVs will act as extensions of manned platforms and will navigate ahead to detect and neutralize mine targets as directed by command personnel. Secondly, UUVs will serve as parent ships for smaller mine countermeasures, such as detection-type and disposal-type UUVs.^{xxi} Chinese analysts believe that with increased development and procurement of advanced technologies, MCM may become the most practical application of UUVs.^{xxii} The PLAN will likely use XLUUVs to carry out covert mine-laying operations as well. According to the People's Daily's science and technology commentary, the AJX002 will target enemy ships and coastal facilities by executing autonomous, rapid, covert mine-laying missions to block the advance of enemy naval forces.^{xxiii}

Anti-Submarine Warfare (ASW)

China intends to use XLUUVs for Anti-Submarine Warfare, particularly to disrupt U.S. undersea dominance in the Pacific. There are three main scenarios in which the PLAN views XLUUVs as advantageous to ASW: Area search, Pre-positioned ASW, and Coordinated ASW.^{xxiv} Area search operations involve parent platforms that deploy UUVs in designated areas to autonomously navigate, search for, and locate enemy submarines. Pre-positioned ASW operations place UUVs at key waterways and port areas to ambush enemy submarines as they pass through. Coordinated ASW operations have XLUUVs conduct ASW in cooperation with main anti-submarine forces. Progress on autonomous torpedoes targeting and further weaponization of unmanned platforms suggests the PLAN treats these scenarios as more than just concepts.^{xxv} China's intent to use these platforms for ASW is also evidenced by the technology it is developing. PLAN research institutions have been developing undersea signature libraries for target detection and recognition, as well as AI-based sonar image processing systems.^{xxvi} These technological advances suggest Chinese XLUUVs may be expected to target and attack adversarial submarine platforms autonomously. Furthermore, the notion of UUV "shark swarms" as a heterogeneous element of a kill chain strengthens the claim that XLUUVs will be used in groups to complement manned platforms and current ASW strategies.^{xxvii} Important to ASW operations, Chinese XLUUVs will be used to disrupt and destroy U.S. underwater sensors and nodes directly. Experts at the Chinese Academy of Military Science have stated that the U.S. military's surveillance network in the Pacific is especially vulnerable to soft kill and hard destruction measures.^{xxviii}

Policy Implications for the United States

China's fielding of UUV and XLUUV systems in the Pacific raises three implications for American defense policy:

1. China leads the United States in the development and deployment of XLUUV weapons systems, and the gap is growing.

China has solidified itself as a world leader in XLUUV development. Through centralized R&D and funding, China has developed a mature unmanned weapons systems industrial ecosystem, enabling it to produce UUVs and other unmanned platforms at scale. In September 2025, China unveiled 8 operational XLUUVs, more than all other nations combined. In the same amount of time China took to field these vessels, the United States has struggled to field even one. The U.S. Navy's *Orca* XLUUV program, which was originally slated to deliver one vessel by 2020 and five by 2025, delivered only one prototype in 2023 and has cost approximately \$885 million.^{xxixxxx}

2. China leads the globe in weaponizing UUVs at scale.

China has demonstrated a willingness to weaponize UUVs at levels not observed in competing Western countries. As mentioned previously, at least three PLAN UUV models are, or can be, weaponized. While Western Navies have expressed intent to develop UUVs with weapons payloads, no other Navy has publicly confirmed a fielded XLUUV with weapons capabilities. This represents a clear advantage for China and signals that the United States' undersea surveillance system and submarine forces still weigh heavily on the Chinese strategic calculus in the region. Willingness to weaponize may lead to the proliferation of weaponized UUVs among other countries. Given the speed and centralization of China's UUV industry, weaponized models that the PLAN does not select may be exported to other navies.

3. The survival space for U.S. manned and unmanned systems within the First Island Chain is and will continue to shrink.

Along with the development of the Transparent Ocean Strategy, emerging Chinese XLUUV capabilities give China an asymmetric advantage that will directly deteriorate the United States' undersea surveillance system in the Pacific. PLAN analysts suggest that an asymmetric XLUUV capability could create an "Achilles' heel" within the U.S. undersea surveillance system, as these unmanned platforms could directly destroy U.S. nodes and sensors.^{xxxi} U.S. submarines in the Pacific would also face novel threats. Due to the low cost and covert penetration capabilities of China's UUVs, they can be used for ASW more aggressively than traditional submarines. These threats may extend beyond the First Island Chain. If China operationalizes an Ultra-large UUV with an approximate range of 10,000 nautical miles, it may gain the capability to threaten U.S. naval platforms in the eastern Pacific and port areas on the western coast of North America.⁶

⁶ See Appendix B for more information on China's "Ultra-Large UUV" capabilities

Appendix A: Index of Chinese UUV Capabilities

Model	Classification	Length (meters)	Diameter (meters)	Propulsion/Power Source	Range(Nautical Miles)	Mission
HSU-001	UUV	5	1.5	Diesel-electric	N/A	ISR
UUV-300	XLUUV	11.5	2	Electric	450/5 knots	Multifunctional
HSU-100	XLUUV	15	3	X-form rudders + Ducted Propeller	N/A	ISR/ASW
AJX002	XLUUV	18-20	1	Pump-Jet/Electric	1,000	MCM/Mine-laying
XXL UUV	XXLUUV	40-42	5	X-form rudders + Diesel-electric	10,000	ASW
Glider	UUV	N/A	N/A	Buoyancy Propelled	N/A	ISR

Appendix B: Ultra Large UUVs

Ultra Large UUVs (XXLUUVs):⁷

China is pursuing the development of at least two Ultra Large UUVs (XXLUUV). These vessels are approximately 40-42 meters long and 5 meters wide, making them look more like conventional submarines than UUVs.^{xxxii} As of October 2025, these UUVs are being tested in the waters surrounding Hainan in the South China Sea and are therefore not yet operational. They have X-form rudders at the stern, but do not have traditional submarine sails. The vessels most likely rely on diesel-electric propulsion, as evidenced by models released by the China State Shipbuilding Corporation (CSSC).^{xxxiii} CSSC claimed that these vessels have an underwater range of 3,000 nautical miles and a surfaced range of 10,000 nautical miles. Analysts believe these figures could be higher due to the large battery bank, which accounts for most of the hull volume.^{xxxiv} There has been little to no indication that these XXLUUVs have been weaponized. However, models published by the CSSC demonstrated a capability to arm these vessels with torpedoes, mines, and smaller underwater drones.^{xxxv} While analysts are unsure as to what these vessels will be used for, the speed and scale at which these weapons systems are already being developed illustrate China's desire and ability to be a leader in the UUV space.

Appendix C: Research UUVs

'Sea Wing' (Haiyi) glider UUV⁸

The Haiyi glider UUV is a buoyancy-propelled UUV that China has deployed since at least December 2019.^{xxxvi} This vessel provides persistent ISR and can operate autonomously at sea for months at a time. The design is fairly basic as it only carries a sensor payload and a communication antenna from its tail. However, given their small size and top speed of only 1 knot, these unmanned platforms must be deployed in large groups or swarms to be truly effective.^{xxxvii}

The Haiyi UUV is one of many gliders that China is capable of deploying. Before the introduction of weaponized XLUUVs, the foundation of the PLAN's UUV program had been portable, lightweight models, such as undersea gliders. These free-swimming platforms can reliably surveil undersea environments and transmit data to surface vessels and ground stations. The PLAN currently plans to deploy them in areas where China doesn't have land to construct fixed undersea arrays, such as the Philippine Sea and the northern South China Sea.^{xxxviii} However, these vessels are primarily developed and produced to collect oceanographic measurements for research and commercial enterprises, making it difficult to determine the extent to which the PLAN also uses these platforms.^{xxxix}

⁷ See Appendix D, image 5.

⁸ See Appendix D, image 6.

Appendix D: Images

Image 1: HSU-001^{xl}



Image 2: UUV-300CB^{xli}

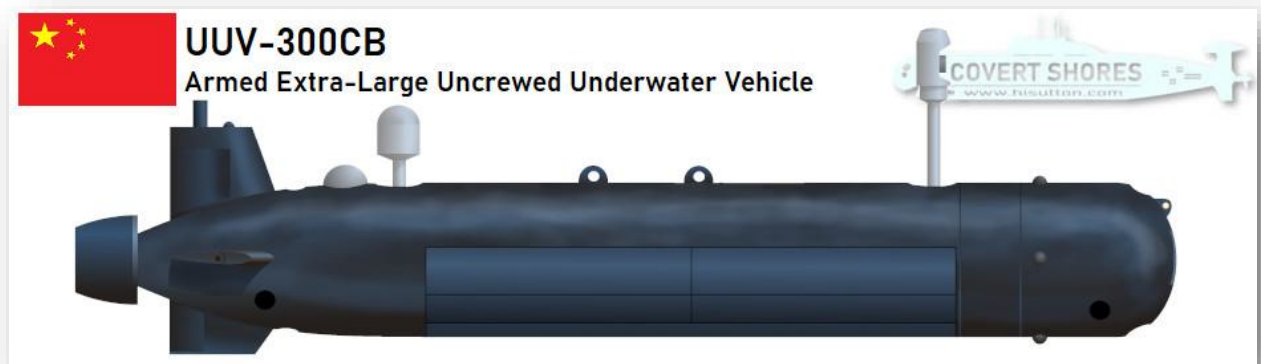


Image 3: HSU-100^{xlii}



Image 4: AJX002^{xliii}

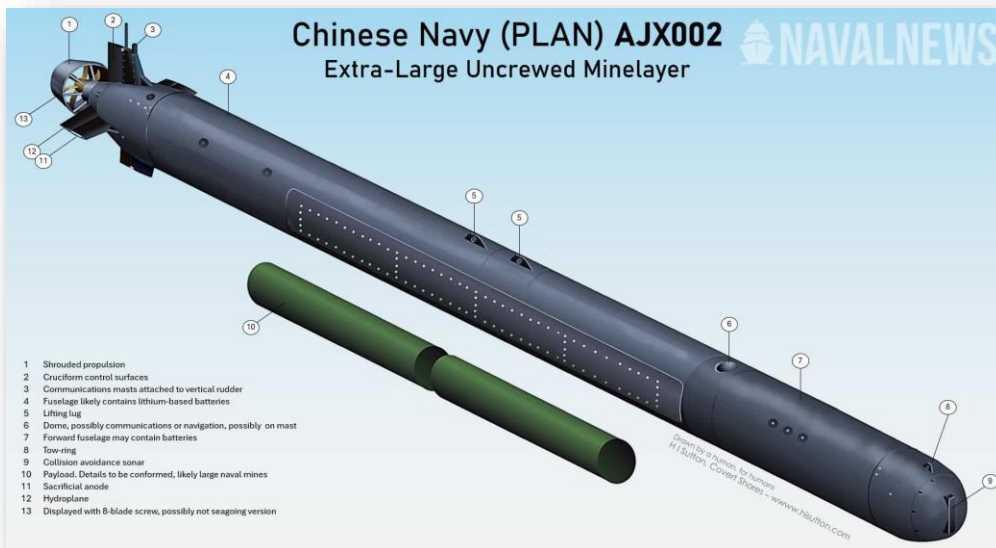


Image 5: China's XXLUVs^{xliv}

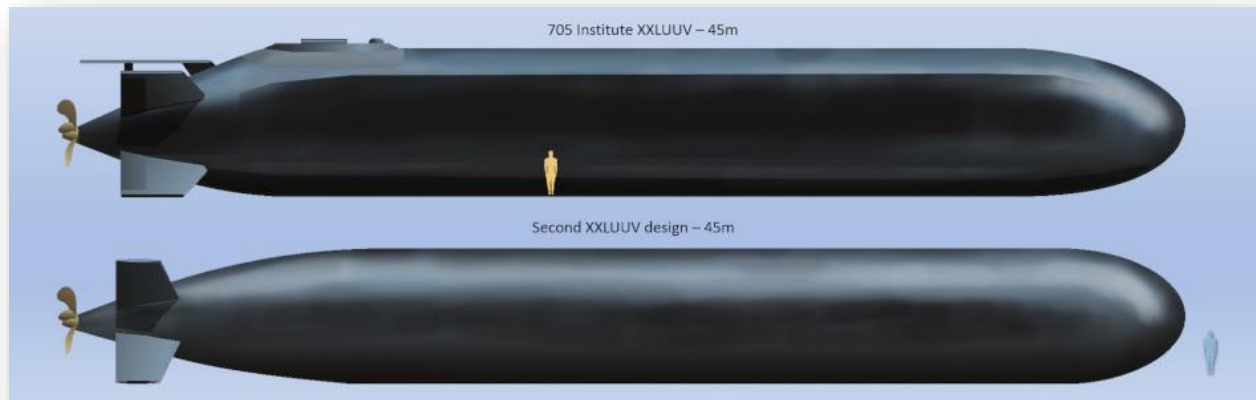


Image 6: 'Sea Wing' (Haiyi) glider^{xlv}



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