



China's Undersea Strategy - Investing in Emerging Capabilities to Undermine American Superiority

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Introduction

The People's Republic of China (PRC) is part-way through arguably the most consequential expansion of undersea military power in the post-Cold War era, designed to undermine American undersea superiority. China's submarine modernization program focused on nuclear-powered and nuclear-armed submarines has drawn considerable attention in Washington, but over time, Chinese investments in alternative undersea capabilities, especially uncrewed underwater vessels (UUVs) could transform the naval balance of power in the Indo-Pacific.

China's ambitious approach to the undersea domain in general, and especially UUVs, could present a growing challenge to the United States Navy, especially in narrower areas like the Taiwan Strait. Over a 10–15-year period, China's attempts to turn emerging technologies into new capabilities will likely mirror those of the United States. Lacking the defense industrial base constraints faced by the United States, and with higher risk tolerance for deploying imperfect systems, though, China could easily end in the lead in fielding emerging capabilities in the undersea domain.

China's Transparent Oceans strategy in combination with its UUV development show that China has the ambition, though not yet the capacity, to leverage emerging technologies to challenge America's undersea military power. Greater Chinese undersea capacity would make deterring Chinese ambitions surrounding Taiwan and elsewhere in the region much more difficult, since the stealth and striking power of America's SSNs are unmatched. In what follows, I describe China's motivations for undersea modernization featuring emerging capabilities, then discuss two arenas for that modernization, uncrewed underwater vehicles (UUVs) and the Transparent Oceans initiative. Publicly available information about all of these arenas is limited, however, making these conclusions necessarily tentative. Additional research and analysis are needed.

Why Undersea Modernization

China's investment in the undersea domain flows directly from core security imperatives that include asserting sovereignty over disputed maritime territories, deterring or defeating American military intervention in a Taiwan contingency, and projecting power beyond the First Island Chain. In the Indo-Pacific, undersea superiority is critical to overall US military superiority. The undersea domain is where the United States maintains its largest comparative advantages vis-a-vis the People's Liberation Army Navy (PLAN) but given that the United States Navy has been slow to embrace uncrewed systems, there is an opening for China to develop an edge outside of traditional nuclear-powered submarines. Additionally, within the First Island Chain, since it is close to home, China has the capacity to build extensive underwater sensor and related sub

seabed capabilities that could complicate Western naval efforts in the area over time. China's pursuit of undersea capability modernization reflects a clear assessment about the character of US-China military competition. The maritime domain—especially beneath the surface—offers both vulnerability and opportunity for China. Given China's growing dependence on sea lines of communication for energy imports and trade, and with a Navy increasingly focused on potential conflict with the United States, the undersea realm is central to deterrence, denial, and escalation control.

First, China undoubtedly views undersea systems as complicating US operational planning. The United States and its allies have long enjoyed advantages in undersea warfare, particularly in submarines and anti-submarine warfare (ASW). By expanding its own fleet of advanced submarines and increasingly sophisticated uncrewed underwater vehicles (UUVs), along with sensors and other undersea payloads, China can seek to offset those advantages.

Second, China's pursuit of both larger-format and smaller, cheaper undersea platforms is consistent with the age of precise mass in war, where states are seeking lower-cost quantity given the intersection of advances in artificial intelligence and autonomous, new manufacturing techniques, and the spread of precision guidance.¹ Autonomous and long-endurance systems, in particular, offer persistence at lower cost, allowing Beijing to surveil contested waters and threaten surface forces. In particular, as costs rise for exquisite platforms, even for Beijing, UUVs can complement existing naval force structure for China and other emerging capabilities such as USVs. Given China's willingness in other domains to not let the perfect be the enemy of the good when it comes to fielding capabilities, such as in anti-ship missiles, we should expect the same in the undersea domain as China uses quantity to become a form of quality.

Finally, the undersea domain provides a degree of ambiguity that can enhance deterrence for China's Navy. Uncertainty about the location, payload, and mission of undersea systems can impose caution on competitors. In a competitive maritime environment, that ambiguity is itself a strategic asset.

China's UUV Ambitions in Context

China's systematic investment in autonomous undersea vehicles began in earnest in the early 2010s. As early as 2021, more than 48 universities and 45 enterprises across China were participating in UUV programs. In 2019, the Chinese Society of Naval Architecture counted 159 active undersea vehicle research projects at more than 40 universities. The expansion likely

¹ Michael C. Horowitz. "Battles of Precise Mass: Technology Is Remaking War—and America Must Adapt." *Foreign Affairs* Vol. 103, no. 6 (November/December 2024). <https://www.foreignaffairs.com/world/battles-precise-mass-technology-war-horowitz>.

reflects China's civil-military fusion approach integrating the defense establishment and civilian research institutions.²

Existing evidence suggests that three major state-owned research institutes participate in China's program. These include the China Shipbuilding Industry Corporation (CSIC)'s 701 Research Institute, one of China's ship design institutes, which has produced the Haishen 6000 ("Poseidon 6000"), a 25-foot prototype capable of diving to 6,000 meters. It contains ultra-short baseline positioning, an aircraft black box search sonar array, deep-sea side-scanning sonar, forward-looking sonar, and underwater cameras.³ At the Chinese Academy of Sciences, the Shenyang Institute of Automation has pursued a parallel track through its Qianlong ("Hidden Dragon") AUV series — vehicles that have set Chinese records for both depth and endurance — alongside the Sea Wing underwater glider program.⁴

China is simultaneously developing and moving towards fielding a range of UUVs from the smaller sizes being pursued by the United States Navy and other navies all the way up to larger sizes unmatched by any country even in ambition.⁵ While in 2019, early Chinese UUVs appeared behind their western counterparts, one analyst argues today that those early designs "now appears toy-like compared to what has followed."⁶ At China's military parade on September 3, 2025 — marking the 80th anniversary of the end of World War II — Xi Jinping displayed the programs progress. Xinhua described the undersea formation as "cutting-edge surprise weapons for naval combat."⁷

For example, China is pursuing a XXL UUV program with two different designs, each of which measures about 40 meters in length. For comparison sake, China's *Shang*-class SSNs measure

² Ryan Fedasiuk. "Leviathan Wakes: China's Growing Fleet of Autonomous Undersea Vehicles." *Center for International Maritime Security (CIMSEC)*, August 27, 2021. <https://cimsec.org/leviathan-wakes-chinas-growing-fleet-of-autonomous-undersea-vehicles/>.

³ "CSIC Unveils New Haishen 6000 UUV at Airshow China 2022." *Army Recognition*, November 2022. <https://www.armyrecognition.com/archives/archives-naval-defense/naval-defense-2022/csic-unveils-new-haishen-6000-uuv-at-airshow-china-2022>.

⁴ Fedasiuk. "Leviathan Wakes: China's Growing Fleet of Autonomous Undersea Vehicles."

⁵ The only country close in ambition to China at the high end of UUV capabilities is Russia. Russia's much-discussed Poseidon 2M39 (NATO nickname: Kanyone) is a nuclear-powered UUV that would be launched from a submarine, with a reported size of 24 meters, range of 10,000 nautical miles, and ability to carry conventional or even nuclear payloads. Zuzanna Gwadera. "Russia's Burevestnik and Poseidon Tests." *IISS Missile Dialogue Initiative*, November 20, 2025. <https://www.iiss.org/online-analysis/missile-dialogue-initiative/2025/11/russias-burevestnik-and-poseidon-tests/>.

⁶ H. I. Sutton, "Chinese Navy (PLAN) Extra-Large & Extra-Extra-Large Underwater Vehicles," *Covert Shores*, October 27, 2025, <https://www.hisutton.com/Chinese-XLUUVs.html>.

⁷ Xinhua News Agency, as reported in David Rising, "China's Military Parade Reveals New Hypersonic Missiles, Drone Submarines and ICBMs," *Associated Press*, September 3, 2025, <https://www.pbs.org/newshour/world/photos-chinas-military-parade-reveals-new-hypersonic-missiles-drone-submarines-and-icbms>.

about 110 meters in length.⁸ As of fall 2025, China is testing both designs in the South China Sea, and at least one appeared in the September 2025 PLA parade.⁹ A XXLUV of that size could more easily deploy into blue water without support vessels, compared to XLUV designs such as China's AJX-002, which is 17 meters with a range around 1,000 nautical miles. A UV the size of the XXLUV design could carry multiple sophisticated payloads, including torpedoes, mines, or other sub-seabed options. The United States has no comparable UV program underway. Table 1 compares the size of China's XXLUV program to the largest American UV program, the Orca, and Australia's Ghost Shark. Note the larger size and range of China's UUV's relative to the United States and Australia.

Platform Name	XXLUV (China)	Ghost Shark (Australia)	Orca (United States)
Size (length X diameter)	40 meters X 2-3 meters	12 meters X 2-3 meters	26 meters X 2.6 meters
Speed	37 km/h (claimed)	13 km/h	15 km/h
Range	18,500km	1,600km	12,000km
Mission Set	Long-endurance, highly autonomous operations, mining, long-range ISR, deploying sub-UUVs and torpedoes	Long-range ISR, strike operations, ASW, and mine countermeasures, seafloor warfare	Long-endurance ISR, minelaying, EW, seabed warfare, anti-submarine, anti-ship, and direct strike capabilities, with high payload capacity

China's UUV portfolio includes a number of other capabilities as well. There is limited publicly available information, meaning the descriptions below are incomplete in some places and uncertain in others. In combination with the XXLUV, these capability development efforts show China is making substantial progress in fielding UUVs that could give China substantial capabilities in the Taiwan Strait and South China Sea.

⁸ The Nuclear Threat Initiative. "China Submarine Capabilities." *NTI: Strategic Naval Developments*, November 19, 2025. <https://www.nti.org/analysis/articles/china-submarine-capabilities/>.

⁹ H.I. Sutton, "China Moves Two Super-Sized XXL Uncrewed Submarines to South China Sea." *Naval News*, September 2025. <https://www.navalnews.com/naval-news/2025/09/china-moves-two-super-sized-xxl-uncrewed-submarines-to-south-china-sea/>.

- **HSU-001:** Large Displacement Unmanned Underwater Vehicle (LDUUV) unveiled in 2019. The HSU-001 is reportedly 5 meters in length and 1 meter in diameter, diesel-electric powered, and designed for surveillance missions, including a homing system in its bow. Given the size, unless configured for one-way attack, the HSU-001 would not be appropriate for underwater combat, though it could carry a small contingent of mines. With its small size and limited payload capacity, the HSU is probably not designed for underwater combat. It is possible that the HSU-001 could be configured to lay a small number of mines, though there is limited public information.¹⁰
- **UUV-300:** At the DSA military technology exhibition in Kuala Lumpur in 2024, Chinese company Poly Technologies exhibited the UUV-300. The UUV-300 has a length of 11.5 meters and a diameter of 1.6 meters. Compared to the HSU-001, its claimed range is significantly smaller, just 450 nautical miles (834 km), with a speed of 5 knots. The model had an internal optronic mast, a diesel-electric engine, and lithium batteries for power storage. More important, like Australia's Ghost Shark, the UUV-300 displayed in 2024 had the capacity to launch one or more torpedoes. Since the 2024 showcase, the system has not received notable coverage, so its current status is not clear.¹¹
- **AJX-002:** The AJX-002 was prominently displayed at the September 3, 2025 parade celebrating the 80th Anniversary of the end of World War II. Publicly available sources state it is 18-20 meters with a likely maximum speed of 30 knots. The larger size means it could carry more exquisite surveillance payloads, naval mines, or torpedoes. There is limited available information about its potential range, but given the size, it should have a range of at least 1,000 nautical miles.¹²
- **HSU-100:** Also demonstrated at the 80th anniversary parade near the AJX-002, the HSU-100 appears to be a different UUV. Though similarly sized, the HSU-100 has a wider-

¹⁰ Lyle Goldstein "UUVs Are Giving China New Means of Naval Attack." *The National Interest*, March 29, 2021. <https://nationalinterest.org/blog/reboot/uuvs-are-giving-china-new-means-naval-attack-179452>. Also see H.I. Sutton. "China Reveals New Robot Underwater Vehicle HSU-001." *Forbes*, October 1, 2019. <https://www.forbes.com/sites/hisutton/2019/10/01/china-reveals-new-robot-underwater-vehicle-hsu-001/>.

¹¹ Tayfun Ozberk. "DSA 2024: New Torpedo-Launching UUV from China." *Naval News*, May 7, 2024. <https://www.navalnews.com/naval-news/2024/05/dsa-2024-new-torpedo-launching-uuv-from-china/>. Also see Brandon J. Weichert. "Why China's XLUUV Drones Are Sea Monsters." *The National Interest*, August 19, 2025. <https://nationalinterest.org/blog/buzz/why-chinas-xluuv-drones-are-sea-monsters-bw-081925>

¹² US Army Training and Doctrine Command. "OE Data Integration Network." 2025. <https://odin.tradoc.army.mil/WEG/Asset/ae94b2cbf1b14837b7812fe0525318dd#:~:text=The%20AJX%2D002%20is%20a%20Chinese%20Extra%2DLarge%20Unmanned,posture%2C%20threaten%20naval%20formations%20and%20coastal%20infrastructure>. Also see H.I. Sutton. "What the World Is About to Learn About China's Extra-Large Underwater Drones." *Naval News*, August 2025. <https://www.navalnews.com/naval-news/2025/08/what-the-world-is-about-to-learn-about-chinas-extra-large-underwater-drones/>. Also see Chen Chuaren. "China Rolls Out New Unmanned Underwater Systems in Parade FOC." *Asian Military Review*, September 2025. <https://www.asianmilitaryreview.com/2025/09/china-rolls-out-new-unmanned-underwater-systems-in-parade-foc/>.

diameter body, X-form rudders, and twin retractable masts, suggesting a greater emphasis on intelligence, surveillance, and reconnaissance.¹³

UUVs are cheaper and faster to produce than traditional nuclear or conventionally powered submarines, require no crew risk, can be deployed in large numbers, operate with plausible deniability below the threshold of armed conflict, and can execute missions in denied environments where sending a manned platform would be politically or operationally unacceptable. For a navy that acknowledges in its own internal documents that its manned submarines are already highly vulnerable to the U.S. undersea surveillance system, autonomous undersea platforms offer an asymmetric path to regain the initiative.

China's navy wants to integrate UUVs across three distinct but overlapping mission sets: persistent surveillance and seabed mapping to enable future operations; offensive combat operations including mine warfare, anti-submarine warfare (ASW), and strike; and the targeting of critical undersea infrastructure such as fiber-optic cables and sensor networks that form the nervous system of American power projection.

The Transparent Ocean: China's Proposed Seabed Sensor Network

China's UUV program is part of a package of undersea development of emerging capabilities that includes technologies being developed as part of China's "Transparent Ocean" strategy. Undersea communication is notoriously difficult in ways that make visions of outcomes like AI-enabled oceanic transparency unlikely. That being said, China is attempting to create a network of sensors from the seabed to space that would help China track and defeat American undersea capabilities.

The architecture consists of five layers: fixed seabed observatories and passive arrays connected by undersea cables (the backbone); relay buoys capable of switching dynamically among satellite, cellular, and acoustic links; surface and air surveillance platforms; a space-based ocean observation constellation; and a deep AI-enabled data fusion layer described in PLA literature as the "Deep Blue Brain."¹⁴

China seeks to leverage AI to fuse together those sensors in real time to create a seamless maritime kill web. From placing sub seabed sensors to placing long duration underwater vehicles that can detect even small movements, China is starting to move forward with the system. To be

¹³ Alex Luck. "Chinese Military Parade Highlights Naval Drones and Missiles." *Naval News*, September 2025. <https://www.navalnews.com/naval-news/2025/09/chinese-military-parade-highlights-naval-drones-and-missiles/>.

¹⁴ Tye Graham and Peter Singer. "China's Burgeoning Undersea Sensor Net Aims to Turn the Ocean Transparent," *Defense One*, October 15 2025, <https://www.defenseone.com/threats/2025/10/chinas-burgeoning-undersea-sensor-net-aims-turn-ocean-transparent/408815/>.

clear, what China's military is seeking to do with AI to fuse together sensors into a kill web is exactly what the American military is seeking to do - and should do to take advantage of advances in AI capability. But the scope of the investments and favorable geography mean that China's moves are a clear threat to US undersea superiority over time.

The system is still in development at this point, from the sensors themselves to the algorithms that would fuse everything together in a kill web. For example, existing sources cite work by Zhejiang University and the China Academy of Sciences, meaning the systems are still in research and development and prototyping, rather than fielding.¹⁵ But the intent is clearly there today. China seeks to turbocharge the transparent oceans initiative with quantum sensing. Just as in AI, China is competing with the US for leadership in quantum technologies, including but not limited to quantum sensing. While there are questions about whether China's model of research centralization in the quantum space will succeed - and it is unclear whether there is a Chinese quantum counterpart to DeepSeek in the AI space - China has clearly recognized the value of leadership in quantum. After cryptography, sensing is one of the most obvious areas where quantum breakthroughs could pay off in real world capabilities.¹⁶

For an example of progress China is making in quantum sensing, one report says that "Chinese researchers have developed and tested a drone-mounted quantum sensor that could allow faster and more accurate detection of submarines and underwater features, according to a study published April 16 in the *Chinese Journal of Scientific Instrument*."¹⁷ The goal of that set of experiments is to use Coherent Population Trapping (CPT) atomic magnetometers to detect magnetic ripples as submarines pass by, enabling more effective and efficient tracking. This would require emplacement of a huge sensor net in areas such as the Taiwan Strait or South China Sea, but China is investing heavily already.¹⁸

Unlike in the UUV space, it is difficult to directly compare progress by China to the United States, in part because China has been so secretive about how its quantum investments are proceeding, particularly in the area of quantum sensing.

Conclusion

¹⁵ Gabriel Honrada, "China's AI Sea Grid Aims to Render US Subs Transparent," *Asia Times*, October 20, 2025, <https://asiatimes.com/2025/10/chinas-ai-sea-grid-aims-to-render-us-subs-transparent/>.

¹⁶ Joseph Federici, with Matthew Dagher-Margosian, *Vying for Quantum Supremacy: U.S.-China Competition in Quantum Technologies* (Washington, DC: U.S.-China Economic and Security Review Commission, November 18, 2025), <https://www.uscc.gov/sites/default/files/2025-11/Vying%20for%20Quantum%20Supremacy%20U.S.-China%20Competition%20in%20Quantum%20Technologies.pdf>.

¹⁷ Matt Swayne, "China Tests Drone-Mounted Quantum Sensor That Could Reshape Submarine Detection," *The Quantum Insider*, April 27, 2025, <https://thequantuminsider.com/2025/04/27/china-tests-drone-mounted-quantum-sensor-that-could-reshape-submarine-detection/>.

¹⁸ Swayne, "China Tests Drone-Mounted Quantum Sensor That Could Reshape Submarine Detection,"



China is not just attempting to challenge American undersea superiority today but is planning for tomorrow. China is pursuing emerging capabilities in the UUV and sensor spaces to give them the ability to detect and defeat US submarines and other undersea warfare assets in the Taiwan Strait and First Island Chain, and beyond. If China's UUV capabilities on paper match the reality in the watch – which to be fair is unclear – China has become a global leader in the autonomous undersea capabilities. No other nation — including the United States — is pursuing undersea autonomy at comparable scale, scope, or speed. While there will be technical limits to the success of the Transparent Oceans initiative, because of the inherent limits not just of undersea sensing, but the communications to make that sensing actionable, technical breakthroughs are possible if not plausible.

Success with China's UUV program and Transparent Oceans initiative would make it harder for the United States Navy, as presently constituted, to maintain undersea presence in the First Island Chain, substantially undermining deterrence. It will be critical for the United States Navy to continue innovating to stay ahead to maintain the stealth and striking power that comes with undersea advantage.