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翻译

TRANSLATIONS

**Vision for Future Next-Generation
Aircraft Carrier Supply Ships**



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Vision for Future Next-Generation Aircraft Carrier Supply Ships¹

Yin He²

Given the substantial increase in sustainment requirements for the PLA Navy's next-generation aircraft carriers, and acknowledging the limitations inherent in the Type 901 replenishment ship due to the technological constraints of its design era, the next-generation (新型) carrier replenishment vessel is expected to undergo significant modifications compared to its predecessor in several key areas.

Hull Dimensions and Displacement Will be Further Increased

While the current length, beam, and displacement of the Type 901 are already considerable, increasing them remains the most effective solution for meeting the demand for higher material payloads. For instance, by extending the hull length from 240 meters to 255 meters, while maintaining a constant beam, it would be possible to increase internal volume by over 6,000 cubic meters. This would allow for an additional load of nearly 5,000 tons of fuel or over 1,000 tons of dry cargo, representing an increased cargo capacity of more than 20 percent over the Type 901. Simultaneously, increasing the hull length would improve the length-to-beam ratio from the Type 901's 7.5 to 8.0. Although this would slightly increase the wetted surface area, it would also reduce wave-making resistance at high speeds and lower fuel consumption, a favorable trade-off that also positively contributes to achieving higher top speeds.

In terms of displacement, the next-generation replenishment vessel may increase to approximately 55,000 tons, which is an increase of 7,000 tons over the Type 901's 48,000 tons. This will be pivotal in comprehensively enhancing the capacity to carry marine fuel, aviation fuel, and ordnance. As the *Fujian* and subsequent supercarriers will likely continue to utilize conventional propulsion, the next-generation replenishment vessel must have a marine fuel capacity exceeding 10,000 tons, ideally reaching the 13,000 to 15,000-ton range. Only by achieving the capacity to provide 1.3 base units of marine fuel can these vessels satisfy the operational demands of high-speed maneuvers and long-term sustained far-seas deployments.

¹ 银河 [Yin He], 未来新型航母补给舰的设想 ["Vision for Future Next-Generation Aircraft Carrier Supply Ships"], 舰载武器 [*Shipborne Weapons*], no. 9 (September 2025), pp. 29-33.

Translator's Note: *Shipborne Weapons* is a magazine published by the China State Shipbuilding Corporation's Zhengzhou Electromechanical Institute (中国船舶集团 郑州机电工程研究所), which is involved in the Chinese naval shipbuilding industry.

² "Yin He" is a pseudonym.



Fuel constitutes the largest portion of maritime replenishment requirements. Given that the *Fujian* has a significantly greater fuel demand than the *Liaoning* and the *Shandong*, the next-generation carrier replenishment vessel must consequently possess a higher fuel-carrying capacity than the Type 901.

Regarding aviation fuel and ordnance capacity, the new-generation replenishment ship must increase these levels to 6,000 tons and 2,500 tons, respectively, to sustain dozens of heavy carrier-based aircraft through at least 15 days of high-intensity naval and air operations. In a medium-intensity local conflict (中等烈度的局部战争), this endurance could effectively double to over 30 days.

With a larger hull, the vessel's total liquid cargo and ordnance capacity will reach approximately 28,500 tons (excluding the minimum 5,000 tons of fuel required for the ship's own propulsion). Even after allocating 7,000 tons of diesel to support escort vessels, nearly 3,000 tons of displacement remains for any essential provisions, fresh water, and various spare parts—sufficient to provide 80,000 to 100,000-ton class supercarriers with at least 60 days of self-sustainment.

If the *Fujian*'s successors retain conventional propulsion, then it will likely be traditional steam-driven plants, so the next-generation replenishment ship will almost certainly drop heavy fuel oil (HFO) in favor of light diesel, ensuring compatibility with the gas turbines and diesel engines used by the rest of the fleet.



Computer-generated rendering of the Chinese Navy's Type 901 replenishment ship. Future carrier support vessels are expected to feature larger main dimensions and greater displacement.

While HFO is significantly cheaper (less than 40 percent the cost of light diesel) and offers higher energy density (about 8 percent), these benefits are negligible when weighed against the

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strategic necessity of maintaining fleet-wide fuel compatibility. By standardizing on light diesel, the replenishment ship's total ship-borne fuel capacity would exceed 23,000 tons. This allows for a far more flexible distribution of fuel across the carrier, escorts, and the supply ship itself, marking a qualitative shift in operational convenience and logistical agility. Even if some of our future supercarriers move to nuclear propulsion, the advantages of this standardized fuel model would be even greater. Space previously dedicated to marine fuel tanks can be easily repurposed into aviation fuel tanks, ordnance magazines, freshwater storage, or dry cargo holds, further strengthening the vessel's ability to support nuclear-powered strike groups.

Replenishment Efficiency will be Further Improved:

To maximize replenishment efficiency, the most straightforward approach is to enable simultaneous multi-channel transfers for both liquid and dry cargo. However, this capability is primarily constrained by the number and placement of the reception points on the carrier. While the *Fujian* has introduced improvements to its intake stations, the constraints inherent in its original hull design leave significant shortcomings. Future carrier designs might undergo radical changes in this area. For liquid cargo, in addition to the traditional stern-focused reception zone (which currently features two sets of dual-pipe stations), two extra dual-pipe stations should be added amidships or toward the bow to support the high-volume, rapid intake of bunker fuel, aviation fuel, fresh water, and other liquids required by 100,000-ton class carriers. All things being equal, the carrier should be able to receive at least 3,500 tons of cargo per hour.

Regarding dry cargo, even with the optimizations on the *Fujian*, there are enduring shortcomings in receiving capacity, transfer speed, and internal throughput. Next-generation carriers should

locate dry cargo stations within the hangar, near the aircraft elevators, using overhead, foldable heavy-duty receiving masts, ideally in a dual-mast configuration, to enable simultaneous multi-channel intake.

The layout of these reception stations on the next generation of carriers will dictate the number and placement of transfer rigs on carrier support ships. Furthermore, to maximize compatibility with the existing three carriers as well as various destroyers and frigates, the next-generation replenishment support ship's integrated gantries should be redesigned as independent, modular masts. Because these modular masts are significantly smaller and lighter, the support ship can flexibly reposition them along the port or starboard sides to match the specific number and spacing of the receiver's intake points. This allows for simultaneous multi-channel transfers to the carrier while maintaining the flexibility to service diverse destroyer and frigate classes, resulting in a substantial gain in overall transfer speed and operational throughput.



The U.S. Navy's *Supply*-class fast combat support ship is conducting simultaneous 3-station liquid and 3-station dry cargo replenishment for the USS *Eisenhower*



With the retirement of the fast combat support ships, the replenishment and sustainment of U.S. Navy carrier strike groups are now handled entirely by specialized oilers, ammunition ships, and dry cargo vessels. While the overall volume and variety of supplies remain largely unchanged, replenishment efficiency has noticeably declined

Regarding replenishment technology, the new vessel will incorporate a suite of advanced designs and systems, including electric propulsion, supercapacitor energy storage, intelligent tension control and stabilization, and modular container transfer units. These will comprehensively optimize the preparation and transfer of all cargo types, shorten cycle times, and significantly enhance both safety and environmental adaptability, all of which are fundamental prerequisites for maintaining the technical superiority of the new replenishment ship.

Furthermore, to boost the ship's own replenishment capabilities and minimize time spent at sea, the number of dry and liquid replenishment rigs could be doubled. This would allow the ship to be serviced by two tankers or cargo ships simultaneously, ensuring the entire vessel can be fully restocked within eight hours, thereby substantially increasing its mission endurance.

The Propulsion System Will be More Powerful

The next-generation carrier replenishment vessel is intended to be among the largest in the world by displacement, possessing premier cargo capacity and replenishment throughput, while also ranking as the fastest ship in its class.

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Given the substantial increase in displacement, a comparison with the hull lines, tonnage, and power configurations of second-generation U.S. Navy fast combat support ships suggests that the new replenishment vessel will require at least 100,000 horsepower to maintain a service speed of no less than 25 knots. China currently possesses several mature, high-output marine propulsion technologies capable of meeting this requirement.

For instance, the 26MW CGT-25 gas turbine (formerly the GT-25000), widely utilized on Type 052D and Type 055 destroyers, has undergone over a decade of continuous refinement. Its performance is technically mature and reliable, with an annual production capacity reaching dozens of units, sufficient to support the construction of more than ten gas-turbine-powered surface combatants per year.

For a new 55,000-ton replenishment vessel, a COGAG (Combined Gas and Gas) plant consisting of four CGT-25 gas turbines—the same configuration used on the Type 055 destroyer—could easily meet the 25-knot full-load speed requirement. Furthermore, due to the high power reserve, if fuel economy is set aside, the vessel's theoretical top speed could reach 27 knots at 70 percent displacement (approximately 40,000 tons). In a light-load condition, such as returning to a rear base for resupply with only a few thousand tons of fuel remaining (reducing displacement to roughly 25,000 tons), the theoretical top speed could approach that of a destroyer. This capability is critical for rapid transit between the carrier strike group and rear logistical zones, effectively shortening the "support window" during which the strike group operates without an accompanying supply ship. For comparison, the U.S. Navy's *Supply*-class achieved 27 knots at 80 percent displacement (approx. 40,000 tons) during sea trials with 105,000 horsepower. Consequently, by adopting a higher-power all-gas propulsion system, the new replenishment vessel will deliver exceptionally strong speed performance.



The U.S. Navy's *Supply*-class fast combat support ships utilize gas turbine propulsion

However, COGAG (Combined Gas and Gas) plants suffer from relatively poor fuel economy. For example, the *Supply* class has an endurance of only 6,000 nautical miles when cruising at 22 knots, a speed that still requires all four main engines to be online. In this state, fuel consumption

reaches nearly 3,500 tons; when accounting for variables like full displacement and hull resistance, that figure climbs toward 3,700 tons, or approximately 70 percent of the ship's 5,300-ton total fuel capacity. Even if speed is dropped to 18 knots, allowing the ship to operate on only two engines, the range only extends to about 9,500 nautical miles, with fuel consumption still hovering around 2,800 tons. The current approach to mitigating this issue is to integrate electric propulsion systems. While the gains in endurance and fuel savings are marginal at high speeds (peaking at roughly 7 percent), the results are far more significant at low to medium speeds. At 18 knots, for instance, range can increase by 20 percent while fuel consumption drops by 25 percent, a substantial logistical improvement.



The gas turbine propulsion system of the PLAN's Type 055 destroyer is now highly mature; given its substantial power output, it is well-suited for the propulsion plants of future aircraft carrier replenishment vessels

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Therefore, in addition to an all-gas (COGAG) plant, the new replenishment ship could incorporate electric propulsion. This is the clear trajectory for future surface combatants. Since the latest batches of PLAN destroyers and frigates are already adopting electric drive systems, it is evident that the primary technical bottlenecks have been cleared. If these systems are viable for front-line combatants, implementing them on an auxiliary vessel like a replenishment ship should pose no significant challenge.

Of course, as the development of next-generation high-output gas turbines reaches maturity, the vessel could potentially utilize two 40MW CGT-40 units instead of four 26MW CGT-25s. While this would result in a lower total power output, it remains sufficient in principle to meet high-speed requirements. A twin-engine configuration would also reduce the engine room space by approximately 30 percent, allowing for a more optimized hull design. At medium to high speeds, a two-engine setup would operate at high load (around 95 percent), which is the peak range for gas turbine thermal efficiency. This would yield roughly 10 percent better fuel economy compared to a four engine configuration of equivalent power, making the ship significantly more efficient overall.

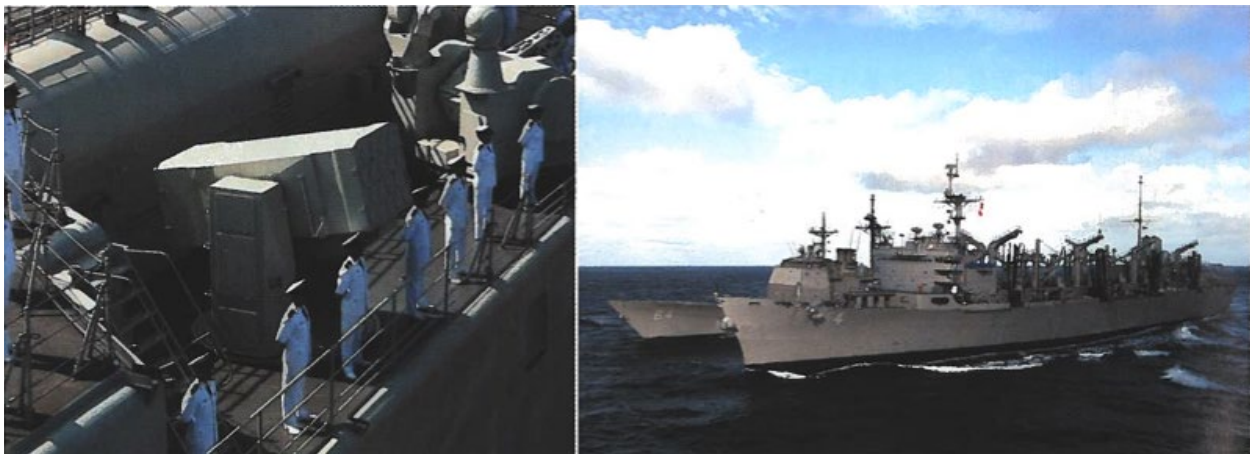
In short, the Chinese Navy currently has a wide range of options for the propulsion system of its

new replenishment vessel. Whether in terms of technology, performance, reliability, or ease of maintenance, these choices can fully satisfy the high speed requirements of a 55,000-ton class ship, a clear testament to China's robust technological and industrial manufacturing capabilities.

Beyond these core technical upgrades, the increasing importance of these vessels in China's future far seas naval strategy means that their self-defense and survivability requirements must be elevated to a new level. The current weapon and equipment configurations on the Type 901 replenishment ships are clearly insufficient to meet these future demands.

Given that the greatest threat to large surface vessels remains the anti-ship missile, the next-generation replenishment ship should prioritize enhancing its independent air-defense and anti-missile capabilities. Balancing factors such as cost, defensive coverage, and engagement intensity, the ship could be outfitted with a defensive suite consisting of one Type 1130 close-in weapon system (CIWS) and one 24-cell HQ-10 short-range air-defense missile launcher, mounted both fore and aft. This combination would provide a multi-layered, deep-defense capability against the vast majority of anti-ship threats, including supersonic missiles, within a range of 500 meters to 10 kilometers. Specifically, it would be capable of simultaneously intercepting two Mach 3+ supersonic anti-ship missiles or four to five high-subsonic anti-ship missiles. This represents a qualitative leap in defensive firepower compared to the Type 901, enabling the new vessel to guarantee its own safety independently in the vast majority of scenarios.

In summary, as the Chinese Navy advances rapidly toward larger, more capable supercarriers, the challenge of developing and building replenishment ships that can effectively support these carriers during far-seas combat and deployment has once again become a priority. While the Chinese Navy can look to the highly experienced U.S. Navy as a reference, the two nations differ significantly in their overarching strategies, operational requirements, mission profiles, and international geopolitical environments. Consequently, the Chinese Navy cannot simply copy the U.S. carrier strike group's far-seas logistics and support system.



The combination of the HQ-10 short-range air-defense missile system and the Type 1130 CIWS is an outstanding self-defense suite (left). The primary reason the U.S. Navy retired its fast combat support ships is its extensive global network of bases, combined with the fact that it has not engaged in large-scale conventional naval warfare for a long time, resulting in relatively low pressure for at-sea replenishment (right).

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Particularly since the end of the Cold War, the U.S. Navy has faced no potential adversary capable of challenging it to a "decisive ocean battle." The mission profiles, operational intensity, and sea-air threats faced by its carrier strike groups have fundamentally shifted. The pressure to conduct high-intensity, long-duration naval and air operations in the far seas has dropped precipitously. This is a primary reason behind the decision to retire all eight fast combat support ships in favor of more specialized, lower-cost vessels—such as tankers, ammunition ships, and dry cargo ships—that are slower and possess narrower functional capabilities. However, thanks to America's extensive global network of overseas bases and numerous alliances, the U.S. Navy's carrier strike groups remain capable of fulfilling nearly any mission even without the accompaniment of fast combat support ships. Their forward-deployed tankers, ammunition ships, and dry cargo vessels remain more than sufficient to satisfy the logistical and combat needs of these groups during overseas deployments.

For the Chinese Navy, while its transition toward becoming a far-seas force has accelerated significantly following the acquisition of multiple aircraft carriers, it will remain a regional navy for some time to come. Faced with the pressure and challenges posed by military forces both in its immediate periphery and from external actors, the Chinese Navy must possess an organic replenishment force capable of providing stable, sustained, and efficient support for carrier strike groups. In this context, specialized carrier replenishment vessels, characterized by high cargo capacity, multi-faceted transfer capabilities, superior efficiency, comprehensive sustainment, and high speed, are essential core assets.

At the same time, to further enhance the operational efficiency of the next-generation carrier replenishment vessels and ensure that the carrier strike group maintains high-intensity combat capabilities for as long as possible, the Chinese Navy also needs to develop a "second-line" replenishment force. Unlike the various liquid and dry cargo supply ships currently being prioritized by the U.S. Navy, the primary mission of China's "second-line" forces will be to resupply first-line replenishment ships (including fleet oilers and carrier replenishment vessels) within "safe zones" established far behind the combat or deployment areas. Aside from exceptional circumstances, these second-line vessels will not directly participate in the far-seas replenishment missions accompanying naval task forces.

Consequently, these "second-line" assets do not require high-performance specifications (e.g., displacement of 30,000+ tons, speeds of 13 to 15 knots, single-engine/single-propeller propulsion, and low-power diesel engines). They can be widely constructed to "commercial standards," allowing for effective control over operational and maintenance costs, or even adapted from existing tankers and cargo ships. For the future far-seas operations of Chinese carrier strike groups, these vessels can greatly alleviate the need for specialized replenishment ships to make long-distance transit back to port for restocking once their supplies are exhausted. This effectively compresses the turnaround time for replenishment, which plays a vital role in ensuring the carrier strike group's sustained combat capability. While this logistics model is generally similar to the U.S. Navy's current "second-tier" approach, the Chinese Navy's development should continue to prioritize high-tech, carrier-dedicated replenishment ships that provide a more tangible boost to strike group combat effectiveness. Furthermore, the scale of this force should be matched to the number of new-generation carriers being built, ensuring the capability to support multiple carrier strike groups in far-seas combat and deployment under any circumstances.

It is foreseeable that with the continuous growth in the number of next-generation destroyers and frigates, along with the rapid development of new-type amphibious assault ships and aircraft carriers, the development of the Chinese Navy's far-seas logistics and replenishment forces will enter the fast lane. Furthermore, it will chart a development path that aligns with the Chinese Navy's strategy and satisfies its operational requirements.



The dual-carrier strike group formed by the Chinese Navy's *Liaoning* and *Shandong* aircraft carriers.