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The Type 054/054A Frigate Series: China's All-Purpose Surface Combatant

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The Type 054/054A series has become the PLA Navy's workhorse surface combatant for a wide variety of missions, ranging from potential high-end naval combat, to piracy suppression and humanitarian operations. The PLAN has commissioned 15 Type 054As to date, and China's total production of the Type 054-class writ large could eventually exceed 35 vessels. Type 054As have conducted anti-piracy and NEO support missions in both the Indian Ocean and Mediterranean Sea, and frequently deploy when Beijing seeks to make naval shows of force in the East and South China Seas. The Type 054A's significant number of deployments is also making the ship a test lab of sorts for ironing out mechanical bugs encountered during missions at sea and Chinese military shipyards appear to be learning from these and addressing them in follow-on vessels, including the Type 054B frigate that will likely enter service in the next decade.

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Since their introduction in early 2005 and 2008 respectively, the Type 054/054A line of Chinese frigates has undergone significant development and redesign commensurate with their expanding role as the PLAN's highest-end multi-function warship. While the PLAN only produced two of the earlier Type 054 Jiangkai-I class frigates, it has commissioned 15 Type 054A Jiangkai-II class frigates to-date, and is working on additional vessels (Figure 1). In addition, a follow-on model, the so-called Type 054B, is in development. When the series is complete, China's total production of Type 054, 054A, and 054B/other follow on frigates could exceed 35 vessels. On this basis, the Type 054/054A/054B series could begin to approach the prolific production of the U.S. Navy's Arleigh Burke-class destroyers, where 60 vessels spread over three "flights" or evolutions have been delivered to the fleet since 1991.

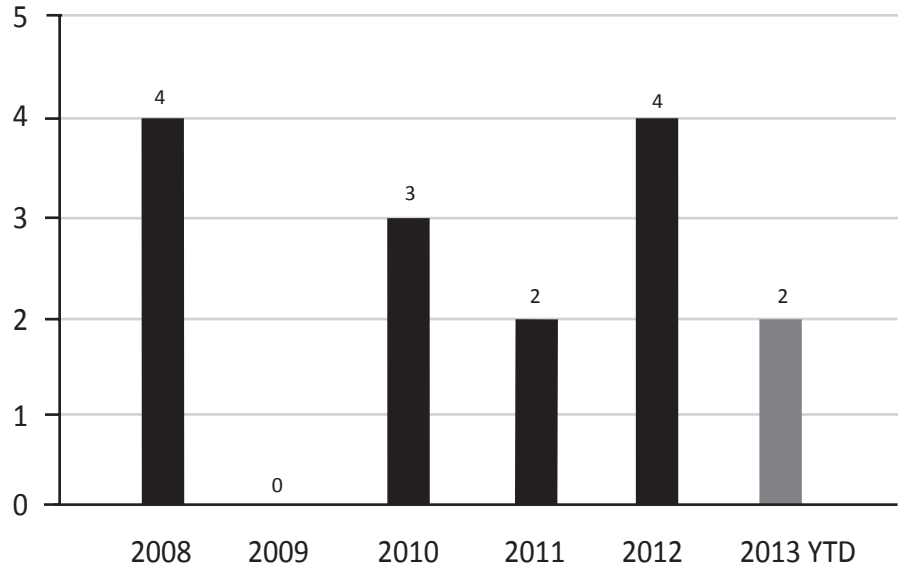
TYPE 054/054A SHIP LINEAGE

The Type 054 was likely heavily influenced by the French La Fayette-class frigate, which the French Navy designed to meet both high-intensity threats and the more non-traditional missions that might arise in the post-Cold War environment. Indeed, China now deploys the Type 054A against pirates in the Western Indian Ocean—precisely the type of post-Cold War, lower-intensity conflict mission the La Fayette-class frigates were designed to confront on behalf of France, a naval power that maintains a limited global operational profile similar to that which the PLAN currently displays.

China has built nearly 20 Type 054As. This, along with the ship's capable anti-air and anti-ship missiles, suggests that the Type 054A will play a more central role in the PLAN than was intended for the La Fayette-class frigates in the French Navy.

MODERNIZING THE RANKS

In the near term, the Type 054A is helping the PLAN to modernize its



Source: Data from Jane's.

Figure 1. Number of Type 054A vessels commissioned, by year

frigate ranks, with seven obsolescent Type 051 ships retired between 2007 and 2012 as the Type 054As were commissioned into the fleet. While the PLAN is "getting salty" with low-intensity missions at present, China faces the potential for high-intensity naval conflict in a way France does not. This reality, coupled with the fact that the Type 054A is becoming one of the PLAN's mainstay warships means that the Type 054A marks where China's mission needs diverged to the point that the Type 054A required a significant evolution beyond the La Fayette-derived Type 054.

ROLES AND MISSIONS FOR THE TYPE 054/54A

The Type 054 and 054A are versatile, "Swiss army knife"-type ships that participate in a broad range of PLAN missions. These include patrolling China's littoral areas as well as forming escort and patrol missions to the South China Sea. Several Type 054As have been part of the counter piracy task forces sent to the Gulf of Aden, and one Type 054A ship, the *Xuzhou*, famously travelled to Libya to conduct the PLAN's first non-combatant evacuation operation. It is generally expected by both Chinese and Western

analysts that the Type 054As will constitute part of a carrier strike group when one is formed. Overall, Chinese and foreign assessments of the ships are largely positive and no major issues have been reported, particularly with the Type 054As that have deployed on the lengthy Gulf of Aden missions.

As mentioned already, the Type 054/054A frigates have been used by the PLAN for a diverse range of missions. These include:

1. Defending China's regional maritime realm.
2. Protecting China's regional maritime economic interests.
3. Non-combatant evacuation operations.
4. Counter piracy/protection of key sea lines of communication.
5. Power projection/global presence: A final category that will likely be realized in the future as China builds its aircraft carrier program is the ability to project power as well as participate in humanitarian assistance and disaster relief around the globe.

The Type 054/054A has operational experience for most of these categories, and will undoubtedly play

a significant escort role in a carrier strike group in the future. As the Type 054As are one of the most advanced frigates the PLAN has, it is likely they will conduct blue water escort for the aircraft carriers once they are operational. Any future Type 054 variants will likely be constructed with defense of an aircraft carrier in mind.

The development and design of the newest Type 054A ships reflect the expanded roles and missions the ship is expected to undertake and potentially indicates the weightier role the PLAN envisions the ship playing in the future. The Type 054A is fitted with much more capable anti-air and anti-ship missiles than the Type 054, and also has a "mini-Aegis" radar system and improved stealth capability that make it much more effective in medium-intensity combat situations. However, Chinese assessments indicate that while the Type 054A represents an exponential improvement in the quality and capability of the PLAN's frigate force, it nonetheless remains a limited design in terms of its size, armament, and electronics outfit and is viewed as an intermediary design intended to play a specific, limited role in fleet defense.

The Type 054B said to be under development now would represent a significant combat capability enhancement relative to the Type 054A. In particular, the Type 054B will likely include an upgraded command system, improved (or different?) air and missile defense systems, and a larger hull design.

LESSONS LEARNED FROM DEPLOYMENTS

In the longer term, the Type 054A is likely to spawn more modern and capable follow-on vessels that incorporate lessons learned in its construction and from deployments in places such as the Gulf of Aden. Chinese sources hint that the PLAN's Gulf of Aden missions may be influencing Chinese naval architecture and engineering. For instance, an article in

Modern Navy notes that during escort missions, electromechanical machinery, toilets, and air compressors have failed on a fairly frequent basis and that domestically-produced items have suffered the highest failure rates. The article's authors also point out that the designs of Chinese warships deployed to the Gulf of Aden fail to provide adequate physical space for making efficient repairs under deployment conditions.

The Chinese sources do not specify which of the ships in the escort fleet suffered from these problems, but since the typical escort fleet composition features destroyers and frigates and since China's large surface combatants all appear to be designed by the China Shipbuilding Industry Corporation's (CSIC) 701 Institute in Wuhan, it is likely that common warship design approaches have made the lack of space a common problem in the fleet. Based on the complaints about lack of space for making repairs and the general need for additional space to accommodate systems to make a ship more combat-capable, there is a strong likelihood that the Type 054B will be significantly larger than the Type 054A. According to various media sources, the design work for a Type 054B has been underway since approximately 2009 and will especially focus on improved electronics and combat information center capability, and may also carry longer-range missiles, both improvements likely necessitating a larger hull.

WHAT THE TYPE 054/054A TELLS US ABOUT THE FUTURE OF CHINESE MILITARY SHIPBUILDING

Overall, the Type 054A has proven a relatively successful vessel for the missions the PLAN needs it for right now, a multi-functional ship that can deploy abroad and has decent air defense and stealth capability.

However, the Type 054A is in many ways an interim design with some flaws and limits to its ability for fleet

defense. The Type 054B will likely improve upon this design. Key expected changes would include a larger hull size to accommodate equipment additions, and a vertical launch system that is physically larger, capable of launching larger missiles and holding more missiles than the 32-cell system used by the Type 054A. It is also likely that the Type 054B will use a more capable radar system and a longer-range anti-air missile, perhaps the HHQ-9 SAM used on the Type 052C/D destroyers, which can engage aircraft up to 125 km away.

The case of the Type 054A points to and supports several key observations about military shipbuilding in China.

First, the corporate split between the China State Shipbuilding Corp. (CSSC) and China Shipbuilding Industry Corp. (CSIC) may be largely notional. At the very least, competition is more likely between individual yards rather than the conglomerates. The Type 054/054A are produced in CSSC's Hudong Zhonghua yard in Shanghai and the Huangpu shipyard in Guangzhou. Additional Type 054A and follow-on Type 054B vessels could come from these yards, as well as CSSC's large new Changxing Island yard near Shanghai and CSIC's shipyard in Dalian. Media reports, however, indicate that any future export orders for the 054A will be assigned to the CSIC yards in Dalian, in order to: a) provide for further redundancy in wartime; b) partially compensate CSIC for the fact that the 054A is its own design; and c) prevent export orders from interfering with the PLAN's own construction schedule.

In the shipbuilding industry, yards controlled by CSSC and CSIC build essentially all of China's surface combatants and submarines. The fact that CSIC personnel design the ships and CSSC personnel actually build them suggests that the decision Beijing took to split the original CSSC into the modern CSSC and CSIC in July 1999 primarily affected the commercial shipbuilding businesses

that each enterprise runs and that the military construction business is, at a fundamental level, one where the company split is largely symbolic. It also strongly suggests that competition in China's naval shipbuilding business is not so much between the CSSC and CSIC parent companies as it is between the individual shipyards themselves. It bears noting that some of the larger CSSC and CSIC yards such as Hudong Zhonghua, Changxing Island, Huangpu, Dalian, and Huludao could by themselves be considered world-scale shipbuilding enterprises.

According to CSSC, simultaneously with beginning construction of *Huangshan* (黄山, pennant 570) in 2006 and as part of a new focus on quality control in the whole process of construction, from the design stage through building, trials, and the servicing of active ships, the Huangpu yards began emphasizing new aspects of the building process, focusing on component source control, developing risk analysis and control plans, and establishing a reliability-centered quality management system. This particularly included a research effort into hull welding processes and methods, with a view to improving reliability based on the suggestions and experiences of serving naval personnel. This is apparently part of the Huangpu yards' efforts at distinguishing itself and the quality of its construction, indicating that such issues may represent a key aspect of the various yards' efforts to competitively differentiate themselves.

Second, the PLAN is very cost conscious in its procurement and (for the present, at least) favors capable rather than cutting-edge equipment and all-purpose as opposed to specialized designs.

The Type 054A likely costs around US\$280 million per vessel to build. This estimate derives from breaking the ship down by its main systems categories (hull and equipment, propulsion, weapons, and electronics)

and calculating their respective costs, as well as the cost of the labor needed to assemble the ship into a finished product. Our preliminary estimate is that the Type 054A's cost structure lies as follows:

- Electronics: US\$83 million.
- Weapons: US\$81 million.
- Hull and equipment: US\$54.5 million.
- Labor: US\$27 million.
- Propulsion: US\$24 million.
- Miscellaneous costs: US\$10 million.

The US\$280 million unit cost estimate dovetails well with the price at which China offered Type 054 frigates to Thailand in early 2013. Thailand's navy sought to spend US\$1 billion on new frigates and China reportedly offered three Type 054s at that price. China's offer of ships at an effective price of US\$333 million each suggests that with higher international-level profit margins built in, the actual delivered ship cost is likely between US\$275 million and US\$300 million per vessel.

If the Type 054A's actual cost falls into this range, with a 5 percent margin for ship deliveries to the PLAN, the delivered ship price would be US\$294 million. In procurement terms, this would offer a significant procurement value to the PLAN relative to the cost of foreign vessels. For instance, French shipbuilder DCNS has sold a FREMM-class frigate to Morocco for US\$676 million and Germany's first four F125 frigates are priced at US\$740 million apiece.

The lower ship cost reduces the "trade-off" burden that Chinese policymakers face when procuring additional ships. Military hardware spending always incurs an opportunity cost, since even a growing economy like China's still has a finite amount of resources which can be realistically devoted to military expenditures. To

put the cost of purchasing one Type 054A at US\$280 million into perspective, consider that the ship uses funds equal to each of the following alternative expenditures, all of which are in demand in various branches of the PLA:

- Ten J-10 fighter aircraft.
- Eight SU-30K strike fighters.
- 86.8 million gallons of jet fuel for training—enough fuel to allow all 97 of China's SU-30 fighters to be fully loaded with fuel 270 times each.
- Pay the annual salaries of nearly 27,000 mid-ranking PLA officers.

Third, most major sensor and weapons systems are the products of shipbuilding industry research institutes, as opposed to ordnance/electronics research centers.

Fourth, the Naval Equipment Research Academy likely plays a central (if ill-defined) role in the RDA process, being responsible for drawing up equipment requirements, validating concepts, evaluating prototypes, and conducting in-service improvement programs.

Finally, China's naval shipbuilding apparatus is becoming sophisticated enough that for major surface combatants, foreign assistance will play a much smaller role in future designs because Chinese military shipyards are advancing to the point that their technology for surface platforms and their subsystems will soon match that of Russia, the main military power willing to share technology with China. To a certain degree, European naval electronics and Ukrainian gas turbine propulsion technology will remain areas of interest, but even these are likely to be substituted within 4–5 years by domestically designed and manufactured systems.

The Type 054A is the first large modern surface combatant that the PLAN thinks it "got right." As the follow-on Type 054B comes into pro-

duction, it will build upon the Type 054A's overall success and continue to quantitatively and qualitatively enhance Chinese naval forces' multi-mission capabilities. And as the Type 054B comes into service, the Type 054A production lines will likely increasingly work to stay open and export their production so that overall

shipyard activity can be bolstered despite the sustained global slowdown in demand for the commodity ships Chinese commercial production lines specialize in building.

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