

The Chinese Aircraft Carrier Program and Its Influence in the Chinese Naval Strategy

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For two decades, the People's Liberation Army Navy (PLAN) immersed itself in an incomparable naval construction program. China is one of the world's biggest economic powers—its firm decisions impacting at a global level, and its wishes aimed at reaching superpower status in the military realm.

China is a terrestrial power—which is true of from historical, present, and future perspectives—with all that this entails when it comes to making decisions about its armed forces. Until the advent of its Strategic Rocket Forces, the People's Liberation Army (PLA) and the People's Liberation Army Air Force (PLAAF) have always been the greatest recipients of China's financial, technical, and human resources. After a series of political changes and overcoming technological thresholds, this trend has changed to favor its naval forces, as this article will try to show in the following pages—with special emphasis on the country's recent development of aircraft carriers.

There is a significant historical parallel between the development of the PLAN and that of the Soviet Union's (USSR) fleet (Voyenno-Morskoy Flot, VMF). These examples are terrestrial world powers that suffer from geographical problems in the development of their naval strategy, and therefore, the ships that comprise their fleets. The VMF designed a nuclear aircraft carrier (CVN) program with the strategic objective of protecting its nuclear-powered ballistic missile submarine (SSBN) sanctuaries, denying Soviet adversaries freedom of movement north of the GIUK gap and preventing access to the Barents and Kara seas.¹ However, the collapse of the USSR forestalled the realization of that program. Still there exists an ongoing discussion regarding the need for CVN for continental terrestrial powers, which consistently argues counter to the carrier battle group (CVBG) concept of the US Navy as something expensive and highly vulnerable to certain offensive weapons. Reality and history show us the error of that thought, since currently, a CVBG is the only existing naval group capable of projecting force at any point within the reach of its deployed fleet.

The PLAN has reacted to this concept differently from the VMF, having accepted the strategic need to equip itself with these platforms and adapt the doctrine of its fleet to this concept, which increases the versatility of its naval capabilities. It is true that its concept of aircraft carrier is yet to be defined and remains in the implementation phase; however, such conceptualization and implementation have the advantage of the very important technological heritage of the aircraft carrier model of the VMF.

The existence of aircraft carriers in a fleet does not provide, per se, the ability to project forces to an ideal point. The US Navy and the French Marine Nationale operate, at a high cost, groupings worldwide with the political and strategic objectives of maintaining the capacity to press the interests of their countries. The United Kingdom has had to sacrifice its amphibious capabilities to regain these capabilities. The training and deployment of these groups pose huge costs for national defense budgets, so they should not be neglected—or one runs the risk of losing them. Case in point, although fulfilling its military and political objectives, the performance of the Russian carrier *Admiral Kuznetsov* in Syria at the end of 2017 showed how a poorly equipped and maintained aircraft carrier, with a deployed wing lacking sufficient training, can lead to un-

necessary losses in an uncontested scenario. Let us extrapolate this action to a confrontation against trained and equipped groups and draw our own conclusions.

Brief Summary of the Evolution of Chinese Naval Strategy

After Chairman Mao Tse-tung's rise to power, strategic and military priorities would concentrate on strengthening and consolidating continental power, as well as on internal economic programs. China's nuclear program was embryonic but would grow in the following decades, absorbing the best resources that the country could produce. Concerning naval power, Mao would focus the objectives of the PLAN on a coastal defense under the umbrella of land-based aviation. Said decision, incongruous with the primary objective of taking over Taiwan, were based on three main factors at that time.

- Chinese economy not able to support a large platform fleet.
- Chinese industry, very behind in comparison to its neighbors, was not in a position to produce the amount of ships and equipment needed, nor prepared to design them. However, for a short period, the assistance provided by the USSR would allow China to make a small qualitative leap in the construction of submarines and initiate its own capabilities in that field.
- The Chinese strategic mentality was completely focused on the consolidation of continental power, with intense border conflicts in Korea and Vietnam in the following years, thus not lending special importance to the naval aspect, which in turn could not be covered by its industry.

The subsequent Korean War and crises in the Strait of Taiwan, Quemoy, and Matsu would demonstrate to Chinese leaders that the lack of a robust naval fleet with the power to deter the positive dominance of the sea by adversaries presented a national priority. In the 1950s and 1960s, China's fleet was comprised of small coastal units with the primary function of repelling external aggressions and conventional submarines garnered through the Soviet support program, which would try to isolate the US reinforcements to Taiwan in the event of a conflict and theoretically make an advance defense of China's coasts.

Thereafter, Beijing was aware of the very limited naval capabilities of the PLAN and began to develop an industrial and operational program to extend the reach of its naval forces, which continued to operate always under the support of ground aviation. A key date is January of 1974, when in a naval operation the PLAN disembarked military troops in the Paracel Islands, the ownership of which is disputed with South Vietnam. After such confrontations, the Chinese presence would remain in these islands, initiating a way toward the consolidation of Chinese occupation of small islands and reefs all over the South China Sea. We can take the PLAN's order of battle (OOB) of 1979 as reference of its main concerns and future growth trends. Its main ships were:

- 75 conventional submarines
- 11 destroyers
- 12 frigates
- 53 corvettes
- 140 missile patrol boats
- 430 patrollers

It can be inferred that the PLAN was a coastal fleet with scarce oceanic projection capabilities, but China maintained a small nucleus of units in order to grow and train future generations of

officers. Likewise, the Chinese nuclear program would further influence the development of the PLAN.

China's decision to arm itself with strategic nuclear weapons, initially with intercontinental ballistic missiles, would involve the PLAN in the development of nuclear propulsion for submarines, both ballistic and attack, as well as allocating an important part of research and development funds to the Chinese SSBN program. This program, which would be one of the longest, most-expensive, and chaotic ventures in recent history, implied China's main and most-fundamental naval strategy would be the deployment and defense of its SSBN, which represented the nation's capacity for a second nuclear response.

In changing the PLAN's mission from a coastal defensive role to the defense of the national strategic armament, China's first decision was to create SSBN sanctuaries near the Chinese coasts, increasing the operating range of its fleet, and thereby building and developing a fleet with advanced capabilities. This new strategic mission would converge in time and represent the beginning of the expansion of Chinese influence in its bordering maritime regions, which would give rise to clashes with neighboring nations that perceived the Chinese expansion as a threat to their own maritime and national interests.

Chinese geography hinders the PLAN's free access to the oceans in a safe, fast, and discreet fashion. The Korean peninsula borders the Bohai Gulf, which is the only maritime access route to the north of China. Shanghai faces the Japanese island of Kyushu, which makes Chinese operations difficult without being noticed by its neighbors. Only Hainan, an island in the south of the country, has a freer access to the ocean, but the proximity to the Vietnamese coast poses a problem even there. This geographic situation forces the PLAN to distribute itself in three different fleets along its coast, in breach of the Mahanian precept of never dividing one's fleet. It was the same situation that the fleets of the Soviet Union, and its successor the Russian Federation, suffered, although in a less severe fashion. The big problem for China lies in the latent threat that its neighbors, which suffer from Chinese expansionism, potentially represent to Chinese sea lines of communication (SLOC). Beijing considers this very threatening and worrisome.

In 1975, a state commission determined the PLAN to be poorly equipped, badly trained, and poorly led. The subsequent conflict with Vietnam served to confirm these concerns. It was about this same time that the Chinese shipbuilding industry began to receive strong state support. Thanks to strong state investment, a cheap labor force, and a more accepting attitude toward foreign construction requests—as well as the transfer of technology, overt and covert—Chinese shipyards began to emerge as global players in terms of annual production capabilities, although some with more than questionable quality. For years, and until now, Chinese shipyards have maintained their position as first in terms of tonnage built and orders for new construction received.

This powerful industrial network, which was not easily established, will be the main support for the current PLAN, as China has now managed to address two of the three main points that Mao lacked to start the construction of a blue-water navy, since the Chinese economy of his day was improving but budgets were still diverted to other programs.

In the mid-1980s, there were strategic changes in the Chinese periphery that drastically changed the PLAN's future function and strategy. Likewise, the effects of the presence of the first Naval High Command at the peak of Chinese power would be alter matters.

Deng Xiaoping's government strategic assessment in 1985 established that China's state of permanent alert due to the threat of Soviet land invasion from the North had ceased. The world situation and the balance of powers between NATO and the Warsaw Pact created a sphere of tranquility for China with respect to the Soviet threat. This allowed Beijing to focus on slowing the growth of its armed forces, turning its attention instead to the technological modernization of its armament, doctrinal and operational development, and improved training for crews.

The PLAN's focus on the defense of the nearby maritime flank of the PLA would now change towards an inland approach. The new naval mission focused on advanced defense until the First Island Chain.² For this mission, the PLAN's platforms and doctrines were inadequate. One figure within the Chinese Communist Party, the PLA, and the PLAN would be the driving force of the strategy to be followed in the coming decades. Liu Huaqing was a general in the PLA, who also held the rank of commander in chief of the PLAN. His naval career was unconventional. Although he never held important operational commands of the fleet, he did hold positions in the Naval Research Institute from the beginning of the 1960s and, with it, control over the Chinese naval industry. He had trained in the USSR at the Voroshilov Naval Academy. From 1982 to 1987, he was commander in chief of the PLAN and later a member of the Central Military Commission and the Chinese Politburo Committee, which were institutions that governed all the decisions of the Chinese state. Additionally, he had a personal relationship with Deng Xiaoping.

All of these factors served Huaqing well when the need for a new strategic concept of advanced defense was raised within the PLAN. His personal opinion of this idea was completely favorable, knowing that the PLAN had to rejuvenate and completely modernize its fleet. He defined the PLAN's need for aircraft carriers, and based on that, he supported and defined the need for the carriers as an absolute need that the country had to fulfill.

In 1986, the PLAN officially implemented forward defense as its main strategic objective in the short term, framed within a general scheme that would culminate, theoretically, in the middle of the twenty-first century with the Chinese fleet as a global naval power. This strategy went through a series of phases that can be summarized as follows:

- By the year 2000, the PLAN should be able to exercise a positive command of the maritime area lying between the First Island Chain and its coast, including Taiwan. Although the PLAN has achieved important objectives, it is still debatable, as we will see later, that the PLAN enjoys positive command of this space. What is certain and undeniable is the growth of Chinese naval power in this space, although it is still disputed whether it begins to approach levels close to its objective.
- By 2020 the previous objective was to extend to the Second Island Chain, which reaches Guam and includes Japan, for example.³ Although the islets taken by Beijing and converted into anti-air warfare (AAW) forward bases and for AsuW and ASW aviation support, the PLAN is decades away from achieving that goal.
- By 2050, the PLAN would like to be able to operate on a global scale in a fashion similar to how the US Navy currently operates. The need for a series of alliances, which currently are non-existent, to logistically support such deployment and other technological factors and number of ships, leads us to leave this objective as a strategic desire for the moment.

The PLAN is at a moment of absolute transition. By building a powerful oceanic fleet, China has found itself in the eternal historical dilemma whether to equip that fleet with aircraft carriers. This time, Beijing's decision has been to follow in the footsteps of the Western powers: to be able to execute the projection of naval force wherever it is required.

Of growing importance to China has been the Indian Ocean, where during the past few years it has deployed more units with few logistical bases outside of its immediate area of influence. Additionally, the importance of the Strait of Malacca for the Chinese economy cannot be overstated. However, India, another power immersed in its own naval program, has the capability to close to commercial navigation, thus threatening Chinese industry and economy.

Currently, the Chinese government has managed to reach agreements with various nations for the use of foreign ports in the Indian Ocean for the PLAN's logistical benefit, although only in Djibouti has China established a naval base. Given this scenario, the CVBG represents the only and most-effective solution when projecting the naval power of China.

Implementation of Carriers within the Chinese Naval Strategy

After this brief historical introduction of Chinese naval strategy, we turn now to focus on those points that require the use of aircraft carriers and explore which platform would be most appropriate in terms of the operational requirements.

Liu Huaqing's premises entailed two specific scenarios where the use of aircraft carriers was essential to achieve success—on one hand, Taiwan, and on the other, the dispute over the sovereignty of the archipelago of the Spratly Islands.

In terms of performance in the area of the Formosa Strait or Taiwan, China could face the need of conducting combat actions either to disembark on the island or to carry out a maritime or air blockade in case Taiwan declared its independence. In both cases, a positive command of the sea would be required. The PLAAF could deploy aviation from the continent, but because of the limited operating range of its air-refueling capabilities, the amount of time that air units could stay on target would not be optimal. The best way to exercise continuous and reliable air coverage would be through a combination of PLAAF units and fixed-wing air units from aircraft carriers, allowing the latter to spend more time on target. Additionally, it would allow Beijing to confront, ahead of time, any reinforcement that the United States would send to support Taiwan—not by destroying those reinforcements, but delaying them enough to consolidate a landing by the PLAN on the island.

The dispute over the sovereignty of the Spratly Islands, very distant from the reach of most of units of the PLAAF, requires an aircraft carrier group to be able to project Chinese naval and air power.

Both cases are clear examples of the needs of the PLAN in case it wants to exercise its power beyond its littoral waters. However, the 1996 Formosa crisis and the removal of Huaqing from his executive and military posts in 1997 halted the aircraft carrier program—although not permanently.

By the early 2000s, China encountered new strategic needs complementary to those detected in previous decades. Chinese naval strategists outlined new requirements, derived from vulnerabilities identified either through direct conflict or through coercion, which China would need to satisfy if it were to sustain its powerful economic growth on an international scale.

In 2004, after years of seemingly unstoppable economic growth, China realized the important economic and societal dependence it had on its fleet of merchant ships to export its goods worldwide, and the fleet of oil tankers that supplied it with crude oil from other parts of the globe. Therefore, Chinese naval forces would need to exercise control of SLOCs far from the nation's territory. The Strait of Malacca is a case in point, as through it Chinese exports flow to the West and crude oil flows from the Persian Gulf, with the Indian fleet easily able to block access in times of crisis.

Likewise, the area of the western Pacific, beyond the First Island Chain, also grew in strategic importance. The PLAN needed to project its power, in a timely manner and with positive command, through the access points or chokepoints, which delimit the first line of the SLOCs with more distant seas.

Both strategic requirements are aircraft carrier scenarios. The distances to be covered and the lack of logistics bases for China's aviation and surface ships finally confirmed to the PLAN the need for a definitive aircraft carrier construction program. Additionally, China's geographical characteristics demanded these aircraft carriers be of the heavy category (CATOBAR) and preferably of nuclear propulsion to augment its deployed air wing and its offensive capabilities during takeoff.

The number of aircraft CVBGs required to fulfill these requirements is another matter of extreme importance. Ideally, the PLAN at all times should be able to maintain one CVBG in the Indian Ocean or close to the Strait of Malacca, another one in the Formosa area, and a third in the western Pacific. Theoretically, if for every deployed carrier China were to keep a recurring cycle of one carrier with its crews in training providing a surge capability, plus another under-

going repair and modernization, the PLAN would need close to nine aircraft carriers. Or, under this theoretical assumption, at a minimum of six, if China were to deploy only one carrier in the Strait of Malacca and the South China Sea, and another in the First Island Chain and the western Pacific.

The Platforms

Given the PLAN's theoretical strategic needs, it is important to examine China's current aircraft carrier platforms and their development.

In the 1990s, China searched the international market for foreign aircraft carriers or related engineering. Spain and France made interesting proposals. Spain, which at that time was building the HTMS *Chakri Naruebet for Thailand*—the flagship of the Thai navy and its only aircraft carrier, offered to build China a conventional aircraft carrier. France offered instead the retired carrier *Clemenceau*, free of charge, with the condition of re-equipping it in Gallic shipyards and using French technology.

In the end, China found access to old aircraft carriers from other nations: the Soviet aircraft carriers *Kiev* and *Minsk* from the scrap market, as well as the Australian *Canberra*. From all of these acquisitions, experimental techniques and knowledge were obtained that would make their way into the Chinese program. Some of these ships then ended in museums or tourist attractions in China.

Finally, China selected the hull of the *Varyag*, the Soviets' second *Kuznetsov*-class aircraft carrier, which had been at the Ukrainian shipyards of Nikolayev since 1992, when its construction was canceled after originally being laid down in 1985 and launched in 1988. The Chinese government had tried to buy it directly from Kiev but did not receive a direct response to its proposal.

In 1998, a Chinese shell company in Macao bought the hull under the pretense of using it for "tourism." Despite having managed to buy the ship for \$30 million, its transfer to Asia was complicated by the required permits from Turkey to cross the Dardanelles. It took a Chinese vice-minister, with a \$350 million investment package and other perks, to unlock permits in Ankara and start the 18-month tow to China, not Macao, where it arrived in 2002. Besides the ship, the representative from the Macao company sent to Beijing 40 tons of drawings and studies of the Soviet aircraft carrier program (of note, in the same abandoned shipyard was the first Soviet CVN aircraft carrier, the *Ulyanovsk*, with all its documentation—a very interesting information base that today may be bearing fruit in China).

Its arrival into the Dalian shipyards would take a long time. Their first trials at sea would not take place until 2011, and they would continue for another year until it was commissioned by the PLAN on September 25, 2012 (a long period for a ship, even for China). China hired many Ukrainian technicians for this program, who comprise the more than 5,000 current technicians involved in the aircraft carrier program today.

A land replica of the flight deck and the island was built in Huludao, where pilots and airplanes would make their first flight and landing tests. The *Varyag* was renamed *Liaoning*, and it has some of the characteristics and flaws of the *Kuznetsov* of the fleet of the Russian Federation. Its propulsion plant is based on eight steam boilers that provide 200,000 HP on four axes with fixed pitch shovels, which propel the ship up to a maximum speed of 32 knots. There is a ramp in the bow of the flight deck with a 14° incline that helps the takeoff of fixed-wing aircraft, although with a strong limitation on the maximum takeoff weight that limits the fuel and the weapons to be carried by the aircraft, limiting, in turn, its radius of action.

Although the *Liaoning's* propulsion plant is more modern and has had the support of the Ukrainian industry, specializing in steam propulsion of boilers and turbines, the comparison with its older brother *Kuznetsov* raises many questions about its operation. The famous smoke

from the propulsion of the Russian vessel should make us question either the quality of the propulsion plant or the quality of Russian maintenance without Ukrainian support. The truth is that so far there are no known reports on the *Liaoning* about these problems. The crew for this vessel is approximately 2,000 crewmembers and 500 personnel attached to the deployed wing.

The *Liaoning*, known as CV-16 or Type 001, is operational and very active in the PLAN, but it should be considered as a technology demonstrator vessel as well as a training platform. With this vessel, the PLAN has managed to start operating fixed-wing aircraft and has the ability to select and train its own naval pilots, independently of the PLAAF. The process of consolidating procedures as well as doctrines could take many years.

The *Liaoning* has the following technical characteristics:

TYPE 001 LIAONING CV-16 (ex VARYAG)	
Displacement (tons)	46,600
Length, Beam, Strut (meters)	281, 38, 10.50
Propulsion	8 boilers, 4 turbines, 4 axis, 9 turbo generators and 4 diesel generators
Autonomy	3,850 nm @ 29 knots 8,500 nm @ 18 knots
Crew	Approx. 2,500
Weapons	3 x CIWS Type 1-130 3 x HQ-18 (18 VLS) 2 x RBU-600
Deployed Wing	26 x J-15 6 x Z-18F (ASW) 6 x Z-18J (AEW) 2 x Z-9 (ASW/SAR)

The naval power projection capability of an aircraft carrier is based on its deployed wing. In the case of the USA or France, the wing has been specifically designed according to their national needs and their industrial capabilities. In comparison, the configuration of the PLAN's deployed wing shows reduced capabilities aimed at closing a capability gap with other countries.

The deployed aircraft is the locally designed Shengyang J-15 based on the Sukhoy SU-33 of Russian design, and from which they acquired a prototype in Ukraine in 2001. Electronics and weapons are locally developed as well. This aircraft is the only one currently in Liaoning and it suffers a heavy penalty in its combat range when using a sloped ramp, instead of steam catapults, which limit its military capabilities.

The J-15 has the ability to provide powerful air coverage in proximity to the CVBG, but is unable to project it much further, very much in the Soviet doctrine of the 70s of the Kiev class and its Yak-38 Forger, although somewhat improved. However, the greatest shortcoming of the PLAN's deployed wing at this time is the lack of fixed-wing support mission aircraft, such as AEW or ASW.

So far, the production of J-15 is estimated at two dozen units, with reports that the PLAN and the PLAAF are not entirely satisfied with the final capabilities demonstrated. Even high-ranking Russian industry officials have spoken openly of Beijing's interest in acquiring the newly built SU-33, or some units and the license to build locally. This is very significant for the future of the program, because if it were true, it would demonstrate a root problem in the entire design and production of the aircraft carrier force.

In the case of a fixed-wing AEW aircraft, for example the E-2 Hawkeye, replaced by helicopters by the Chinese, British and Spanish (which have early warning capabilities with much shorter coverage as well as reduced loitering time). These reduced capabilities, in the case of an oceanic deployment, are a great disadvantage for a CVBG since China lacks a network of logistical bases that can replace these platforms. Specifically, in the Indian Ocean or Western Pacific the Liaoning CVBG would have a very limited detection radius and very little chance of receiving support

from aviation based on land. It is assumed that currently in China is working on an embarked version of an AEW aircraft, having shown a scale model of the plane, although not much more is known. The development of an aircraft of this type is long and expensive, as well as extremely complicated technologically.

The ASW defense, apart from the escort's own ships, would be based on a few ASW helicopter units. As in the case of the AEWs, their limited scope and patrol time severely limit the ability of the PLAN to protect its most powerful vessel from the most latent and effective threat that its adversaries are capable of presenting. This is not new; ASW capabilities have never received much attention in Chinese doctrine, which is why it is one of the most dangerous fields, and in the best of cases do not fulfill the new ASW function that a CVBG in oceanic deployment would require.

We can infer, therefore, that the current capabilities of the PLAN's CVBG are limited and focused more specifically on the training of the fleet and its deployed Naval Aviation, thus taking important risks in case of conflict and advanced deployment, but providing an embryonic capability.

Type 001A

If the program had been stuck, at this point we could be talking about a national experiment or even a strategic national objective to be achieved in future decades. However, the peculiarity of the Chinese program lies in the development speed it currently has. A fact that makes us ask many questions with few clear answers, and that keeps many analysts continually searching for the minutest evolutions of the PLAN.

In November 2013, the China Shipbuilding Industry Corporation (CSIC), the corporation that owns the Dalian shipyards, would begin the sheet metal cutting of a new aircraft carrier in the greatest of secrecy, or at least not making it public.⁴ The keel would be placed in March of 2015 and in December of that year a spokesperson of the PLAN would officially confirm that it was in the process of being built. It would be launched on April 26, 2017.

The vessel, whose official name is not yet known, is the first fully Chinese-built aircraft carrier. Based on the experience and design of the *Varyag*, slight structural and layout improvements are assumed comparable to the first unit. Its length reaches 315 meters and the island is significantly smaller than the *Liaoning*. It is also important to note the reduction of construction periods in the shipyard. The deployed wing of the new aircraft carrier would be increased by eight units, although of the same type and with the same limitations during takeoff. It is important to note that the construction of both ships cannot be directly compared, since one was a project from another country and the other a new ship since its inception.

The first sea trials of the Type 001A took place on April 23, 2018. It is expected that the experience gathered in the first vessel will reduce the time needed to complete them, but it is not expected that these will end before mid-2019, at best. The CSIC itself has announced that it expects to be able to deliver the vessel to the PLAN in 2018, which would mark a milestone in shipbuilding. The most important difference from the *Liaoning* is that the Type 001A is a military operational vessel in all aspects, while its predecessor was a technological demonstration-training vessel, with limited military capabilities. However, the PLAN would continue to face the situation of owning two aircraft operational carriers in the fleet, while continuing to develop and test all the operational doctrines associated with these types of vessels.

Type 002

Since 2015, there have been convincing reports and news from the Asian media regarding the start of the construction of a new aircraft carrier by the PLAN. In this case, it would be of a new design and by a new shipyard. According to different sources, the construction of this new air-

craft carrier, called Type 002, should have started between 2015 and 2016. The shipyard designated for its construction was Jiangnan Changxinghao, in the Shanghai area.

The news about this project is diverse and confusing, due to the secrecy that the PLAN imposes on its entire aircraft carrier program. The estimates speak of a conventional aircraft carrier (CATOBAR) although following the hull lines of the *Kuznetsov* class, of which the CSIC already has enough information and experience to develop without major inconveniences. It should be considered at this point that the Ulyanovsk project is also leaving its mark on said vessel.

Another of the key points that creates controversy is the propulsion plant. Since China is the nation that has probably had the most complex, expensive and longest naval nuclear propulsion program in history, this third aircraft carrier seems to be at a good technical, political and economic moment to apply the technologies developed in the SSN and SSBN in a surface vessel, specifically in a CVN. As we have seen, the operational needs that derive from the Western Pacific and Indian Ocean scenarios require a CVN. The new EMALS launch catapults also require a nuclear plant, of which China appears to have a very advanced technology, and which require a high electrical consumption for its operation, not to mention the power requirements of its new laser weaponry, which is another one of the PLAN's open research programs. It is curious that in 2018 the CSIC website published, as one of its immediate priorities, to equip new aircraft carriers with nuclear reactors. This information was subsequently deleted from the web.

The Central Military Commission demanded the inclusion of the EMALS in these Type 002 vessels, since they provide deployed aviation with a range much higher than the one provided by sloping takeoff ramp. Likewise, the problems it has suffered in its development, at the Huludao test site, seem to be the main reason why the construction of Type 002 was stopped in the summer of 2017, same date when the Commander in Chief of the PLAN, Vice Admiral Shen Jinlong, visited the shipyard.

However, the propulsion plant remains an open and interesting subject of debate. One of the most important naval engineers of China, Ma Weiming, recently received a state award for what seems to be the application of a new electric transmission network in ships, which would allow the Type 002 to comply with the energy needs of the EMALS without the need to resort to a nuclear plant. This leaves open to speculation which propulsion plant will be on the ship.

In any case, the Type 002 can be considered the first aircraft carrier of Chinese design, concept and construction. It is true that if the technologies mentioned are applied, it will be a very risky technological bet for the PLAN. Only time will tell.

It is expected that the deployed wing of the Type 002 will accommodate up to 40 aircraft and will have a displacement in the order of 90 to 100,000 tons. Its launch is expected in 2020 and its commissioning with the fleet will be three years later, in 2023.

The short deadlines between the deliveries of the Type 001A and the Type 002 also force us to address their deployed Naval Aviation requirements. So far, the units produced by J-15 are estimated at 24, two batches of 12 and some prototypes. This production allows equipping the *Liaoning*, although without possibilities of rotation or maintenance. Therefore, equipping the Type 001A, the Type 002 and the ground-based training units will require at least 80 newly built aircraft. This is a very important program for Chinese strategic objectives and we will see if it enjoys a national solution, or one from its northern neighbor. Some of the prototypes of the J-15 have been equipped with the necessary equipment to operate with CATOBAR aircraft carriers.

Since 2010, the existence of a scale model of the prototype of a fixed-wing deployed aircraft AEW, known as Xi'an Y-7, has been known. Said prototype was photographed in 2017 at the Huludao polygon, which shows the PLAN's interest in operating this type of aircraft. The Type 002 and its characteristics would allow the PLAN to operate these essential aircraft in the current naval warfare. However, apart from this model, nothing else is known about this project.

The training of naval aviators has also been reinforced with the creation of naval institutions under the command of the PLAN to accelerate their training, making it more specific and less dependent on the PLAAF, although they do not yet have advanced trainers specifically designed for this function.

The PLAN's OOB in the Coming Years

The PLAN can be proud of the achievements made in its aircraft carrier program and, in general, in the construction of the modern ocean fleet that it is beginning to forge and build. However, the PLAN's main problem for the future is not in which aircraft or aircraft carriers it will operate, but in achieving an ocean fleet, without neglecting its other maritime responsibilities, and at the same time being able to cover the costs of all these units, crews, logistics, training and maintenance.

We must never forget where the once world superpower, the Soviet Union, ended, despite its technological achievements in the naval field. The costs of all these programs, plus those of the other military branches, were the slab that would end up on the grave of a country and a system that was not able to maintain the economic rhythm for its voracious appetite for new weapons and technologies. Vessels and programs such as the Alfa, Typhoon or Papa submarines, and ships such as the Kiev, Kirov and Ulyanovsk, would not be noted if not for the economic ballast they caused in the nation as a whole.

The PLAN's CVBG is still to be clearly defined, although we can estimate some of the ships that will become part of its escort. The new Type 055 Destroyers will be part of the escort of the CV, but it is a program with few finished units and in the process of construction.

To be conservative, and knowing that the PLAN is reflective to a large extent of the experiences of the US Navy, adapting them to their particular situation, the escort of a CV could be constituted by the following units: 2 DDG (Type 055, 052C or 052D) for ASuW and AAW, 1 to 2 FFG Type 054A for ASW and at least 1 SSN for ASW, in addition to the logistics ships required to keep all the CVBG supplied. At this moment the PLAN is in the process of building 2 CV / CVN and we have to assume that they will at least reach a quantity of 4 to 6 vessels, with the objective of standardizing the fleet and creating synergies of the construction process, assuming that the Type 002 is the fleet's standard.

If the program were stopped with the three known units, surface units assigned to aircraft carrier escorts would be in the following order: 6 DDG, 3 to 6 FFG and 3 SSN. According to the current composition of the fleet, these vessels assigned to escort functions would be 23% of the available destroyers of all types in the PLAN, 12% of the total FFG, and 50% of the available SSNs. They are abysmal numbers for a fleet in the process of transition, mainly in the underwater field. Although they would not be the most effective, this function could be fulfilled, with a significant reduction in effectiveness, by conventional submarines of which the PLAN has a large number. However, they would not effectively accomplish this mission, even if the Type 002 had nuclear propulsion.

The aircraft carrier program in the coming years will represent that a significant percentage of the fleet, both in surface and submarine units as well as logistics used for escort functions, instead of naval operations. To solve this situation the number of units in the fleet would need to be increased, with the respective economic, maintenance and personnel costs, or the rest of operations of the PLAN would need to be reduced for the benefit of the CVBG. Both are solutions involving compromise, and place the PLAN at a critical moment in its history, just as they begin to realize naval projection capabilities beyond their regional maritime influence zone.

On the economic side, since China is one of the world's leading economies, this issue should not represent a bigger problem than a state budget adjustment. However, the volatility of Chi-

nese growth, as well as the important defense budget assigned to other programs such as the Strategic Forces, SSBN, SSN, PLAAF, compels us to rationalize or reduce units and costs at some point in the future.

We can try to put gross figures at the cost of the program, taking into account that the three units under construction are in each case prototypes and, therefore, expensive units to build, despite the lower cost of Chinese hand labor. Each aircraft carrier can be estimated at \$3 to 4 billion dollars. The deployed wing, taking as a reference a Su-33 at \$50 million dollars per unit, and a total of 30 units per vessel plus support aircraft, AEW and ASW, would give us a total cost of another \$3 billion dollars. Escorts and logistic vessels, excluding submarines, will exceed \$4 billion dollars. All this gives us a necessary amount to build the combat units of a CVBG that would exceed \$10 billion dollars in the construction period, which can range between 6 to 10 years.

The operational factors of maintenance, training, fuel and repairs, can be estimated at 10% of the cost of construction, according to experiences of the US Navy, which would be more than \$1B per year for CVBG. However, we must bear in mind that this is a factor that in the early years and with prototype ships, become more expensive exponentially and cannot be assessed a priori. The necessary personnel for 3 CVBG, several tens of thousands of officers, naval aviators and crewmembers, also represent an important cost for the PLAN's budget. The experiences of the US Navy are not directly applicable to bring decades of experience applied to the global operation of CVBG. In the Chinese case these estimates, being their first experiences, can double or triple the costs.

Although they are very important figures, if the Chinese economy maintains its growth rate and the CMC continues to support the CVBG development policy for the PLAN, it is a feasible objective to achieve and maintain over time. However, as the PLAN begins to absorb a quantity of resources to its brothers PLA and PLAAF, the unlimited growth of the naval forces of a nation, against limited budgets and variable to external factors, is something very difficult to maintain over time.

Neighbors and Threats

The biggest problem facing China in its naval strategy is its geographical position with respect to the oceanic SLOCs and their exit to deep waters. Around China, its neighbors are hostile or maintain border disputes in different archipelagos. The truth is that the naval forces of China are the PLAN, while that of its adversaries is the sum of the different organizations of Defense and Allies of the United States.

Regardless of the Fleets it may face, the greatest threat that a CVBG of the PLAN should face is, precisely, the Achilles heel of the PLAN: submarine warfare. It is no coincidence that the nations bordering China have modern submarine units in significant numbers.

Let us see a quick summary of the submarine threat in the Asian continent:

Japan	9 Soryu submarines and 3 more in Construction, 11 Ohashio submarines and 1 Asahio submarine.
South Korea	9 Type 209/1200, 7 Type 214 plus 2 in Construction, 2 class DSX 3000 authorized and they are studying the possibility of a new class based on the French SSN Barracuda.
Taiwan	2 Zwaardvis and 2 Guppy II. For decades, Taiwan has tried to increase the number of submarines, either purchasing them abroad or through local construction.

Singapore	2 Västergötland and 2 Sjöormen. At the present time 2 type 218SG are being built in Germany.
Vietnam	6 Kilo Project 636MV. Considered excellent and very capable submarines.
Malaysia	2 Scorpene.
Indonesia	2 Type 209/1300 and 3 Type 209/1400 being built.

Other nations, such as India, Canada and Australia, are currently undergoing programs to renew their submarine fleet in large numbers with some of the most numerous and advanced SSK programs in the world. To all this we must add the units that the US Navy can get to deploy in an area of interest.

As we can see in a simple arithmetic operation, the sum of the border submarine threat against the PLAN is very high. To this, we must add that the PLAN has always relegated ASW training as secondary, so the risk faced by a CVBG in a hypothetical combat is high. The lack of on-board aviation ASW or logistical bases for ASW support with aviation based on land in more distant scenarios puts check on the Chinese naval strategy of CVBG in remote seas.

As we have seen, the aircraft carrier program is expensive and takes a long time, if not decades, to reach optimal operational capabilities. However, the PLAN if the tried to correct their shortcomings in ASW, it would also face a new problem of cost and time, since it is another aspect of the Naval warfare that is expensive and difficult to maintain in a fleet, and we cannot stop investing in it at the risk of losing capabilities. It is the PLAN's great Achilles heel.

Conclusions

China has demonstrated the political, economic, and technological ability to develop and build aircraft carriers. In addition, the number of aircraft carriers currently in operation, in tests or under construction, shows strong political support for the program. It is currently in the process of developing operational doctrine for the use of the CVBGs framed within the rest of the PLAN and within its own national strategy. The great doubts are mainly framed in its deployed wing, with the J-15 fighters in question, and with fixed-wing support aviation, AEW and ASW, still pending to be developed. The CV platforms themselves have yet to define the standard that China wants as a definitive for its fleet. The possibilities of improvements in these aspects in the coming years are very great, depending on continuing economic and political support. If the SLBM, SSBN and SSN programs are an example, they will continue with them regardless of cost or time.

Another aspect to be evaluated is the impact that the CVBGs will have on the OOB of the PLAN, since it will require a large percentage of the surface, submarine and logistic units that the PLAN currently enjoys. Therefore, the PLAN will have to increase the construction of more escort units and SSN, or reduce the missions of the PLAN outside of the CVBG.

Thus, the next few years will need an intense follow-up to the PLAN in order to elucidate where the future composition of the fleet is going and how the CVBGs will fit in. □

Notes

1. The GIUK gap is an area in the northern Atlantic Ocean that forms a naval choke point. The acronym is derived from Greenland, Iceland, and the United Kingdom, with the gap representing the open sea located between these three landmasses.

2. The First Island Chain is considered those made up by the Japanese archipelago, the Ryukyu, Taiwan, the Philippines and Borneo. Basically from the Kamchatka peninsula to the Malaya peninsula.

3. The Second Island Chain extends from the Japanese archipelago to Guam and Eastern Australia.

4. The CSIC is the Chinese macro corporation that controls the main military and civilian shipyards in the country and carries out all of the PLAN's naval programs.



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