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Issue Brief

China's Fujian Aircraft Carrier: A Technological Leap in Shipbuilding

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Summary

The 'Fujian' aircraft carrier is China's first carrier equipped with an electromagnetic aircraft launch system. While the US has 11 nuclear-powered aircraft carriers, only the USS Gerald R. Ford has electromagnetic catapults.

Introduction

In November 2025, China commissioned its third aircraft carrier, 'Fujian', which is more advanced with better combat capabilities than the previous two aircraft carriers, i.e., Liaoning and Shandong.[1] The Fujian carrier, estimated to cost approximately US$ 8 billion, is China's first domestically designed aircraft carrier.[2] It was officially launched in June 2022 and conducted its first sea trials in May 2024. It is now a part of the South Sea Fleet of the Southern Theatre Command Navy.[3]

The 'Fujian' aircraft carrier is distinctive compared with the previous two because its commissioning marks a technological breakthrough that demonstrates China's capability to build an indigenous aircraft carrier. Unlike the Fujian, the last two aircraft carriers were based on Soviet technology. Moreover, the 'Fujian' aircraft carrier is China's first carrier equipped with an electromagnetic aircraft launch system (EMALS).[4] The previous two aircraft carriers have ski-jump aircraft takeoff decks. Before Fujian, the United States was the only country to have an aircraft carrier with an electromagnetic catapult launch system, which was commissioned in 2017.[5]

The commissioning of 'Fujian' surprised analysts as China has leapt from ski-jump technology to electromagnetic catapult technology, bypassing the steam catapult technology.[6] For aircraft carrier-based takeoff and landing, most countries, including the United States, first developed ski-jump technology, then steam catapult technology, and finally electromagnetic catapult technology.[7] However, China directly transitioned from ski-jump technology to electromagnetic catapult technology, which is the most advanced and provides an edge in combat capabilities. Second, the 'Fujian' carrier's electromagnetic catapult system is conventionally

[1] **"China's First Electromagnetic Catapult-equipped Aircraft Carrier Enters Service (我国第一艘电磁弹射型航空母舰入列)"**, *Shaanxi Daily*, 8 November 2025.

[2] **"Serious Design Flaws Weaken the Functionality of the Newly Built Aircraft Carrier 'Fujian' (严重设计缺陷削弱全新'福建'号航空母舰功能)"**, *RFI*, 21 November 2025.

[3] Mei Changwei, **"Xi Jinping Presented the PLA Flag to the Chinese Military and Boarded the Ship for Inspection. At the Catapult Control Station, He Pressed the Catapult Button, and the Unloaded Rotor Launched Like an Arrow Towards the Bow"**, *Xinhua News Agency*, 8 November 2025.

[4] **"Following the Delivery of the Fujian Aircraft Carrier, US Media's Tone Has Changed, Revealing a Sour Grapes Attitude Once Again (福建舰交付美媒口风变了酸葡萄味再现)"**, *Xiaodi Vision*, 7 November 2025.

[5] **"Navy to Commission New First-In-Class Aircraft Carrier Gerald R. Ford"**, U.S. Department of War, 20 July 2017.

[6] Nectar Gan,Brad Lendon, **"China's Latest Aircraft Carrier Showcases New Fighter Jet Launch System. Only the US Has the Same Tech"**, *CNN*, 23 September 2025.

[7] Kyle Mizokami, **"The U.S. is Throwing Things Off Aircraft Carriers With an Electromagnetic Catapult"**, *Popular Mechanics*, 7 March 2024.

powered, unlike the United States' nuclear-powered USS Ford-class carrier.[8] This makes the Fujian carrier the first of its kind, a conventionally powered aircraft carrier with electromagnetic catapults.

A Technological Leap in Shipbuilding

Before the commissioning of the Fujian aircraft carrier on 5 November 2025, the Chinese military released a video showing the take-off and landing of three types of carrier-based aircraft on the deck of the Fujian carrier, including J-15T multi-role fighter, J-35 stealth fighter, and KJ-600 early warning aircraft, using electromagnetic catapults.[9] According to Lu Junyong, a member of Fujian Carrier's R&D team, the ship features three electromagnetic rails and a flat deck, with a water displacement of 80,000 tons. Sea trials of the Fujian carrier began in May 2024, and by August 2025, eight rounds had been completed. These trials primarily tested its power, electrical and catapult systems.[10]

With the combination of an electromagnetic catapult, the Fujian aircraft carrier can carry various types of aircraft, including fighter jets, attack aircraft, early-warning aircraft, electromagnetic warfare aircraft and search-and-rescue aircraft. In addition, the Fujian carrier is equipped with a multifunctional integrated electronic mast that combines the functions of multiple antennas previously installed on the two preceding aircraft carriers. The mast provides three key functions. First, it includes air and sea search, tracking and guidance, as well as missile defence and fire control. Second, it supports the electronic reconnaissance function of collecting and analysing enemy electromagnetic signals. Third, it helps jam and deceive enemy electromagnetic signals.[11] Furthermore, the Fujian carrier is equipped with 32 phased-array radars, including S-band and X-band fire-control radars. These are all active phased-array radars, meaning each radiator is fitted with an independent transmitting and receiving component that can generate and receive electromagnetic waves.[12]

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[8] Yu Zeyuan, **"China's Fujian Hits the Water — Next Carrier Already in the Works"**, *Think China*, 10 November 2025.

[9] Xin Li, **"Footage of Fujian Warship's Electromagnetic Catapult Released: China Takes the Lead Over the US (福建艦電磁彈射畫面公開　中國走在了美國前一步)"**, *Hong Kong News*, 24 September 2025.

[10] **"Following Ma Weiming, China has Produced Another Academician in the Field of Electromagnetic Catapults, Reaching the Pinnacle of Academia at the Age of 47"**, Jiezhi, Henan, 26 November 2025.

[11] **"Hong Kong Media: Chinese Paper Reveals Advanced Mast Technology, Giving Fujian Aircraft Carrier an Advantage Over US Ford-Class Ships (港媒：中国论文披露先进桅杆技术，让福建舰相比美福特级更有优势)"**, Tianji Tea Bureau, Jiangsu, 31 January 2024.

[12] **"How Advanced is the Island Superstructure of the Fujian Warship? An Integrated Mast and 32 Radars—Unparalleled Globally! (福建舰舰岛有多先进？一体化桅杆，32 面雷达，独步全球！)"**, *Zhihu.com*, 10 May 2024.

Why Electromagnetic Catapult Technology?

For several years, a team of Chinese engineers has been developing a steam catapult system based on the decommissioned Australian Navy aircraft carrier HMAS Melbourne, which China acquired in 1985.[13] However, following the successful development of a mature electromagnetic catapult by Chinese academician Ma Weiming and his team, the Chinese leadership decided to forgo the steam catapult for their new Fujian aircraft carrier.[14] Ma Weiming is better known as the 'Father of the Chinese Electromagnetic Catapult'. He is recognised for a series of breakthroughs in ship propulsion and electrical engineering, which are considered milestones in the development of modern naval equipment. He was awarded the 'August 1st Medal' by the Central Military Commission, one of the highest awards in the Chinese military.[15]

With electromagnetic catapults, the Fujian carrier can have significant advantages over aircraft carriers with ski-jump or steam catapult technology, including a higher aircraft sortie rate, shorter take-off preparation time, the ability to use multiple catapults, and easier maintenance. In addition, in comparison to the steam catapult system, the Fujian carrier with electromagnetic catapult multiplies the combat radius and thereby enhances the carrier's overall combat capabilities.[16] Secondly, unlike the steam catapult, the Fujian carrier's electromagnetic catapult does not require complex piping systems. Thirdly, the electromagnetic catapults in Fujian enable the airline to flexibly select the launch force that prevents damage to the aircraft. Furthermore, unlike the ski-jump deck, the Fujian carrier has a flat deck that accommodates more aircraft.[17]

The Electromagnetic Aircraft Launch System (EMALS), also known as the electromagnetic catapult system, is a shipborne takeoff device on aircraft carriers. It is a device that uses electromagnetic force to drive the launch object and accelerate it to ultra-high speed. Essentially, it is an energy-conversion technology that converts

[13] **"Unable to Master Electromagnetic Catapults, Are US Aircraft Carriers Reverting to the Old Path of Steam Catapults? No Going Back, Bro! (玩不转电磁弹射，美国航母重走蒸汽弹射老路？回不去啦兄逮！)"**, *Guancha.cn*, 31 October 2025.

[14] Ibid.

[15] **"National Treasure-Level Academician Ma Weiming: If the US Has Any Questions About Electromagnetic Catapults, Feel Free to Ask Me! Netizen: Electromagnetic Saint (国宝级院士马伟明：电磁弹射领域，美国有不明白的地方可以来问我！)"**, *Sina*, 27 September 2025.

[16] Laura Bicker, **"China Launches New Aircraft Carrier in Naval Race with the US"**, *BBC*, 7 November 2025.

[17] **"Video | Major Breakthrough! Unveiling the Core Support Behind the Electromagnetic Catapult System on the Fujian Aircraft Carrier (视频丨重大突破！解密福建舰电磁弹射背后的硬核支撑)"**, *CCTV News*, 15 November 2025.

electromagnetic energy into kinetic energy with high efficiency.[18] Unlike previously developed take-off devices such as ski-jump and steam catapults, the electromagnetic catapult can launch a wide range of manned and unmanned aircraft, from small drones to large fighter jets, with high precision. So far, only four countries—the United States, the United Kingdom, Russia and China—have researched the electromagnetic catapult system. Among them, only the United States and China have successfully built and commissioned it.[19]

China Shipbuilding Corporation developed the electromagnetic catapult system mounted on the Fujian aircraft carrier under the supervision of Chinese academician Ma Weiming. The Chinese electromagnetic catapult system differs from the United States 'in that a DC power system drives it, whereas the United States' is driven by an AC power system.[20] The technology was developed at the Shanghai Aerospace System Engineering Research Institute under the supervision of Ma Weiming.[21] In fact, Ma Weiming is the first to propose and develop a medium-voltage DC integrated power system for all-electric propulsion systems and the electromagnetic catapult of aircraft carriers.[22] Unlike the steam catapult, the electromagnetic catapult drives its piston with electricity rather than steam; therefore, it requires fewer service personnel than the steam catapult system, resulting in lower maintenance costs.[23] One reason China avoids using steam catapults is that they cannot launch heavier early-warning fighters, which are crucial for information support in modern warfare.

It is worth noting that China has taken relatively less time to develop an electromagnetic catapult than the United States. The United States began researching electromagnetic catapult technology for its aircraft carriers in the 1930s, during World War II.[24] The research was shelved due to the lack of available technology and the required magnetic material at that time. However, it was resumed in the 1980s, and it took more than three decades before they commissioned their

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[18] Li Bing, Li Weichao and Jing Congkai, **"Current Status and Application Prospects of Electromagnetic Launch Systems (电磁发射系统研究现状及应用展望)"**, National Key Laboratory of Electromagnetic Energy Technology, Naval University of Engineering, 2023.

[19] **"Electromagnetic Aircraft Launch System (电磁弹射器)"**, *Baidu*, 2025.

[20] **"Electromagnetic Launcher (电磁弹射器)"**, *Chinese Wikipedia*, 2025.

[21] **"Can Anything be Launched? Academician Ma Weiming's Team Has Created the World's First Patent for Electromagnetic Catapult-launched Satellites. What Kind of Cutting-edge Technology Is This? (万物皆可弹？马伟明院士团队全球首创电磁弹射发卫星专利，这是一种什么样的黑科技？)"**, *QQ*, 11 July 2023.

[22] Zong Wen, **"Ma Weiming, a 'National Treasure' Expert (国宝级"专家马伟明)"**, *People's Weekly*, 27 November 2021.

[23] **"Experts Explain the Advantages of Electromagnetic Catapult Technology on the Fujian Aircraft Carrier (专家解读福建舰电磁弹射技术优势)"**, *Phoenix TV*, 7 November 2025.

[24] **"Hong Kong Media: Chinese Paper Reveals Advanced Mast Technology, Giving Fujian Aircraft Carrier an Advantage Over US Ford-Class Ships (港媒：中国论文披露先进桅杆技术，让福建舰相比美福特级更有优势)"**, Tianji Tea Bureau, Jiangsu, 31 January 2024.

first aircraft carrier equipped with an electromagnetic catapult system. In contrast, China's second aircraft carrier, Shandong, with a ski-jump, was commissioned in December 2019. At the same time, a team of Chinese engineers were working on a steam catapult system, probably for the Fujian aircraft carrier. However, Ma Weiming's team was ready with a mature electromagnetic catapult technology for the aircraft carrier. Therefore, Xi Jinping decided to shift to electromagnetic catapult technology and to forgo their nearly developed steam catapult technology.[25]

Combat Capability of Fujian Carrier

Two weeks after the commissioning of the Fujian aircraft carrier, it was sent for its first live-fire training exercise at sea on 18 November 2025. The formation of the Fujian aircraft carrier group included *Yan'an* Type 055 guided-missile destroyer, *Tongliao* Type 054A guided-missile frigate. The training aimed to assess the compatibility between the ship and its aircraft by conducting multiple take-offs and landings.[26] So far, the identified aircraft and equipment at the Fujian carrier include the KJ-600 early-warning aircraft, J-35 stealth fighter jet, J-15T fighter jet, J-15D electronic-warfare aircraft, GJ-21 UAV, Z-18F anti-submarine helicopter, and Z-20H multipurpose helicopter.[27]

The electromagnetic catapult system in Fujian is capable of launching both a 30-ton heavy fighter and light drones weighing only a few tons. In addition, the sortie rate of the Fujian carrier is 2.5 times higher than that of the Shandong aircraft carrier, and is capable of launching 160-180 sorties per day. In comparison, the Shandong carrier has 54 sorties per day. With a water displacement of 80,000 tons, the Fujian far exceeds the previous two aircraft carriers, Liaoning and Shandong, enabling it to carry more carrier-based aircraft, ammunition, and fuel reserves, and ensuring longer endurance at sea.[28]

Analysts note that the combination of the J-15D electronic-warfare aircraft, the J-35 stealth fighter, and the KJ-600 early-warning aircraft indicates a significant leap

[25] Mei Changwei, **"Xi Jinping Presented the PLA Flag to the Chinese Military and Boarded the Ship for Inspection. At the Catapult Control Station, He Pressed the Catapult Button, and the Unloaded Rotor Launched Like an Arrow Towards the Bow"**, no. 3.

[26] **"Fujian Aircraft Carrier's First Live-fire Exercise Reveals Latest Details; Experts: 'Aircraft Carrier's Five-piece Set' Combat Capability Begins to Emerge (福建舰首次实兵演练，最新细节曝光专家：'航母五件套'战力初显)"**, *Global Times*, 19 November 2025.

[27] **"National Strategic Weapon / Entering the Era of Three Aircraft Carriers: Breaking Through the Island Chain to Deter and Control the Western Pacific (国之重器/迈入三航母时代冲破岛链慑控西太)"**, *Ta Kung Pao*, 8 November 2025.

[28] Zhao Guanqi, **"Fujian Aircraft Carrier Changes the Strategic Landscape of the Western Pacific: The Era of Three Aircraft Carriers – Has the US-China Rivalry Entered a New Stage? (福建舰改变西太平洋战略格局　三航母时代　中美博弈迈入新阶段？)"**, *Hong Kong News*, 11 November 2025.

forward in Chinese aircraft-carrier capabilities relative to its previous two carriers. The Fujian carrier has the advantages of operational range, payload and awareness range.[29] Fujian's operational radius can effectively control the airspace and waters hundreds of nautical miles.[30] Fujian aircraft carrier's weapon systems are modern and comprehensive, with its core capabilities centred on air power and electronic warfare.[31] Its design focuses on forming a powerful carrier strike group and coordinating multidimensional operations through information, electronic, air, and surface capabilities.[32] It can also conduct land-attack, anti-submarine warfare, humanitarian-assistance, and other missions.

The Fujian carrier is expected to carry 50–60 aircraft of various types.[33] Its ammunition primarily consists of various air-to-air, air-to-ground, and air-to-sea missiles, bombs, and anti-ship missiles for its carrier-based aircraft, namely the J-15T, J-15D, J-35, and KJ-600, as well as ammunition for the aircraft's own cannons.[34] The electromagnetic catapult system enables the Fujian carrier to launch a variety of fully loaded aircraft with fuel and weapons, thereby enhancing their combat range and firepower.[35] Key weapons include PL-10 and PL-15 air-to-air missiles, and YJ-12/18 air-to-ground missile.[36]

Among the carrier-based aircraft on the Fujian carrier, the J-35 fighter jet primarily carries 4 to 6 folding-wing PL-15 medium-range air-to-air missiles, enabling beyond-visual-range strikes in stealth mode.[37] Its secondary weapons bay can carry the

[29] Wang Jinzhi, **"When Will It be Fully Staffed and Operational? How Will Its Performance be Improved? Where Will It be Deployed in the Future? Several Key Questions Surrounding the Commissioning of the Fujian Aircraft Carrier Have Attracted Widespread Attention (何时满编上舰？如何提升性能？未来部署哪里？福建舰服役多个热点引)"**, *Global Times*, 11 November 2025.

[30] Albee Zhang, **"What to Know About China's Newest Aircraft Carrier, the Fujian"**, The Associated Press, 7 November 2025.

[31] **"The Fujian Aircraft Carrier Has a Key Flaw; Its Air Combat Capability is Only 60% of that of a US Aircraft Carrier from 50 years ago (福建號存關鍵缺陷空中戰力僅美 50 年前航母六成)"**, *The Epoch Times*, 17 June 2022.

[32] **"J-35 Stealth Design Reaches World-class Level After Successful Electromagnetic Catapult Launch from Fujian Aircraft Carrier (在福建舰成功电磁弹射起飞歼-35 隐身设计已达世界一流水平)"**, *CCTV News*, 4 October 2025.

[33] Richard Thomas, **"Analysis: What We Know About the Fujian, China's New Aircraft Carrier"**, *Naval Technology*, 9 May 2024.

[34] Francesca Genovese, **"China: The FUJIAN Aircraft Carrier Enters Service - The First Equipped with EMALS Electromagnetic Catapults"**, *FW Magazine*, 7 November 2025.

[35] Alec Hively, **"China Just Launched Their Most Advanced Aircraft Carrier With Electromagnetic Catapults"**, *BGR*, 10 December 2025.

[36] **"Focusing on China's Aircraft Carriers (Part 1): Fujian Ship (聚焦中国航母专题（一）：福建舰)"**, *Yuna a Yun*, 18 June 2022.

[37] Enoch Wong, **"China's Carrier-borne J-35 Stealth Jets Can Carry up to 6 Missiles, Designers Say on CCTV"**, *South China Morning Post*, 8 September 2025.

short-range air-to-air missile PL-10.[38] It operates in conjunction with early-warning and electronic-warfare aircraft to allow beyond-visual-range strikes.[39] Second is the J-15T carrier-based fighter jet, which has powerful weapon-carrying capabilities and carries PL-15 long-range air-to-air missiles, PL-12 medium-range air-to-air missiles, PL-10 short-range air-to-air missiles, PLA-8 short-range infrared-guided air-to-air missiles, YJ-83K subsonic anti-ship missiles, and YJ-12 supersonic anti-ship missiles.[40]

Third is the J-15D carrier-based electronic warfare aircraft, equipped with advanced electronic warfare pods and systems to conduct aerial electronic jamming, reconnaissance, and suppression of enemy air defence systems.[41] This aircraft enhances the overall combat capability and survivability of the Chinese carrier strike group, especially in complex electromagnetic countermeasures environments. Fourth is the KJ-600 carrier-based fixed-wing early-warning aircraft, primarily deployed on the Fujian aircraft carrier, which utilises electromagnetic catapult launch and recovery systems, providing long-range early warning and command-and-control capabilities for carrier strike groups.[42] The aircraft acts as a force multiplier by tracking numerous targets simultaneously.

The self-defence weapons in Fujian carrier include a close-in weapon system (CIWS) such as four Type 1130 CIWS to intercept supersonic anti-ship missiles and aircraft, four HQ-10 24-cell surface-to-air missile defence systems, anti-submarine weapons such as 12-cell anti-swimmer grenade launcher to counter underwater infiltration threats, 6-cell 324mm anti-torpedo launcher, and the 24/32-cell 122mm multi-purpose rocket launcher. Lastly, the overall combat capability of the Fujian carrier group also depends on the accompanying destroyers, frigates and submarines, which together form a multi-layered, comprehensive defence and attack system.[43]

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[38] **"China's J-35 'Beast Mode': Stealth Fighter That Can Carry 12 Missiles to Dominate Indo-Pacific Skies"**, *Defence Security Asia*, 17 October 2025.

[39] Liu Xuanzun, Guo Yuandan and Liang Rui, **"J-15T, J-35, KJ-600 Aircraft Complete Electromagnetic Catapult-assisted Takeoffs, Landings on China's Carrier Fujian; Event a Milestone in PLA Navy's Transformation and Construction"**, *Global Times*, 22 September 2025.

[40] Da Yiwan, **"Is This Even Watchable? A CCTV Documentary About Aircraft Carriers Shows the J-15 Fighter Jet 'Covered in Mosaics'—What Role Will China's Carrier-based Aircraft Play? (这是能看的吗？央视航母纪录片歼-15 '布满马赛克'，中国航母舰载机将发挥何种作用？)"**, *Zhihu*, 17 April 2025.

[41] **"Chinese Naval Drills Reveal Two New Operational Fighters: How the J-15B and J-15D Enhance Aircraft Carriers' Potentials Asia-Pacific , Naval"**, *Military Watch Magazine*, 3 November 2024.

[42] **"CNS Fujian Achieves Milestone with Electromagnetic Launch of Advanced Naval Aircraft"**, *China Daily*, 23 September 2025.

[43] **"National Strategic Weapon / Entering the Era of Three Aircraft Carriers: Breaking Through the Island Chain to Deter and Control the Western Pacific (国之重器/迈入三航母时代冲破岛链慑控西太)"**, *Ta Kung Pao*, 8 November 2025.

Conclusion

The commissioning of the Fujian aircraft carrier is the beginning of an era in China’s aircraft carrier building. It indicates that the upcoming Chinese aircraft carriers, Type 004 and Type 005, may be able to match the United States in terms of water displacement and combat capabilities. Nonetheless, a critical gap remains between the United States and China in nuclear-powered aircraft carriers, which limits China’s aircraft-carrier combat capabilities. With 11 nuclear-powered aircraft carriers, the United States is far ahead of China. However, the United States has only one nuclear-powered aircraft carrier, the USS Gerald R. Ford (CVN-78), with electromagnetic catapults. Although China doesn’t have a nuclear-powered aircraft carrier, it has built an aircraft carrier equipped with electromagnetic catapults, which enhance its airpower capabilities and combat range. It is likely, however, that China will pursue the construction of nuclear-powered aircraft carriers equipped with electromagnetic catapults.

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