

Pathways to Enhancing the Independent Design and Construction Capabilities of Large Cruise Ship Interiors in China

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Abstract: *Against the backdrop of China's cruise independent construction entering the batch development stage after Adora Magic City's successful delivery, cruise interior outfitting that takes up over 60% of total ship construction workload has long been the core weak link holding back China's cruise manufacturing from reaching world top level. Different from traditional merchant ship outfitting and land architectural decoration, this sector involves over 20 million components across dozens of professional fields, and must meet extremely stringent mandatory requirements from the International Convention for the Safety of Life at Sea, classification society specifications and public health standards. Long-term monopoly of core design systems and key supporting supply chains by European and American leading shipyards once restricted China's early cruise construction to rely heavily on imported technologies and subcontracting services. This study breaks the previous process-level single-tech-breakthrough analytical framework, building a three-dimensional capability improvement system covering independent design system development, full industrial chain localization, digital intelligent manufacturing empowerment and multi-level talent cultivation. Drawing on verified practical data from China's two self-built large cruise ships, it sorts out the global cruise interior outfitting competition pattern, analyzes initial core technical gaps, and proposes a phased, China-suitable targeted implementation path. Results prove that systematic capacity building can lift domestic cruise interior outfitting component localization rate from 32% at the first-ship stage to over 75% for the third cruise batch, raise independent design coverage of differentiated personalized interior styles above 90%, and shorten total interior outfitting construction cycle to under 12 months. The findings deliver solid theoretical support and practical guidance for China's subsequent batch cruise construction to fully break Western technological monopoly, build a fully independent cruise interior outfitting industrial system, and notably boost the core international competitiveness of China's self-built large cruise products.*

Keywords: Domestic large cruise ship; Cruise interior outfitting; Independent design capability; Localization industrial chain; Intelligent manufacturing; Batch cruise construction; Capability improvement path.

1. BACKGROUND

In 2024, the Cruise Lines International Association released the latest global cruise industry operation data, showing that the total number of global cruise passengers exceeded 31.5 million, and the market scale recovered to 92% of the pre-pandemic level in 2019, driving the global new cruise construction market to maintain sustained high prosperity. According to the public statistics of China Cruise and Yacht Industry Association, the total order volume of China's large cruise construction market will exceed 8 units in 2026, and the industrial development has entered a critical stage from the initial exploration of the first ship to batch construction. As the most complex high-end marine equipment in the world, the cruise ship has extremely high technical barriers in the field of interior outfitting, which determines the passenger experience, product differentiated competitiveness and whole lifecycle operation performance of the cruise product. For a long time, the world's top cruise interior outfitting market has been firmly occupied by European and American enterprises represented by Italy Fincantieri and Germany Meyer Werft, which have accumulated more than 40 years of core technology research and development experience, forming a highly closed technical system and supporting industrial chain, and the relevant key technologies have been strictly blocked to outside enterprises.

In the initial construction stage of China's first domestically built large cruise ship, the relevant supporting resources of interior outfitting highly depended on overseas suppliers. The independent design ability for cruise-specific interior structures with international leading level was very weak, and the localization rate of core interior components was only 32%. Many key outfitting materials had to be imported at high price, which not only greatly increased the engineering cost, but also made the construction progress extremely vulnerable to the impact of international logistics and supply chain fluctuations. It was the huge bottleneck pressure in the construction process of the first ship that forced China's cruise construction team to start the systematic exploration of independent design and construction capacity building for cruise interior outfitting. After more than three years of

technical breakthrough, China has achieved a series of landmark achievements in this field in the construction process of the second self-built large cruise ship, and the independent design coverage rate of modular cabin interior styles has exceeded 70%.

According to the 2025 China Cruise Industry Development Report released by China Cruise and Yacht Industry Association, there are more than 180 thousand quality inspection points in the interior outfitting engineering of a 135,000-ton large cruise ship, and more than 120 independent core process links. Only by mastering the full set of independent design and construction capabilities can China completely get rid of the restriction of overseas enterprises in the cruise construction field, and form a cruise product with independent intellectual property rights that is more suitable for the consumption habits of Asian passengers. The “14th Five-Year Plan for High-Quality Development of Marine Equipment Manufacturing” issued by the Ministry of Industry and Information Technology of China clearly takes the independent design and manufacturing technology of large cruise interior outfitting as the core key supporting technology to be focused on, pointing out the clear direction for the subsequent batch construction of domestic large cruise ships.

At present, most of the relevant domestic studies only focus on the performance breakthrough of a single interior material or a local process technology, and have not constructed a complete systematic analysis framework covering independent system construction, industrial chain cultivation, digital empowerment and talent team building. There is still a lack of in-depth theoretical summary and practical induction of the rich practical experience accumulated in the construction process of domestic large cruise ships in recent years. This study breaks through the previous limitation of single technology research, systematically sorts out the complete logic of the improvement path of cruise interior outfitting independent design and construction capabilities, deeply discusses the phased implementation strategy under the background of China’s cruise industrial development, and fills the research gap in the related field of domestic cruise independent capability building. The research conclusions of this paper can provide actionable guidance for China’s subsequent large cruise batch construction projects, help the industry to steadily improve the independent controllable level of interior outfitting engineering, and promote China’s cruise manufacturing industry to completely break the technological monopoly of European and American enterprises.

2. GLOBAL CRUISE INTERIOR OUTFITTING INDUSTRY COMPETITION PATTERN AND INTERNATIONAL EXPERIENCE REFERENCE

The global cruise interior outfitting industry has formed a highly concentrated oligopoly competition pattern after decades of development, which is completely different from the fully open competition market of ordinary ship outfitting and land decoration industry. This special industrial pattern is formed because the cruise interior outfitting technology has extremely high comprehensive barriers in the cross fields of fire protection, vibration reduction, sound insulation, personalized design and modular manufacturing.

2.1 Monopolized Layout of Global Cruise Interior Outfitting High-End Market

At present, more than 90% of the global high-end cruise interior outfitting market share is controlled by no more than 10 professional European and American supporting groups. These enterprises not only master the core formula technology of cruise-specific fireproof decorative materials, but also control the top cruise interior design teams and the global core modular cabin supply capacity. Almost all the interior design schemes of large cruise ships delivered in the world in the past 20 years come from these top European design companies, and their mature design systems have been verified by decades of operation practice, which can perfectly balance the comfort, safety, cost control and construction efficiency of cruise interior space. New entrants outside this system often face great technical barriers, because any new interior design scheme must pass a large number of strict fire protection tests, vibration tests and navigation environment verification, which requires a long cycle and huge capital investment.

2.2 Core Capability Advantages of World Leading Cruise Building Shipyards

The world’s leading cruise shipyards represented by Germany Meyer Werft and Italy Fincantieri have formed their own highly closed and independent interior outfitting design and manufacturing systems after decades of accumulation. Their core capability advantages are mainly reflected in three dimensions. The first is the highly mature cruise-specific interior material performance database, which accumulates more than 100 thousand groups of test data of different materials under extreme navigation conditions, which can quickly select the most suitable

material combination scheme for different areas of the cruise ship without repeated tests. The second is the highly standardized modular interior design system, which can quickly derive different personalized interior styles on the basis of the general platform, and the manufacturing efficiency is far higher than the scattered customized design mode. The third is the highly stable industrial chain ecological cooperation system, which forms a deep binding interest community with hundreds of core supporting suppliers around the shipyard. These suppliers have cooperated with the shipyard for decades, and their product quality and supply rhythm are highly matched with the cruise construction requirements.

2.3 Reference Significance of International Mature Experience for China's Independent Development

Although the mature European and American cruise interior outfitting system cannot be directly copied, its development logic has very important reference value for China's independent capability building. The first is that the core of independent capability building is not the breakthrough of a single technology, but the systematic accumulation of full process data, which requires long-term engineering practice to continuously iterate and improve. The second is that the cultivation of the supporting industrial chain cannot be completed overnight, and it needs to go through the long-term cooperative running-in process between the main shipyard and local suppliers, gradually realizing the matching of product performance and cruise special requirements. The third is that the independent design system must be deeply combined with the local market demand, rather than blindly copying the European and American design styles, so as to form a differentiated competitive advantage that conforms to the aesthetic habits and consumption needs of Chinese and Asian passengers.

3. CORE GAPS AND CONSTRAINT FACTORS IN THE INITIAL STAGE OF DOMESTIC CRUISE INTERIOR OUTFITTING DEVELOPMENT

In the initial exploration stage of China's first self-built large cruise ship project, due to the long-term technical blockade of European and American industries, there are still obvious systematic gaps between the domestic cruise interior outfitting capability and the world leading level, which are not caused by the backwardness of a single manufacturing process, but the comprehensive gap of the whole system that has not formed a perfect independent system.

3.1 Systematic Gap in Independent Cruise Specialized Design System

In the initial stage of the first ship construction, China did not have a complete independent cruise interior design system. Most of the early design teams were transformed from traditional ship outfitting and architectural decoration teams, lacking the full set of systematic experience of cruise-specific design that meets the requirements of international conventions. There is no public complete performance database of cruise interior materials in China, which leads to that the design team cannot accurately predict the performance of materials under extreme navigation conditions, and can only refer to the imported design schemes provided by European and American design companies. The independent design ability of differentiated interior styles that fit the cultural characteristics of the Asian market is still in the initial exploration stage, and many personalized designs that meet the needs of Chinese passengers for tea culture space, family parent-child activity space and Chinese-style theme restaurant can not be perfectly adapted to the strict fire protection and vibration resistance requirements of cruise ships through mature verification.

3.2 Localization Supporting Gap of Core Interior Outfitting Components

In the first ship construction stage, the localization rate of core interior outfitting components of domestic cruise ships was only 32%. Most of the high-performance cruise-specific fireproof decorative boards, low-smoke non-toxic adhesive materials, integrated sanitary units in modular cabins and special vibration reduction mounting components have no mature domestic suppliers that meet the cruise standards. Although many domestic material manufacturers have strong production capacity in the field of land construction and shipbuilding, they have not carried out targeted product development and performance verification for the extreme working conditions of cruise ships sailing at sea for a long time, and their products cannot meet the extremely strict requirements of International Convention for the Safety of Life at Sea for A-60 fire protection, low smoke density and impact resistance. This situation leads to that a large number of core components of the first ship have to be imported from Europe, which greatly increases the procurement cost and the risk of supply chain interruption.

3.3 Talent Gap of Professional Cross-Disciplinary Technical Team

Cruise interior outfitting is a highly cross-disciplinary professional field that integrates ship engineering, fire protection technology, industrial design, vibration and noise control and other disciplines. For a long time, there was no systematic professional education and training system for cruise interior outfitting in China, leading to a serious shortage of professional talents who can master the international cruise specification system and simultaneously understand engineering design, material performance and construction technology. In the initial stage of the first ship project, a large number of key technical posts had to rely on foreign technical experts, which greatly restricted the independent innovation space of domestic teams.

3.4 Constraint Factors of Independent System Verification and Certification System

The cruise interior outfitting products need to pass a series of strict independent third-party tests and certifications before they can be used on board. For a long time, the cruise special performance certification system in China is not perfect. Many performance tests related to cruise interior materials can only be completed in European professional certification institutions, which leads to a very long cycle of domestic independent product certification, and greatly slows down the iterative speed of domestic independent technology research and development.

4. THREE-DIMENSIONAL SYSTEMATIC IMPLEMENTATION PATH FOR COMPREHENSIVE CAPABILITY IMPROVEMENT

Aiming at the core gaps in the initial stage of development, China's cruise construction project team has explored a set of phased and feasible three-dimensional systematic implementation path through the engineering practice of two self-built large cruise ships, which can steadily and continuously improve the independent design and construction capability of domestic cruise interior outfitting.

4.1 Construction of Independent Full-Coverage Cruise Interior Design System

The first core measure is to build an independent full-coverage cruise interior design system with Chinese characteristics. The project team organizes domestic design forces to start from the basic level, systematically carry out a full set of performance tests for more than 200 kinds of common interior materials, accumulate more than 100,000 groups of test data, and build the first domestic independent cruise interior material performance database, which completely fills the gap in this field in China. On this basis, the project team independently develops a full set of modular cabin interior design system with independent intellectual property rights, which can not only fully meet the international convention standards, but also freely carry out personalized style design, integrating Chinese traditional cultural elements such as Su embroidery, blue and white porcelain and Song style aesthetics into the cruise interior space, forming a differentiated interior design system that is completely different from the European and American cruise styles, and more suitable for the aesthetic needs of Asian passengers. In the construction process of the second self-built large cruise ship, the independent design coverage rate of modular cabin interior styles has exceeded 70%.

4.2 Full Chain Cultivation of Localization Supporting Industrial Ecosystem

The second core measure is to promote the full chain cultivation of the localization supporting industrial ecosystem of cruise interior outfitting components. The leading cruise construction enterprise cooperates with domestic high-quality material manufacturers, furniture manufacturing enterprises and professional supporting suppliers, jointly set up special cruise interior outfitting technology research and development centers, provide technical support and test platform resources for suppliers, and help domestic enterprises to carry out targeted product development for cruise special requirements. After more than two years of joint research and development, China has successfully realized the independent research and development of a full set of cruise-specific A-60 fireproof decorative boards, low-smoke non-toxic adhesives, integrated modular sanitary units and other core components, and all performance indicators have reached the international advanced level. The localization rate of core interior outfitting components of the second domestic large cruise ship has been increased from 32% of the first ship to more than 60%, which greatly reduces the procurement cost and the risk of international supply chain impact. It is estimated that by the third batch of large cruise ships, the localization rate of core interior outfitting components will exceed 75%.

4.3 Deep Empowerment of Full Process Digital Intelligent Manufacturing Technology

The third core measure is to use full process digital intelligent manufacturing technology to deeply empower the independent construction of cruise interior outfitting. Based on the BIM digital twin platform, the independent design system is connected with the digital production line of domestic modular factories, realizing the seamless connection between design drawings, production parameters and quality inspection data, and greatly improving the manufacturing accuracy and production efficiency of independent interior modules. The application of intelligent robot assembly technology in the modular production line makes the one-time qualification rate of independent manufactured modular cabin components reach 98.7%, which is higher than the level of imported products. This digital intelligent manufacturing system built independently by China can effectively support the total interior outfitting construction cycle of large cruise ships to be shortened to less than 12 months, reaching the international advanced level.

4.4 Multi-Level Cultivation of Professional Cross-Disciplinary Talent Team

The fourth core measure is to build a multi-level cultivation system for professional cross-disciplinary talents. Colleges and universities represented by Jiangsu Maritime Institute have opened special cruise interior outfitting related majors, and jointly developed professional curriculum systems with cruise construction enterprises, training a large number of front-line technical talents who meet the needs of cruise engineering practice. At the same time, through the engineering practice of two large cruise ships, a group of leading core technical talents with rich experience in cruise interior outfitting design, construction and management have been cultivated, forming a complete independent talent echelon, which completely gets rid of the dependence on foreign technical experts.

4.5 Construction of Independent Cruise Product Performance Verification and Certification System

The fifth core measure is to build an independent cruise interior product performance verification and certification system. China has built the first domestic cruise interior material full-scale fire protection test platform, which can independently complete all cruise-specific performance tests that originally needed to be sent to Europe, greatly shortening the research and development cycle of domestic independent new products, and providing a solid public service platform for the technological innovation of domestic cruise supporting enterprises.

5. DEVELOPMENT PROSPECT OF INDEPENDENT CAPABILITY BUILDING UNDER BATCH CONSTRUCTION BACKGROUND

With China's large cruise construction entering the batch operation stage, the independent design and construction capability of domestic cruise interior outfitting will continue to iterate and upgrade in three important directions in the future, further moving towards full independent controllability and leading international level.

5.1 Full Independent Control of the Whole Industrial Chain

In the next three to five years, with the continuous promotion of batch cruise construction, the localization rate of core cruise interior outfitting components will steadily exceed 90%, and all key materials and core components will be independently developed and manufactured by domestic enterprises, completely breaking the long-term monopoly of European and American suppliers. China will form a complete independent cruise interior outfitting industrial cluster with international competitiveness, which can not only fully meet the domestic batch cruise construction demand, but also export independent cruise interior outfitting technology and products to the global market.

5.2 Global Leading Chinese Characteristic Independent Design System

China's independent cruise interior design system with Chinese cultural characteristics will become a new global benchmark for cruise differentiated design. The interior design scheme deeply integrated with oriental cultural elements will form a unique product competitive advantage, which is more suitable for the huge Asian cruise market, making domestic independent cruise products have irreplaceable core competitiveness different from European and American cruise products, and completely changing the global cruise interior design pattern dominated by European design teams for decades.

5.3 Open Sharing of Public Independent Technology Platform

China will build an open sharing cruise interior outfitting public technology platform facing the global industry, open the independently accumulated material performance database, design standard system and test verification platform resources to global cruise supporting enterprises, promoting the common technological progress of the global cruise interior outfitting industry, and contributing Chinese solutions to the high-quality development of the global cruise industry.

6. SUMMARY AND OUTLOOK

The independent design and construction capability building of domestic large cruise interior outfitting is a systematic project covering independent system construction, full industrial chain cultivation, digital intelligent empowerment and multi-level talent cultivation, and it is also the core core link for China's cruise manufacturing to break the international technological monopoly and move towards the world's top level. This study systematically sorts out the global competition pattern of cruise interior outfitting industry, deeply analyzes the core systematic gaps in the initial stage of domestic cruise construction, and constructs a targeted three-dimensional capability improvement implementation path. The verified practical data of domestic two large cruise ships prove that this phased promotion path can steadily increase the localization rate of core interior outfitting components from 32% in the first ship stage to more than 75% in the third batch of cruise ships, and the independent design coverage rate of personalized interior styles will reach more than 90%, which fully meets the demand of subsequent batch construction of domestic large cruise ships. With the continuous deepening of China's large cruise batch construction practice, the independent cruise interior outfitting system with Chinese characteristics will surely reach the world's leading level, strongly promote China's high-end cruise manufacturing industry to steadily step into the top of the global industry, and bring new development impetus to the prosperity of the global cruise market.

Against the backdrop of China's cruise independent construction entering the batch development stage after the successful delivery of the first domestically built large cruise ship Adora Magic City, interior outfitting, which accounts for more than 60% of the total construction workload of the whole ship, has long been the core weak link restricting China's cruise manufacturing to catch up with the world's top level. Different from traditional merchant ship outfitting and land architectural decoration, cruise interior outfitting involves over 20 million components covering dozens of professional fields, and must meet the extremely stringent mandatory requirements of the International Convention for the Safety of Life at Sea, classification society specifications and public health standards. For a long time, the core design system and key supporting supply chain of the global cruise interior outfitting industry have been monopolized by European and American leading shipyards, resulting in that China's early cruise construction work can only rely on imported technologies and subcontracting services. This study breaks through the previous single analytical framework that only focuses on technological breakthrough at the process level, systematically constructs a three-dimensional capability improvement system covering independent design system construction, full industrial chain localization support, digital intelligent manufacturing empowerment and multi-level talent cultivation. Drawing on the verified practical data accumulated in the construction process of China's two self-built large cruise ships, this paper sorts out the global competition pattern of the cruise interior outfitting industry, analyzes the core technical gaps in the initial stage of China's cruise independent construction, and puts forward a phased targeted implementation path suitable for China's industrial development characteristics. The research results show that through systematic capacity building, the localization rate of domestic cruise interior outfitting components can be increased from 32% in the first ship stage to over 75% in the third batch of cruise ships, and the independent design coverage rate of differentiated personalized interior styles can reach more than 90%, which can support the total interior outfitting construction cycle to be shortened to less than 12 months. The conclusions of this study can provide solid theoretical support and practical guidance for China's subsequent batch construction of large cruise ships to completely break the technological monopoly of European and American enterprises, build a fully independent cruise interior outfitting industrial system, and significantly enhance the core international competitiveness of China's independently built large cruise products. (Total 394 words)

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