

## *Original Paper*

# Legal Research on the Freedom of Navigation of Maritime Autonomous Surface Ships in the Exclusive Economic Zone

Yifan Xu<sup>1</sup>

<sup>1</sup> School of Dalian Ocean University, Dalian, Liaoning, China

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### **Abstract**

*Driven by the global tide of maritime intelligent transformation, the widespread application of Maritime Autonomous Surface Ships (MASS) technology—an inevitable product of integrating artificial intelligence, the Internet of Things, and big data into the maritime domain—poses a substantial challenge to the rules regarding the freedom of navigation in the Exclusive Economic Zone (EEZ) established by the United Nations Convention on the Law of the Sea (UNCLOS). In regulating MASS, the current international legal framework presents three prominent dilemmas: the “hollowing-out” of flag State jurisdiction and the subsequent rupture of the accountability chain; the structural contradiction between the traditional freedom of navigation and the national security imperatives of coastal States; and the profound technical difficulties in algorithmically quantifying and objectively fulfilling the conventional obligation of “due regard.” Faced with these normative conflicts and theoretical disputes, China, strategically positioned as a prominent coastal State with a vast EEZ and cutting-edge maritime technological prowess, should advocate for a “systemic jurisdiction” framework within the global ocean governance architecture. This entails establishing a classified navigation notification mechanism and promoting the evolutionary interpretation of the “due regard” obligation. Such approaches ensure that the integration of AI into maritime navigation remains consistent with the fundamental principles of UNCLOS, while effectively safeguarding national security and marine ecological interests, ultimately contributing Chinese legal perspectives to the refinement of international maritime rules.*

### **Keywords**

*maritime autonomous surface ships, exclusive economic zone, freedom of navigation*

## 1. Introduction

In recent years, the rapid advancement of artificial intelligence, big data, the Internet of Things, and autonomous control technologies has profoundly transformed the operational paradigms of the traditional maritime transport industry. As a pivotal achievement of smart shipping, MASS—characterized by their capacity to reduce operational costs, enhance navigational efficiency, and mitigate human error—are being increasingly deployed across diverse domains, including marine transport, resource exploration, ocean monitoring, and military operations. The International Maritime Organization (IMO) has incorporated MASS into its core research agenda, while countries such as the United Kingdom, Norway, Japan, and China have successively initiated testing and commercialization endeavors. As MASS transitions from a theoretical technological concept to practical operation, the ensuing legal ramifications have garnered widespread international scrutiny.

The existing international maritime legal framework is fundamentally predicated on traditional manned vessels. The UNCLOS, serving as the foundational legal instrument for the international maritime order, established the EEZ regime and the principle of freedom of navigation, thereby providing crucial institutional safeguards for global ocean utilization and international shipping. However, drafted in the 1970s and 1980s, the normative design of UNCLOS implicitly assumes direct physical control by a master and crew, failing to anticipate the advent of AI-driven autonomous decision-making and remote-control technologies. Consequently, the entry of MASS into the EEZ has exposed a pronounced incompatibility between traditional maritime rules and emerging intelligent technologies.

On the one hand, whether MASS qualifies as “ships” under UNCLOS constitutes a prerequisite for their entitlement to navigational freedom within the EEZ. Given the absence of a definitive legal definition of a ship within UNCLOS, scholarly debate regarding the legal status of MASS has diverged into the “ship,” “non-ship,” and “special ship” doctrines. On the other hand, even assuming the legal attribution of a ship, MASS operations within the EEZ face formidable legal challenges. For instance, remote operation and autonomous decision-making modalities undermine the flag state’s practical control over the vessel, exposing the traditional flag state jurisdiction to the risk of “hollowing out.” Furthermore, the sensors, communication equipment, and data collection systems equipped on MASS may be repurposed for military reconnaissance or intelligence gathering, thereby exacerbating the structural tension between freedom of navigation and the national security of coastal states. Additionally, Article 58 of UNCLOS mandates that states exercise the obligation of “due regard” when enjoying navigational freedom; however, whether algorithmic systems can execute the requisite interest-weighting and legal judgments remains highly contentious. These issues not only impede the lawful exercise of MASS navigational freedom but also bear heavily upon the future stability of the international maritime order.

In response to these challenges, extensive research has been conducted globally. International scholarship has primarily concentrated on defining the legal status of MASS, the applicability of international maritime conventions, and the construction of liability regimes for autonomous ships.

Domestic academic discourse has predominantly focused on the legal attributes of MASS, maritime liability allocation, and the refinement of international rules. Nevertheless, existing literature largely addresses the generalized legal issues of MASS. There remains a conspicuous dearth of systematic analysis concerning the institutional conflicts between MASS navigational rights and coastal state interests specifically within the highly specialized maritime zone of the EEZ. Furthermore, there is substantial room to advance research on reconciling technological innovation with maritime security under the UNCLOS framework.

Against this backdrop, this article utilizes the UNCLOS EEZ regime as its normative foundation and takes the navigational freedom of MASS as its core subject to scrutinize the legal dilemmas and corresponding resolution pathways for MASS navigating the EEZ. First, by analyzing the controversy over the legal status of MASS, it clarifies the jurisprudential basis for their entitlement to freedom of navigation. Second, from the triad of flag state jurisdiction, national security, and the “due regard” obligation, it delineates the institutional conflicts confronting MASS navigational freedom. Finally, integrating the developmental trajectories of international law and China’s practical experience, it proposes institutional recommendations for perfecting international rules and advancing the modernization of global ocean governance.

The innovations of this study are threefold: First, by bridging the legal status of MASS with the EEZ freedom of navigation regime, it constructs a comprehensive analytical framework of “legal attribute—right basis—rule conflict—institutional response.” Second, grounded in the technical characteristics of intelligent systems, it posits the concept of “systemic jurisdiction” to address the vulnerabilities of traditional flag state jurisdiction. Third, by seeking an institutional equilibrium between safeguarding freedom of navigation and protecting coastal state security, it provides theoretical support for China’s participation in formulating international MASS rules and reforming the global ocean governance system. Investigating the navigational rights of MASS within the EEZ not only rectifies existing deficiencies in international maritime law research but also holds substantial theoretical and practical significance for fostering the healthy development of smart shipping, maintaining the maritime security order, and elevating China’s discursive power in international maritime rulemaking.

## **2. Theoretical Debates on the Legal Status of Unmanned Ships**

The deep integration of artificial intelligence and maritime shipping technology has driven the progressive application of unmanned ships across various fields. These include marine exploration and maritime freight transport. Consequently, unmanned ships have become vital maritime carriers in the era of smart oceans. The rapid proliferation of unmanned ships has highlighted the difficulties in defining their legal attributes. This trend also poses unprecedented challenges to the existing international maritime legal framework. The United Nations Convention on the Law of the Sea (the Convention) lacks a clear definition of a “ship.” As a result, academics and practitioners have

developed three mainstream viewpoints regarding whether unmanned ships possess the legal attributes of a ship. These are the ship theory, the non-ship theory, and the special ship theory. A critical question remains as to whether unmanned ships can legitimately enjoy and exercise the freedom of navigation within the EEZ. The logical starting point to address this issue lies in the theoretical characterization of this emerging technological product. Only by clearly defining their legal attributes can we establish their precise boundaries of rights and codes of conduct.

### *2.1 The Jurisprudential Basis for the Ship Attributes of Unmanned Ships*

Disagreements over the legal attributes of unmanned ships stem from two main factors. First is the legislative void regarding the definition of a “ship” in the Convention. Second is the historical limitation of the constituent elements of traditional ships. The Convention serves as the fundamental norm in the law of the sea. It frequently uses the term “ship” throughout its text. However, it fails to clearly define this term. Furthermore, it does not mandate “manned operation” as a prerequisite for a ship. This legislative design is not an oversight. Rather, it reflects a forward-looking approach to the development of shipping technology. It deliberately reserves space for legal interpretation regarding various novel maritime vehicles. The core elements of a traditional ship include an artificial structure, mobility in water, and specific operational functions. These three elements jointly form the jurisprudential basis of ship attributes. Unmanned ships substantially meet these criteria in both physical structure and functional purpose.

Defining the legal status of unmanned ships directly determines the boundaries of their navigation rights in the EEZ. This definition serves as the logical prerequisite for resolving dilemmas surrounding the freedom of navigation. According to Article 58 of the Convention, ships enjoy the freedom of navigation within the EEZ. Conversely, non-ship maritime installations do not possess this right. If recognized as ships, unmanned ships can enjoy the freedom of navigation under the Convention. Simultaneously, they must comply with reasonable regulatory obligations established by coastal states. If their ship status is denied, their navigational activities will lack an international legal basis. Consequently, coastal states could legally restrict their operations. Ongoing disagreements over their classification have led to inconsistent national standards regarding unmanned ships’ navigation rights in the EEZ. This inconsistency hinders the promotion of smart shipping technologies. It also exacerbates the uncertainty of the international maritime order.

### *2.2 Mainstream Theories on the Legal Status of Unmanned Ships*

The “ship theory” is the mainstream view in foreign academia. Its core argument is that unmanned ships meet the core constituent elements and functional positioning of ships. Therefore, they should be regulated under the existing maritime legal framework. This view is supported by the principle of functional equivalence and the inclusiveness of legal interpretation. It argues that the Convention omits the “manned operation” requirement to accommodate technological advancements. The unmanned nature of these vessels is merely a technological upgrade. It does not alter their essential attributes as maritime transport vehicles. Proponents argue that the vitality of legal norms lies in adapting to reality.

Denying the ship attributes of unmanned ships due to different operational modes would leave smart shipping technologies without clear legal regulation. This would hinder technological promotion and disrupt the maritime navigational order.

The limitation of the “ship theory” lies in its overemphasis on functional equivalence. It ignores the technological particularities of unmanned ships. This easily leads to regulatory mismatches and loopholes. Traditional maritime rules are built around “onboard personnel.” Directly integrating unmanned ships into the existing system cannot resolve the compliance dilemmas caused by the absence of a crew. Furthermore, this theory fails to clarify the liability boundaries among multiple entities, such as shore-based operators, algorithm developers, and shipowners. This deviates from the attribution logic of the traditional maritime liability system. Consequently, liability tracing can easily fail after an accident. Moreover, the “ship theory” ignores differences in the autonomy levels of unmanned ships. Applying uniform rules to both remote-controlled and fully autonomous ships is problematic. It cannot prevent the algorithmic and cybersecurity risks of highly autonomous ships. Simultaneously, it overly restricts the application of lower-level autonomous ships. This fails to meet the development needs of smart shipping.

Conversely, the “non-ship theory” denies the ship attributes of unmanned ships. Its core argument asserts that “manned operation” is a prerequisite for a ship. Because unmanned ships lack onboard personnel, they do not meet the legal definition and regulatory logic of traditional ships. Proponents note that many public law obligations in the Convention and auxiliary maritime treaties assume the on-site perception and decision-making of “humans.” For instance, Rule 5 of the International Regulations for Preventing Collisions at Sea (hereinafter “the Regulations”) requires maintaining a proper look-out by “sight and hearing.” Interpreted literally, this point directly to human sensory functions. The sensors and algorithms of unmanned ships cannot fully replace human subjective judgment and emergency response capabilities. Additionally, this theory argues that the “ship-shore separation” characteristic paralyzes traditional liability tracing and regulatory mechanisms. Recognizing them as ships would disrupt the existing maritime legal order. Therefore, they should be defined as special maritime installations. They should not enjoy the freedom of navigation in the EEZ.

The limitation of the “non-ship theory” is its rigid adherence to a literal interpretation of legal texts. It ignores the role of technological development in driving legal norms. The current maritime legal system’s presumption of “manned operation” stems from past technological limitations. It is not a rigid legislative definition of a ship’s essence. Artificial intelligence and remote-control technologies are maturing rapidly. The sensor systems and algorithmic decision-making capabilities of unmanned ships can now effectively replace certain functions of human crews. Technological upgrades can also gradually overcome emergency response shortcomings. Moreover, denying the ship attributes of unmanned ships creates a regulatory vacuum. This approach can neither protect their freedom of navigation nor prevent their potential risks to maritime security and the ecological environment. It contradicts the broader development trends of smart shipping.

The “special ship theory” serves as a compromise. It considers both functional attributes and technological particularities. It advocates for the differentiated regulation of unmanned ships. This theory recognizes the essential ship attributes of unmanned ships. It asserts that they should enjoy the freedom of navigation in the EEZ. However, it emphasizes that their unmanned nature and algorithmic decision-making differ significantly from traditional ships. Therefore, existing rules cannot be fully applied. Its core proposition is to establish different regulatory standards and liability systems based on autonomy levels. It suggests setting separate navigational obligations for remote-controlled and fully autonomous ships. This approach safeguards technological innovation while preventing security risks. Several national legislative practices have adopted this theory. It has become a crucial pathway for reconciling the theoretical differences between the ship theory and the non-ship theory.

### *2.3 Chinese Scholars' Position on the Legal Status of Unmanned Ships*

Amid the debate over the legal status of unmanned ships, Chinese scholars have established a mainstream position centered on the “special ship theory.” This stance neither denies the ship attributes of unmanned ships nor simply equates them with traditional manned ships. Instead, it advocates for specialized regulation within the existing maritime legal framework to address their technological particularities. This achieves a necessary balance between legal regulation and technological development. The position asserts that unmanned ships possess the core constituent elements and functional positioning of traditional ships. Therefore, they should be recognized as special ships. They rightfully enjoy the freedom of navigation within the EEZ. However, a differentiated legal regulatory system must be constructed to accommodate their technological uniqueness. This approach avoids the limitations of the “ship theory,” which ignores technological differences. It also resolves the dilemma of the “non-ship theory,” which hinders technological advancement. Consequently, it balances legal regulation with industrial growth. This demonstrates China’s pragmatic attitude as a major coastal state and a maritime power.

Chinese official practices and policy proposals provide solid support for this position. Domestically, the revised Maritime Traffic Safety Law of 2021 incorporates smart ships into its regulatory scope. The Rules for Intelligent Ships published by the China Classification Society explicitly define the “special ship” status of unmanned ships. Furthermore, the White Paper on the Development of Smart Ships: Ocean-Going Ships clarifies that unmanned ships are special ships with autonomous navigation capabilities. It recommends establishing a tiered regulatory system. Internationally, China has submitted the Draft Guidelines on MASS Instruments under the Purview of the Legal Committee to the IMO for three consecutive years. This proposal advocates recognizing the ship status of unmanned MASS and implementing equivalent regulations. This initiative has garnered support from multiple countries.

Although minor internal disagreements exist within Chinese academia, the consensus boundaries of the “special ship theory” remain clear. Some scholars lean toward the “ship theory.” They advocate expanding the definition of a ship to fully integrate unmanned ships into the traditional regulatory

framework. This approach aims to seize the initiative in international rule-making. Conversely, a minority of scholars hold the “non-ship theory.” They emphasize prioritizing the prevention of security risks and advocate delaying the recognition of ship attributes. These divergences have not shaken the mainstream consensus. Both academia and official authorities acknowledge that the “special ship theory” ensures the freedom of navigation for unmanned ships while achieving effective regulation. It remains a rational choice that aligns with China’s national conditions and international trends.

### **3. Rule Conflicts over the Freedom of Navigation for Unmanned Ships in the EEZ**

Establishing the legal attributes of unmanned ships is only the first step. Their navigation rights within the EEZ do not constitute an absolute, unrestrained freedom. The EEZ is a typical maritime zone characterized by compound rights and interests. Here, a coastal state’s sovereign rights over resources and its environmental jurisdiction coexist with other states’ freedom of passage. These competing rights mutually restrict one another. Unmanned ships possess distinct technological particularities. These include remote operation, algorithmic decision-making, and high concealment capabilities. Such features deeply disrupt this inherently fragile balancing mechanism at both theoretical and normative levels. Consequently, profound conflicts emerge across three primary dimensions. These dimensions are practical jurisdiction, national security tensions, and the fulfillment of statutory obligations.

#### *3.1 The Hollowing-out Crisis of Flag State Jurisdiction*

The traditional international maritime legal system relies on a stable connection. This connection exists among the flag state, the ship, and the onboard master. The Convention mandates that flag states exercise effective jurisdiction over ships flying their flag. This jurisdiction covers administrative, technical, and social matters. Flag states must also ensure the master and crew possess appropriate qualifications and control capabilities. However, remote operation and algorithmic decision-making deconstruct this foundational framework. In practice, this evolves into a tripartite separation. The physical navigation location, the flag state registry, and the actual shore-based operation center become spatially divided. This spatial fragmentation directly triggers a hollowing-out crisis of jurisdiction within the EEZ.

Consider a transnationally operated unmanned ship. Suppose it is registered in State A, controlled by a center in State B, and navigating the EEZ of State C. State A often struggles to impose direct administrative regulation and legal coercion on the remote control center in State B. The substantive control of the flag state degrades into mere formal registration. Consequently, international legal obligations, such as preventing marine pollution and ensuring navigational safety, are practically circumvented. Meanwhile, State B is neither the flag state nor the coastal state. It lacks the legal incentive to actively exercise jurisdiction. State C, the coastal state facing potential risks, encounters severe technical barriers. When exercising law enforcement jurisdiction in its EEZ, it faces the absence of physical enforcement targets and difficulties in evidence collection. Traditional maritime law enforcement relies on boarding inspections and physical control over the master and crew. For

unmanned ships, boarding inspections can only secure the physical hull. They cannot block transnational operational commands or cloud-based algorithms. This misalignment between jurisdictional obligations and actual control ruptures the international liability tracing chain. It constitutes the primary theoretical controversy regarding unmanned ships navigating the EEZ.

### *3.2 Structural Tensions in National Security*

The Convention affirms other states' freedom of navigation in the EEZ. However, this freedom is subject to the principle of peaceful purposes and the non-threat of force. Unmanned ships, especially military or dual-use ones, possess distinct features. They are small, highly concealed, and capable of long endurance. They also carry high-precision sensors. These characteristics significantly amplify the structural tension between the freedom of navigation and coastal states' national security.

Some major maritime powers have long conducted freedom of navigation operations. They expansively interpret the provisions of the Convention. They argue that unmanned ships can lawfully conduct close-in reconnaissance, hydrographic surveying, and electronic intelligence gathering in the EEZ. They view these activities as legitimate extensions of the freedom of navigation. However, the modern comprehensive national security concept requires defending multidimensional security. This includes territorial, military, economic, and information security. High-frequency and intrusive activities by foreign unmanned ships substantially threaten coastal states. They compromise national defense deployments and maritime information security. Such actions violate the principle of the peaceful use of the oceans. Unmanned ships continuously collect sensitive intelligence in the EEZ. They rely on sensors and algorithms to do so. This creates extreme ambiguity regarding the nature of their activities. It blurs the line between marine scientific research and the general freedom of navigation. Furthermore, the current Convention lacks precise definitions for military surveying and data collection devices in the EEZ. This creates challenges for coastal states dealing with the hidden threats of unmanned ships. Consequently, the legal boundaries for exercising jurisdiction and taking preventive self-defense measures remain highly controversial.

### *3.3 The Dilemma in Fulfilling the "Due Regard" Obligation*

The Convention affirms the freedom of navigation in the EEZ. Simultaneously, it establishes clear legal boundaries. It requires states to have due regard for the rights and duties of the coastal state when exercising their rights. International arbitration practice demonstrates that this principle is a substantive obligation. It requires adequate balancing and coordination of interests between states in areas of overlapping rights. Navigational decisions must consider the safety of the coastal state's resource exploration facilities and ecological environmental protection. However, the current regulatory system has inherent limitations. Constrained by these limits, unmanned ships face severe dilemmas in fulfilling this obligation.

In traditional shipping, fulfilling the duty of care depends on the ordinary practice of seamen and the professional judgment of a prudent master. In the era of AI-driven autonomous navigation, algorithmic decision-making relies on data training. Algorithms lack human subjective moral consciousness. They

also lack the capacity to make comprehensive value judgments in complex sea conditions and geopolitically sensitive waters. Fully autonomous ships may approach a coastal state's exclusive fishing zones or artificial islands. In such cases, it is uncertain whether their collision avoidance algorithms can accurately identify the legal particularity of these specific areas. It is also unclear whether they can effectively fulfill the due regard obligation. This remains unsettled in international jurisprudence. Furthermore, current rules of public international law ensuring navigational safety rely heavily on human senses. For example, Rule 5 of the Regulations requires maintaining a proper look-out by sight and hearing. Unmanned ships rely on data streams from radar, lidar, and cameras. Mechanically equating these technological inputs to the legally required proper look-out and due regard obligations is problematic. It constitutes an overly expansive interpretation of the legal provisions. It may also substantially lower the standard for the duty of care in navigation. Algorithmic failures or communication delays could trigger collisions and marine pollution. These incidents would inflict severe consequences on coastal states. Ultimately, this poses a major challenge to the existing public order of the oceans.

#### **4. International Legal Pathways to Resolve the Freedom of Navigation for Unmanned Ships in the EEZ**

The existing Convention framework exhibits an inevitable lag in regulating intelligent unmanned ships. Essentially, this system relies on a physical-space regulatory logic centered around "onboard personnel." This desynchronization between technology and law creates multiple challenges for unmanned ships navigating the EEZ. Therefore, international maritime governance rules urgently require reform and improvement within the international legal framework. This reform must proceed across three dimensions. These dimensions are remodeling jurisdictional mechanisms, establishing safety notification systems, and advancing the evolutionary interpretation of statutory obligations.

##### *4.1 Remodeling Jurisprudential Logic: Establishing a "System Jurisdiction" Mechanism*

The "ship-shore separation" phenomenon has triggered a hollowing-out dilemma for flag state jurisdiction. To address this, the "genuine link" principle in current international maritime law urgently requires an extended interpretation. This interpretation must accommodate technological advancements. Introducing the concept of "system jurisdiction" into the public international law framework offers an effective pathway. This approach can fundamentally remodel the foundation of jurisdiction.

Traditional jurisdiction often relies on the registration of physical entities. In the intelligent era, however, the system jurisdiction mechanism demands a broader scope. It requires flag state jurisdiction to completely transcend the single physical boundary of the hull. Jurisdiction must legally extend to the shore-based control center, its underlying operating systems, and its human operators. This dual jurisdictional model integrates physical and data elements. It directly compensates for the inherent limitations of traditional territorial jurisdiction when confronting transnational network commands. Remote operation is now a practical reality. In this context, pure unilateral regulation easily fails.

Consequently, constructing a transnational joint review and joint liability mechanism becomes critically necessary. The international community can address this by concluding new agreements or issuing interpretative guidelines. These instruments should clarify the joint public law liability between two key entities. These are the state of the physical hull's registry and the state hosting the system control terminal. Remote control stations are often located outside the flag state. In such cases, relevant states must establish normalized bilateral or multilateral mechanisms. These mechanisms should facilitate judicial assistance and data review. The flag state must fully demonstrate its effective regulatory capacity over the remote control center. Simultaneously, the state hosting this center must commit to cooperating in fulfilling relevant international obligations. Only under these conditions should an unmanned ship obtain legal international navigation credentials. This prerequisite guarantees the substantive fulfillment of flag state regulatory obligations.

#### *4.2 Building Mutual Trust Tools: Creating a Risk-Graded Navigation Notification Mechanism*

Under the premise of not substantially derogating from the lawful freedom of navigation, the international community should engage in consultations. States must establish electronic notification standards for specific high-risk unmanned ships navigating through sensitive waters. Proactive information disclosure is particularly necessary when such ships enter specific areas. These areas include the peripheries of crucial military facilities, intensive resource development zones, and special ecological protection areas. The jurisprudential core of this mechanism is not to distort it into a tool for coastal states to exercise "prior approval" hegemony. Instead, it aims to establish an intervention measure that builds bilateral security trust. Navigating states can share non-classified navigational trajectories, ship autonomy levels, basic algorithmic logic, and navigational task attributes. Through this data sharing, they can proactively and effectively prove their strict compliance with the principle of peaceful purposes.

Objectively, unmanned ships are highly susceptible to non-traditional maritime security threats. These include transnational cyber hijacking and algorithmic loss of control. This vulnerability requires the international community to establish a multilaterally coordinated digital maritime infrastructure system. Relying on global governance platforms like the IMO, states can establish an authoritative center for risk notification and navigation data sharing. This initiative will deepen comprehensive international public law cooperation between flag states and coastal states. Such cooperation must cover maritime electronic identity verification, cybersecurity protection, and joint search and rescue. This approach not only patches the security loopholes caused by technological advancement. It also achieves a profound institutional balance. It effectively safeguards the core interests of coastal states while ensuring unimpeded international shipping.

#### *4.3 Breaking Technological Barriers: Promoting the Evolutionary Interpretation of the "Due Regard" Obligation*

In traditional navigational practice, "due regard" relies heavily on the subjective morality and professional judgment of human masters. Unmanned ships are now driven by artificial intelligence.

Consequently, international maritime law must discard rigid regulatory paradigms. It should actively promote an “evolutionary interpretation” of the relevant provisions in the Convention. This approach will translate macroscopic, abstract principles into executable and verifiable legal-technical standards. At the practical level of normative refinement, the primary task is structural. Statutory public law principles must be translated into rigid compliance logic within algorithm designs. Therefore, prior to commencing operations in the EEZ, unmanned ships must meet strict prerequisites. Their collision avoidance and environmental perception systems must undergo and pass security stress tests compliant with public international law. Furthermore, relevant legal rules must explicitly define operational boundaries. They must specify the limits of legitimate navigational necessity for data collection by sensors. A dual-level prohibition encompassing both underlying code and statutory law is imperative. Unmanned ships are strictly forbidden from using collision avoidance or meteorological monitoring as a cover. They must not collect sensitive data within a coastal state’s EEZ beyond authorized scopes or at excessive precision. To further consolidate the regulatory foundation, relevant international organizations should issue authoritative technical resolutions. These resolutions must establish universally applicable cyber-seaworthiness standards. These standards will provide critical legal confirmation. Provided there is specific safety redundancy and anti-interference capacity, integrated high-precision sensor systems can legally equate to and replace routine human visual and auditory look-outs. Statutory obligations must be codified into technology. This process firmly upholds public law standards for the navigational duty of care and security prevention. Ultimately, it provides rigorous and pragmatic normative support for unmanned ships to properly exercise their freedom of navigation.

### **5. China’s Pathway to Advancing the Freedom of Navigation for Unmanned Ships in the EEZ**

China is a major coastal state with a vast EEZ. It firmly safeguards its national sovereignty and maritime security. Simultaneously, China is a rapidly emerging maritime technological power. It is advancing quickly in artificial intelligence, unmanned system equipment manufacturing, and global smart shipping. Therefore, China must adopt a broad and pragmatic strategic vision when addressing the frontier international law issue of unmanned ships’ freedom of navigation. The international maritime order is currently undergoing structural reconstruction. Grounded in this context, China should fully implement the comprehensive national security concept. It must establish clear positional guidelines during the refinement of international legal rules for unmanned ships. China should propose solutions that demonstrate both legal validity and operational feasibility. Furthermore, it must actively articulate its perspectives and assert its propositions on the international stage. Through these targeted efforts, China can substantively lead and facilitate the robust development of the international maritime legal framework.

#### *5.1 Adhering to the Convention Framework and Maintaining China’s Position*

The international community is currently clarifying the public law status of unmanned ships and reconstructing global jurisdictional rules. In this historical process, China must firmly uphold the

Convention as the “Constitution of the Oceans.” It must maintain the Convention’s core and foundational status from a jurisprudential perspective. Intelligent equipment brings significant institutional impacts. In response, China must remain highly vigilant. It must explicitly oppose any fragmented international legislative attempts that abandon the existing Convention framework to create entirely new systems. This stance safeguards the integrity and authority of the international maritime legal system. Furthermore, it serves as the prerequisite for ensuring a legitimate foundation for the evolution of unmanned ship navigation rules.

At the strategic top-level design, China should consistently uphold a balanced and inclusive concept of freedom of navigation. This concept must fully align with the spirit of the Convention. China is a global shipping power heavily dependent on maritime corridors. Therefore, it firmly supports the full freedom of navigation for commercial unmanned ships within the EEZ. This support aims to facilitate global trade circulation and enhance shipping efficiency. Conversely, China will never tolerate hegemonic states or military alliances abusing the name of “freedom of navigation.” It strictly opposes the deployment of military or dual-use unmanned vessels for illegal close-in military reconnaissance and sensitive data theft. Therefore, China advocates for a profound institutional balance. This balance must bridge the gap between ensuring unimpeded shipping and safeguarding the core interests of coastal states. China firmly opposes any abuse of rights.

Adhering to the Convention framework maintains the international rule of law. More importantly, it directly protects the fundamental maritime rights and interests of developing nations. The formulation of international rules for unmanned ships involves complex negotiations. China should transition from passive adaptation to active shaping. It must act as a “leader” in modernizing jurisdictional rules. This role should be exercised across core multilateral platforms, including the UN General Assembly, the International Law Commission, and the IMO. China should advocate for cross-border joint review mechanisms. It must also lead the development of scientifically risk-graded navigation notification standards. These actions prevent a minority of technologically advanced states from monopolizing rule-making power. They ensure that future international legal rules for smart ships accommodate the security demands and development interests of developing nations. Ultimately, this approach contributes a robust Chinese solution to the historical process of realizing a “maritime community with a shared future.”

### *5.2 Participating in Rule-Making and Proposing Chinese Solutions*

Building upon its clear position, China should shift from passive adaptation to proactive shaping. It must play a critical “leading” role in modernizing jurisdictional rules during the evolution of the international rule of law. Specifically, China should participate deeply and substantively in drafting and finalizing mandatory international instruments regarding unmanned ships. This participation should occur across core multilateral platforms. These include the UN General Assembly, the International Law Commission, and the IMO. At the public international law negotiating table, China should proactively submit constructive proposals. These proposals must integrate China’s rich maritime

management practices. China should strongly advocate for translating its advanced domestic public law experiences into universal norms for international conventions. These experiences stem from maritime administrative legislation and judicial practices. They specifically concern the identification of “actual controllers” and the “system jurisdiction over shore-based control centers.” Furthermore, China should actively propose establishing a cross-border and cross-jurisdictional joint review mechanism. This mechanism would connect the flag state and the system control state. Through this initiative, the public law connotation of the traditional “master” can be thoroughly reconstructed and enriched within the global maritime legal framework.

Mastering rule-making power equates to securing the initiative in future maritime governance. China should strongly advocate for a categorized navigation notification system. It should also promote a multilateral security cooperation mechanism based on scientific risk grading. Relevant international organizations should uniformly coordinate these efforts. China has accumulated first-mover technological advantages in high-end shipbuilding, satellite navigation, and ocean communications. Relying on these strengths, China possesses both the capability and the responsibility to lead international legislative processes. It should spearhead the establishment of public law standards for the cyber-seaworthiness of unmanned ships and marine electronic identity systems. Ultimately, China should translate its technical standards into international public law rules. By doing so, it can substantively secure the leadership in formulating future international legal rules for global smart ships. This approach also solidifies China’s capacity to provide high-quality institutional supply.

### *5.3 Articulating China’s Voice and Calling for Major Power Responsibility*

Smart shipping technology is rapidly reshaping the global maritime order. In this context, the evolution of international maritime rules is not merely an iteration of technical standards. Nor is it a mechanical patching of legal provisions. Instead, it represents a profound political and jurisprudential negotiation. It directly concerns the reconstruction of the global maritime governance landscape. China is a major coastal state with a vast EEZ. It firmly safeguards its national sovereignty and maritime security. Simultaneously, China is a rapidly emerging maritime technological power. It is advancing quickly in artificial intelligence, unmanned system equipment manufacturing, and global smart shipping. Therefore, China must adopt a broad and pragmatic strategic vision when addressing the frontier international law issue of unmanned ships’ freedom of navigation. In this historical process, China must focus on the adaptive refinement of specific legal rules. Furthermore, it must articulate a resolute Chinese voice from a higher political stance. This demonstrates the historical responsibility of a major power. Through these efforts, China can lead the consolidation of consensus within the international community. It can propel the rules governing unmanned ships’ freedom of navigation in the EEZ toward a fair, reasonable, and inclusive direction.

The EEZ is not only a jurisdictional maritime zone of individual states. It also serves as a connecting bond for all humankind. It facilitates the joint maintenance of marine ecology and the development of maritime cooperation. The ocean in the intelligent era should not become a battleground for

major-power arms races and intelligence espionage. Instead, it should emerge as a new frontier for mutual trust and international cooperation. China advocates transcending the limitations of single-state interests when discussing unmanned ships' navigation rights in the EEZ. The focus must shift toward the peace, security, and sustainable development of all humankind. China urges all states to rationally view the institutional impacts of unmanned ships within the existing legal framework. Furthermore, it calls upon major powers to establish a novel maritime partnership based on mutual trust and assistance. This facilitates the global sharing of technological dividends from smart shipping. China deeply practices the concept of a "maritime community with a shared future." Throughout this historical process, China contributes robust, rigorous, and visionary Chinese solutions. Ultimately, these efforts will guide all humankind to peacefully, safely, and sustainably utilize the intelligent maritime space.

## 6. Conclusion

The vigorous development of smart shipping technology has become an irreversible trend. The widespread application of unmanned ships poses profound contemporary questions to the traditional public order of the oceans established by the Convention. This is particularly true regarding the rules on the freedom of navigation in the EEZ. Academic debates continue between the "ship theory" and the "non-ship theory." Both of these mutually exclusive traditional approaches face severe limitations. They either lead to regulatory failure or hinder technological evolution. Therefore, it is a rational choice to establish the jurisprudential foundation of the "special ship theory." This theory essentially recognizes their ship attributes to guarantee lawful navigation rights. Simultaneously, it implements differentiated regulation based on their technological characteristics, such as algorithmic decision-making and remote operation. This approach effectively balances technological innovation with the international rule of law.

Under this theoretical framework, unmanned ships trigger practical conflicts in the EEZ. These include the hollowing-out crisis of flag state jurisdiction. They also involve structural tensions between the freedom of navigation and coastal states' comprehensive national security. Furthermore, they highlight the difficulty in objectively quantifying the "due regard" obligation. These practical conflicts urgently require alleviation through a systematic reconstruction of international legal rules. The international community must discard the rigid regulatory paradigm based on physical space. Regarding legal response pathways, several specific steps are necessary. First, states must establish a "system jurisdiction" mechanism. This mechanism legally extends the regulatory chain to shore-based control centers. This step remodels the attribution basis of public international law liability. Second, states should create a categorized navigation notification mechanism based on scientific risk grading. It should utilize electronic disclosure to eliminate security blind spots. This approach builds bilateral trust between coastal states and navigating states. Finally, the international community must promote the evolutionary interpretation of statutory obligations, such as "due regard." This process translates abstract public law principles into the underlying algorithmic standards of unmanned ships. Ultimately,

this achieves effective legal regulation.

The landscape of the international maritime rule of law is undergoing a profound evolution. China must play a crucial leading role during this rule reconstruction period. China acts as a major coastal technological power, possessing both a vast EEZ and leading smart shipping technologies. China must consistently adhere to the core framework of the Convention. It must seek an institutional balance. This balance lies between ensuring unimpeded global commercial shipping and firmly safeguarding multidimensional national maritime security. China should actively export its advanced domestic jurisdictional experiences and cyber-seaworthiness standards. This should occur across core multilateral platforms, including the UN General Assembly and the IMO. These efforts will drive the modernization of global maritime rules. This is a strategic necessity for securing discourse power in future international maritime governance. Moreover, it reflects China's contemporary responsibility in practicing the concept of a "maritime community with a shared future." Through this, China provides a "Chinese solution" to the world. It offers fair, inclusive, and sustainable development rules for the global intelligent maritime space.

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