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**The Journal of Robotics,  
Artificial Intelligence & Law**

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# Autonomous Vessels: Legal, Regulatory, and Insurance Issues

Alan M. Weigel and Thomas H. Belknap, Jr.\*

*Once thought to be decades away from incorporation into the maritime transportation network, advanced automation is already emerging as a viable alternative for some segments of the industry as a way to reduce operational costs, improve safety, and increase efficiency. The authors of this article discuss this new and disruptive technology, and its legal, regulatory, and insurance questions.*

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The maritime industry is currently experiencing a technological sea change resulting from the development of advanced automation on unmanned surface vessels. Once thought to be decades away from incorporation into the maritime transportation network, advanced automation is already emerging as a viable alternative for some segments of the industry as a way to reduce operational costs, improve safety, and increase efficiency. This new and disruptive technology, however, brings with it unique legal, regulatory, and insurance questions—the answers to which have been elusive.

## The Legal Landscape

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Over the past five years, many jurisdictions in the United States have implemented regulations governing the use of unmanned aircraft and drones. As a result, there have been more than 50 cases in the United States involving unmanned aircraft operations. During the same period, however, except for cases involving unmanned barges, there have been no cases in the United States referring to unmanned surface/subsurface ships or vehicles.

Because U.S. regulators and the courts have not considered issues involving unmanned and autonomous surface or subsurface vehicles, there is no clear legal guidance for their operation. The cases involving manned vessels and even unmanned barges provide imperfect analogies. Thus, clear operating regulations and legal guidelines remain to be developed.

## What Are Unmanned Autonomous Vessels?

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One of the challenges in addressing new operating regulations for automated or unmanned vessels is nomenclature. There is no universally accepted name for unmanned maritime systems. Various designations have been proposed, such as Unmanned Surface Vessels, Maritime Autonomous Surface Ships, Autonomous Surface Vehicles, and Unmanned Maritime Vehicles. Such systems also have become commonly referred to as maritime “drones” or even “smart ships.”

The level of autonomy utilized in the vessel’s operating systems is one useful classification method. *Lloyd’s Register*, for example, has set out guidance for marine autonomous operations. The guidance describes autonomy levels ranging from “AL 1,” which uses autonomous systems to assist onboard crew with decision support, through to “AL 6,” which denotes a fully autonomous ship with no access and no onboard supervision required during a mission. What is clear, however, is that in many cases, autonomous does not always equal unmanned.

Just as there is no universally accepted nomenclature for unmanned or autonomous ships or vessels, there is no universally accepted definition of what a vessel is. In the U.S. Code, the word “vessel” includes “every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water.”<sup>1</sup> Transportation has been defined to mean “to convey or carry from one place to another,” including the conveyance of “passengers, cargo, or equipment.” This broad definition has been held to mean a device designed or used to encounter “perils of navigation.” The manner of propulsion is not relevant and includes watercraft operated by oars, sails, steam, towed by other vessel, or drifting with the tides or currents.

The international conventions administered by the International Maritime Organization (“IMO”) contain equally broad or ambiguous definitions. For example, Rule 3(a) of the International Regulations for Preventing Collisions at Sea (“COLREGS”) defines a vessel similarly to the U.S. Code as “[e]very description of watercraft, including non-displacement craft and seaplanes, used or capable of being used as a means of transportation on water.” The 1982 U.N. Convention on the Law of the Sea (“UNCLOS”) does not define a ship or vessel, but it has never been construed as

meaning “simply every floating object capable of bearing weight without sinking.”

Cases in the United States have found a variety of craft qualify as “vessels.” For example, drilling platforms; floating dredges; scows without steam power, sails, or rudders, and which were moved by being towed; motorboats operated as pleasure craft; jet skis; and rafts of logs, have all been found to be vessels. On the other hand, seaplanes, floating docks and dry docks, floating oil and gas production facilities, permanently moored riverboat casinos, and houseboats not designed to any practical degree for transportation over water have all been found to not be vessels.

## The Implications of “Vessel” Classification

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Whether an unmanned maritime craft can be considered a “vessel” or “ship” is a determination of legal significance, as craft that so qualify have certain obligations and entitlements under international and U.S. domestic regulations. Nothing in U.S. or international law indicates that an unmanned craft cannot be considered a “vessel” or a “ship.” On the other hand, there also is nothing that says they can, or must, be so considered. Resolution of the issue is of key significance to the operation of autonomous vessels. An examination of international maritime conventions and U.S. regulations illustrates some of the complications that make this determination difficult.

COLREGS Rule 5, for example, requires “every vessel” to maintain a “proper look-out by sight and hearing.” The U.S. Coast Guard considers that Rule 5 lookout obligations apply to all vessels, including “unmanned crafts.” But there is no provision in the COLREGS for using electronic means to substitute for human sight and hearing. And the Coast Guard considers commonly used electronic means such as radar to be secondary to a lookout maintained by “watching and listening” or “sight and hearing.”

The Standards of Training, Certification and Watchkeeping for Seafarers sets the minimum qualifications for persons in charge of watches on vessels. But how can an autonomous unmanned vessel be in the charge of a watchkeeper, much less one with appropriate qualifications and training?

UNCLOS, Safety of Life at Sea Convention, the International Search and Rescue Convention, and U.S. statutory law all require

masters of vessels to render assistance to those in distress at sea. But who is the master to take the decision of where and when an autonomous vessel will render assistance, or even how an unmanned vessel can render assistance?

The U.S. Code of Federal Regulations has specific provisions governing the safety, safety management, and inspection of all towing “vessels,” and includes guidelines for minimum safe manning. There is, however, no provision for autonomous unmanned towing vessels.

## Industry Initiatives

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There are several industry initiatives working toward providing owners and operators of autonomous unmanned vessel guidance on how to resolve some of the ambiguity found in international and domestic regulations.

The U.S. Coast Guard’s Navigation Safety Advisory Council has published an *Unmanned Maritime Systems (“UMS”) Best Practices* to provide guidance and information to UMS owners and operators concerning development and operations of their systems in the maritime environment. In addition, the *Best Practices* seek to provide vessel operators with notice of the issues and potential risks associated with UMS operations as well as a means to demonstrate their obligation to support safe and responsible operations of their systems through safety measures, operating standards, and maintenance procedures.

As previously mentioned, *Lloyd’s Register* has published a code for UMS for use in certifying the safe design, build, and maintenance of UMS against an established framework that is acceptable to flag states and local regulators.

The UK Maritime and Coastguard Agency has published an *Autonomous Surface Ship Code of Practice* that seeks to provide practical guidance for the design, construction, and safe operation of autonomous and semi-autonomous vessels under 24 meters while the more detailed regulatory framework for larger autonomous ships is developed.

The Comité Maritime International has established a Working Group on Unmanned Ships, which is presently engaged in a regulatory scoping exercise that is analyzing current IMO conventions posing challenges to unmanned ships with the goal of

recommending amendments to clarify the legal rights and obligations of autonomous ships.

## **Autonomous Vessels: Legal Liability and Defenses**

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Notwithstanding the codes and best practices currently in effect or under consideration by various regulatory authorities, in the event of a casualty involving an autonomous unmanned vessel, an admiralty court will eventually say what is required and, as often occurs in U.S. cases, may call upon an owner to supply more than the bare minimum required by statutory or regulatory law.

Two doctrines in U.S. law should guide an owner's decisions on how to operate and maintain its autonomous systems to avoid casualties. First, an owner should keep in mind that under U.S. law, compliance with best practices and government regulations may not absolve it of liability. Regulations are a "minimum requirement" such that noncompliance usually leads to imposition of liability almost as a matter of course, but liability may be imposed for negligence even with no violation of regulations. As many cases have held, prudent navigation practice or "the exacting standards of seaworthiness" may require an owner to supply more than the bare minimum called for by regulations.

Second, custom also may not insulate an owner from liability. Custom does not justify negligence, and the standard of care is not limited to complying with customary practices. Methods employed in the maritime industry, however long continued, cannot avail to establish as safe in law that which is dangerous in fact. It has been frequently held that there are precautions "so imperative that even their universal disregard will not excuse their omission." Thus, courts can reject a custom if wanting in due care.

When a vessel is involved in a casualty, the U.S. Shipowner's Limitation of Liability Act permits the owner to limit its liability for the accident if it can demonstrate that it had no prior knowledge of unseaworthiness that caused the loss and that it exercised reasonable diligence to ensure that the vessel was seaworthy at the start of the voyage. But neither the Limitation Act nor the Limitation Convention were drafted with unmanned autonomous vessels in mind. As a result, many questions come to mind that a court will eventually have to grapple with.

What, for example, makes an autonomous vessel unseaworthy? Does the seaworthiness extend to the sensors and operating software both on the vessel and in use by shore installations monitoring a vessel's operations and performance? Does it also extend to the training, certification, and manning of personnel manning vessel monitoring centers ashore?

Autonomous vessels are expected to operate using an array of sensors and software not traditionally used on manned vessels. To limit its liability, will it be necessary for an owner to have extensive knowledge of these advanced software operating systems or sensor designs? And if an autonomous vessel's sensors are monitored by personnel at a shore-based vessel operations center, how does an owner demonstrate an accident was outside of its "privity or knowledge"?

## Autonomous Vessels and Insurance

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Insuring autonomous unmanned vessels will also be a new challenge for underwriters. The advanced technology expected to be utilized in autonomous vessels raises the question of what material facts must be disclosed to satisfy the "utmost good faith" or "fair presentation" required under U.S. or UK law. Will underwriters require the disclosure of proprietary operating software or sensor designs to extend coverage for autonomous unmanned vessels? And what perils will in fact be covered under the relevant marine insurance clauses—or will the standard clauses have to be adapted to accommodate autonomous operations?

For example, will the "negligence of master, officers and crew" continue to be a covered peril under British and American marine insurance hull clauses for autonomous unmanned vessels? Such negligence is currently a covered peril if it has not resulted from a lack of due diligence by the assured, owners, or managers. Who are the master, officers, and crew whose negligence an owner may insure against? And as with limitation of liability, it remains uncertain how far the due diligence standard applies with respect to the advanced technology expected to be utilized by autonomous unmanned vessels.

On the other hand, insurance adjusting may become easier with the advent of autonomous unmanned vessels. For vessels monitored at shore-based operations centers, the adjusting process will likely

become streamlined by an abundance of data, possibly to the point of automatic adjusting.

There also will likely be decreased claims from unmanned vessels. Historically, one-third of vessel claims have been caused by personnel error and 40 percent of claims have been for personal injuries. Such claims, along with maintenance and cure obligations, should ultimately largely disappear when a vessel is operated autonomously without a crew.

## Conclusions

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Autonomous unmanned vessels and their attendant new technologies have the potential to provide a multitude of beneficial uses. At the same time, however, the introduction of such vessels presents a range of currently unanswered legal, regulatory, and insurance questions. Regulators and international governing bodies will play an important role in developing new rules or interpreting current legal regimes to ensure regulatory compliance and that autonomous vessels are safely operating in the complex maritime environment. As autonomous unmanned vessels become more commonplace, possibly much sooner than anticipated, the future regulatory approach to their operations and maintenance must consider both the demands of the maritime industry and the overriding need for safety of navigation and environmental protection.

## Notes

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1. 1 U.S.C. §3.