

Title: Autonomous Ships, Future Casualties, and Cargo Loss/Damage:

Domo Arigato, Mr. Roboto?

By Frank J. Gonynor, Gard (North America) Inc. *

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Introduction:

The implementation of autonomous technology to maritime shipping is taking place at a pace quicker than many have thought. Autonomous vessels have already been tested in short runs, but under real conditions with passengers and cargo aboard, and such shipping tests are continuing (e.g., see : <https://worldmaritimeneews.com/archives/273879/nmt-north-sea-hosts-1st-autonomous-shipping-tests/> , posted on 27 March 2019).

The next significant step is embodied in the vessel 'Yara Birkeland', that is currently being built at the VARD yard in Breivik, Norway and is scheduled to enter service in the year 2020. This vessel will not only be autonomous in navigation, but also fully automated in connection with cargo loading, stowage, unloading and handling (the vessel will also be electric/zero emissions and has a ballast-less design). It is this projected advancement in fully automated cargo operations which brings into focus the possible legal issues arising from such a change in the way cargo is carried and cared for by the marine carrier. It will only carry 120 TEU's, but over the course of a year, due to the short haul liner service that it will enter, there will be 20,000-30,000 container movements.

The development of laws relating to liability and defenses for cargo loss and damage were all predicated on ships being operated by human beings. By removing the onboard human crew, and either having humans control the ship and its operations remotely, or going further, and having a fully autonomous ship without any active human interaction, the premise for much of the thinking behind the current cargo liability legal scheme must be reconsidered.

To date, there are no cases to cite, nor are there new statutory/regulatory schemes to be given here. The latter are currently under development and will appear soon. The International Maritime Organization has just recently released materials on its project of a regulatory scoping exercise for the use of 'Maritime Autonomous Ships' ('MASS'), and has already conducted workshops and is eliciting comments (see:<http://www.imo.org/en/MediaCentre/PressBriefings/Pages/08-MS-C-99-MASS-scoping.aspx>).

But much of this development is concentrated on laws, rules, and regulations concerned with the navigational aspects and safety at sea considerations. These are of initial importance, and do have impact on the legal context of maritime cargo carriage, since when casualties occur that result in damage or loss of cargo, the applicable rules governing the ship's basic operations can have a significant bearing on the outcome of liability to cargo, and other related issues, such as cargo's potential obligations in contributions to general average.

We are now dwelling in a very interesting time and place, where such issues about cargo carried on autonomous ships, and how to approach them, are a 'blank slate', awaiting to be filled by ideas, concepts, and arguments of maritime lawyers.

The remainder of this paper contains basic definitional and developmental information on the forming legal landscape, and some of the basic legal guideposts that are out there, that should assist the reader in forming a uniform vocabulary and beginning knowledge of this growing field.

But some of the questions to be addressed in the future are examined below. In addition, as part of the live presentation of this paper, an exercise/hypothetical scenario is presented, using the 'Trolley Car Dilemma' problem, and some questions about cargo liabilities are posed within that hypothetical framework.

What could the legal issues for cargo be? – many basic statutory premises and legal definitions/concepts must be reexamined, such as:

Definition of 'ship' In COLREGS, UNCLOS, and other international conventions/treaties seem inclusive of autonomous vessels. MLAUS response to CMI questionnaire generally was positive to inclusion of autonomous vessels as ships. But would the shoreside remote operation center be an extension of the ship? What about information used in such operations, that are stored in cyber-based facilities (e.g. 'the Cloud')?

Role of the Master/Transferal of crew duties ashore – Master control ('the conn' of the ship) – how will that work in U.S. law? MLAUS answer is 'yes' as to remote controller, but 'no' as to others more remote to the system. But what about crew discipline and response to orders – is it to the remote 'controller' not on the ship, or to the ranking officer actually aboard? (U.S. law makes a strong duty to obey the Master but is this rationale present on an autonomous ship?).

Many statutes use the descriptor for a liable party for a ship to be **the 'owner or operator, or owner pro hac vice/bareboat charterer'**. In the world of autonomous ships, these categories and identities could get easily blurred – is the operator the owner of the ship who has contract for robotic hardware/software, or is it the company who provides same on license as an independent contractor?

Tort Liability: a.) **Negligence:** breach of a 'duty' within the definition of negligence offers the most challenging analysis for autonomous ships, because the laws/rules/regulations from which such duties arise are unclear/not yet written. b.) **Product Liability:** would there be tort liability for a software manufacturer whose design defect caused an autonomous ship to damage cargo? c.) **Negligent entrustment of a vessel:** would there be a cause of action under this concept, if there is found a

likelihood of risk of accident for remote or autonomous operations, particularly in the early use of the technology, when the limitations of it are not all known yet? d.) **Vicarious Liability, Borrowed Servant and Imputation of Knowledge?** is this the obvious pathway for legal liability for vessel owners to remain liable for autonomous service providers? Are there not non-delegable duties, or will there be the ability for ship owners to delegate them?

What about pilotage and vicarious liability? The concepts developed about pilots could be translated generally to the world of autonomous ships, but is that desirable, normally absolving, or rendering minimally liable, the 'pilot' equivalent? And what about pilot liability in the normal parlance, but where the pilot is guiding the ship remotely from shore? This is not so farfetched or futuristic (cite Finnish statutory provision and mention video).

What about offshore installations? There is progress on implementing autonomous application for work boats that shuttle between offshore energy installations, both oil & gas and wind farms. What legal issues will this practice pose, for goods/cargo carried? These are 'short haul' operations, normally within the EEZ and/or territorial waters of a single country. Thus, this area may be one of the segments of autonomous operations that develops first, and for those operations within a single country's territorial sea, then domestic legislation may quickly move forward to define the legal underpinnings of such operations.

1. Basic/common legal terms and definitions; Concepts:

The 4 categories of autonomous ships:

The International Maritime Organisation (IMO) recognizes that autonomy is a 'spectrum' yet, for the purposes of examining regulatory changes, it has defined a MASS as a ship which, to a varying degree, can operate independent of human interaction. For present purposes the IMO has established the following four degrees of autonomy:

- Degree one: Ship with automated processes and decision support: *Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.*

- Degree two: Remotely controlled ship with seafarers on board: *The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.*
- Degree three: Remotely controlled ship without seafarers on board: *The ship is controlled and operated from another location. There are no seafarers on board.*
- Degree four: Fully autonomous ship: *The operating system of the ship is able to make decisions and determine actions by itself.*

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II. AUTONOMOUS/UNMANNED SHIP – discussion of a general definition and then the U.S. perspective:

A. Definition of Ship

- 1. Below is taken in part from “Liability of Autonomous Ship: The Scandinavian perspective ,” put out by the Scandinavian Institute of Maritime Law, Universitetet I Oslo, Candidate Number : 8010 Submission Deadline: 20.11.2016***

Currently, there is not a universal definition of ‘ship’. All international conventions pertaining to public and private maritime matters have prescribed their own interpretations of what a ship is. This will be further discussed below. Even on a national level, each country has also established its definition of a ship. Hence, it is essential to find out whether autonomous ships are categorized as ships by existing definitions, and consequently, if current conventions are still applicable in the case of autonomous ships.

Under international law, the term “ship” is in fact not strictly defined.¹ The terms “ship” and “vessel” are used interchangeably.² For instance, in the United Nations Convention on the Law of the Sea (UNCLOS), the term is not defined at all even though it has been widely used.³ In other conventions such as the

* Footnotes 1-13 were the sources cited in the paper.

¹ Van Hooydonk, E. “The law of unmanned merchant shipping – an exploration”, p. 406

² Cartner, J., Fiske R., Leiter T, "The International Law of the Shipmaster, „ Informa Law., 2009, p83-84

³ Walker G., “Definitions for the Law of the Sea Terms Not Defined by the 1982 Convention,” Martinus Nijhoff., 2012

International Regulations for Avoiding Collisions at Sea (COLREGS), a ship is defined as “every description of watercraft, including non-displacement craft and seaplanes, used or capable of being used as a means of transportation on water”.⁴ Many other important international conventions related to the carriage of goods by sea such as the Convention on Maritime Liens and Mortgages, Hague Rules, Rotterdam Rules, and so forth have also had the similar definition of ship.⁵

Similarly, the conventions that related to the liability of shipowners, such as the International Convention on Civil Liability for Oil Pollution Damage⁶, International Convention on Civil Liability for Bunker Oil Pollution Damage⁷, International Convention on Liability and Compensation for Damage in Connection With the Carriage of Hazardous and Noxious Substance by Sea⁸, etc, have defined the ship as “any seagoing vessel and seaborne craft, of any type whatsoever”, solely based on its functionality. In short, the crew is not mentioned in any of the definitions of ‘ship’. It is clear that autonomous ships have not been excluded to be categorized as a ship. In other words, an autonomous ship will be considered a ship under international law. Therefore, the current relevant conventions would apply accordingly even though there is no crew working on board.

In the United States, the word ‘vessel’ implies ‘every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water’.⁹ On the other hand, according to the Maritime Code of the People’s Republic of China a ‘ship’ is one of any ‘sea-going ships and other mobile units’. However, the definition does not include ships or craft to be used for military or public service purposes, nor small ships of less than 20 tons gross tonnage’.¹⁰ This definition is very similar to that stated in the Norwegian Maritime Code, specifying that the minimum length of vessel to be 15 meters.¹¹ Other maritime nations such as the United Kingdom Merchant Shipping Act defines a ‘ship’ as ‘every description of vessel used in navigation’¹² while the Dutch Civil Code defines ‘ships’ to be ‘all things, not being aircraft, that according to their construction are intended for floating, and that do float or have been floating’.¹³ As shown above, there are no semantic obstacles to prevent autonomous vessels from being considered normal ships on a national level. Autonomous ships sailing to most ports will be treated as normal vessels as well.

2. A U.S. Perspective – and the MLAUS response to the CMI Questionnaire re Ship Nomenclature

⁴ COLREGS Part A – Rule 3

⁵ Van Hooydonk, E, *supra*, p.407-408

⁶ International Convention on Civil Liability for Oil Pollution Damage, London 1992 Article I/1

⁷ International Convention on Civil Liability for Bunker Oil Pollution Damage, London 2001 Article I/1

⁸ International Convention on Liability and Compensation for Damage in Connection With the Carriage of Hazardous and Noxious Substance by Sea, London 1996 Article I/1

⁹ U.S. Code Title 1 Chapter 1 § 3

¹⁰ Maritime Code of the People’s Republic of China § 3

¹¹ Norwegian Maritime Code § 11

¹² United Kingdom Merchant Shipping Act 1995 Part 1 -Preliminary

¹³ Dutch Civil Code § 8.1

Admiralty and maritime law in the United States are matters of federal law and the definition of “vessel” is derived from federal statutes which have been interpreted by federal courts. The Rules of Construction Act (the “RCA”) provides the default definition of “vessel” used throughout the U.S. Code,¹⁴ which definition applies “unless the context indicates otherwise.”¹⁵ Under Section 3 of the RCA (“Section 3”), the definition of “vessel” includes “every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water.”¹⁶

Courts have applied the Section 3 definition in different contexts, including liability cases arising under suits brought against “vessel” owners pursuant to the Longshore and Harbor Workers’ Compensation Act (the “LHWCA”),¹⁷ in determining whether a person is a “seaman” for purposes of the Jones Act¹⁸ and when assessing federal admiralty jurisdiction generally.¹⁹ There is little legal doubt as to the nature of traditional categories of vessel (such as bulkers, oil tankers, etc.). The courts have also held that Mobile Offshore Drilling Units (“MODUs”) are vessels. However, a substantial amount of litigation has occurred regarding marginal structures, and to the extent that courts may occasionally reach divergent conclusions, a degree of uncertainty may exist in the jurisprudence.

The Court [in *Stewart*] determined that a watercraft qualifies as a Section 3 vessel so long as its use as a means of transportation on water “is a **practical possibility** [rather than] a merely theoretical one[.]”²⁰ Therefore, under *Stewart*, it is not necessary that a watercraft’s primary purpose be transport over water, or that it actually “be in motion” to be considered a Section 3 vessel.²¹ The inquiry instead depends on the particular facts of each case relating to the practical possibility of the use of the structure for water transportation.

In *Lozman*, the Court added a reasonable observer standard to the application of *Stewart*’s “practical possibility” test, stating that “a structure does not fall within the scope of [Section 3] unless a reasonable observer, looking to the [structure]’s physical characteristics and activities, would consider it designed to a practical degree for carrying people or things over water.”²² Applying this test to the floating home, the *Lozman* Court found that it was not a Section 3 vessel.²³ Factors of design (e.g., the lack of any means of self-propulsion or steering mechanism) and the infrequency of its actual travel over water (just four times over a period of seven years) figured prominently in the *Lozman* Court’s

¹⁴ See *Stewart v. Dutra Constr. Co.*, 543 U.S. 481, 490 (2005)

¹⁵ See 1 U.S.C.A. § 1 (2012). It should be noted that the term “vessel” is also defined with variations in specific provisions of federal statutes, e.g., 19 U.S.C.A. § 1401(a), 49 U.S.C.A. § 13102 (25).

¹⁶ See 1 U.S.C.A. § 3 (2012).

¹⁷ See 33 U.S.C.A. §§ 901-950 (2009); *Stewart*, 543 U.S. at 490.

¹⁸ See 46 U.S.C.A. § 30104 (2012); *Holmes v. Atl. Sounding Co.*, 429 F.3d 174, 182 (5th Cir. 2005).

¹⁹ See *Lozman v. City of Riviera Beach*, 133 S. Ct. 735, 740 (2013).

²⁰ See *Stewart*, 543 U.S. at 496.

²¹ See *id.* at 495-96 (citing *Chandris, Inc. v. Latsis*, 515 U.S. 347, 363 (1995)).

²² *Lozman v. City of Riviera Beach*, 133 S. Ct. 735, 741 (2013).

²³ See *id.*, at 739.

conclusion.²⁴ But the *Lozman* Court did not fully address case law following *Stewart* involving structures that were indefinitely or permanently moored to land.

Therefore, based on Section 3 and applicable judicial precedent, under US law a “vessel” must be used or capable of use for transportation on water, be in navigation (or not permanently out of navigation) such that transportation is a practical possibility, but subject to whether a reasonable observer, looking to the structure’s physical characteristics and actual use, would consider the structure designed to a practical degree to carry people or goods over water.

The definition of the term “vessel” as set forth at 1 U.S.C. § 3 provides the default definition used throughout the U.S. Code (and related federal regulations) “unless the context indicates otherwise[.]”²⁵ For example, the regulations relating to registration under the U.S. flag provide that a vessel “includes every description of watercraft or other contrivance capable of being used as a means of a transportation on water, but does not include aircraft.”²⁶ The definition is generally consistent regardless of the statutory or regulatory context (such as vessel registration, taxation, etc.), and courts would generally apply the same test to whether a structure is a “vessel.”

3. MLAUS Response to the CMI Questionnaire re Unmanned Ships

U.S. domestic maritime law is not concerned with the definition and classification of "ships," but is instead drawn in the term of "vessels." In that regard, there are both statutory, regulatory and general maritime law sources of definition and classification. The U.S. Congress has defined a "vessel" without regard to its need for operational manpower in Title 1 U.S. Code §3 as follows:

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.

The U.S. Supreme Court has put a gloss on that definition (in a case involving a maritime lien claim upon a houseboat) as follows:

"Not every floating structure is a 'vessel' [A] structure does not fall within the scope of the statutory phrase unless a reasonable observer, looking to the [thing's] physical characteristics and activities, would consider it designed to a practical degree for carrying people or things over water."

Lozman v. City of Riviera Beach, 568 U.S. 115, 121 (2013) (emphasis in original).

Neither "watercraft" nor "artificial contrivance" is specifically defined in U.S. statutes.

In response to the following questions:

Would a "cargo ship" in excess of 500 grt, without a master or crew onboard, which is either:

1.1.1. controlled remotely by radio communication?

²⁴ See *id.* at 737.

²⁵ *Stewart v. Dutra Constr. Co.*, 543 U.S. 481, 488 (2005) (citing 1 U.S.C.A. § 1 (2012)).

²⁶ *ee* 46 C.F.R. § 67.3 (2012).

1.1.2. controlled autonomously by, inter alia, a computerized collision avoidance system, without any human supervision constitute a "Ship" under your national merchant shipping law?

The U.S. response was:

Yes to both 1.1.1 and 1.1.2

- 1 U.S.C. § 3: "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."
- 18 U.S.C. § 2280(5): "'covered ship' means a ship that is navigating or is scheduled to navigate into, through or from waters beyond the outer limit of the territorial sea of a single country or a lateral limit of that country's territorial sea with an adjacent country"; see also see also 47 U.S.C. § 153(46)(A) "The term 'ship' or 'vessel' includes every description of watercraft or other artificial contrivance, except aircraft, used or capable of being used as a means of transportation on water, whether or not it is actually afloat."
- *Lozman v. City of Riviera Beach*, 568 U.S. 115 (2013).

1.3 Under your national law, is there a mechanism through which, e.g. a Government Secretary may declare a "structure" to be a "ship" when otherwise it would not constitute such under the ordinary rules?

RESPONSE: For general purposes, whether or not a structure is a "vessel" under United States law is a question of statutory interpretation. See *Lozman*, 568 U.S. at 121 (refining the statutory definition of "vessel"). And, as alluded to above, most U.S. regulations and statutes incorporate the same specific definition of the term (with slight variation), including the regulations governing the registration and documentation of U.S.-flagged vessels. 46 C.F.R. § 67.3 ("Vessel (includes every description of watercraft or other contrivance capable of being used as a means of transportation on water, but does not include aircraft."). The U.S. Coast Guard's National Vessel Documentation Center determines, on application by the owner, whether a particular structure meets this definition and the owner has a right to appeal that decision within the Coast Guard, 46 C.F.R. § 1.03-45, and, from there, to a federal court, 5 U.S.C.A. § 703 (West 2017). Thus, to some extent, the Coast Guard has the power to declare a structure to be a vessel, but in doing so is bound by the ordinary definition of "vessel".

II. ROLE OF MASTER

Nowadays, the Master is simply a person who takes order from the head office to navigate the vessel safely from one port to another. On the sea, the Master will be taking orders on nautical and operational matters. At the port, the appointed port agents will be representing the shipowner to make all necessary arrangements for the ship when she is there. Even the storage plan and all the necessary shipping documents such as the Bill of Lading can also be processed by the shore based office. The role of Master is indeed gradually downgraded. When the autonomous ship is deployed, it would seem that this role will be totally superseded. However, upon closer inspection, this is not entirely true.

The implementation of autonomous ships does not mean that all the crew's responsibilities are gone, especially for the ROV-type autonomous vessel. The crew's duties are however being transferred to the

shore based controller. Theoretically speaking, the shore based controller should be bound to all the conventions related to the current crew's responsibilities. Therefore, it is indeed essential to ensure that all the conventions' wordings concern the shore based controller. For example, the STCW Convention clearly states that the standards for the training, qualifications and certification apply only to 'seafarers serving on board seagoing ships'.²⁷ The definition needs to be broader so as to include the shore based controller and therefore ensure that the person in this role is well trained in accordance to the international standards.

1.4. Under your national merchant shipping law, could either of the following constitute the unmanned ship's "master?"

1.4.1. The chief on-shore remote-controller

1.4.2. The chief pre-programmer of an autonomous ship

1.4.3. Another 'designated' person who is responsible on paper, but is not immediately involved with the operation of the ship.

MLAUS RESPONSE:

Yes as to 1.4.1 - the "the chief on-shore remote controller".

Currently no as to 1.4.2 and 1.4.3.

See 46 U.S.C. §10101(1) "'master' means the individual having command of a vessel."

See *Spentonbush/Red Star Cos. v. NLRB*, 106 F.3d 484,488 (1997). Excerpts below:

The tug captains thus occupied a position that was markedly different from that of a foreman or lead person in a shore-based enterprise. See *June T, Inc. v. King*, 290 F.2d 404, 406 n. 1 (5th Cir.1961). This difference was summarized by the Supreme Court in *Southern Steamship Co. v. NLRB*, 316 U.S. 31, 38, 62 S.Ct. 886, 890, 86 L.Ed. 1246 (1942), in the following, oft-quoted language:

Ever since men have gone to sea, the relationship of master to seaman has been entirely different from that of employer to employee on land. The lives of passengers and crew, as well as the safety of ship and cargo, are entrusted to the master's care. Every one and every thing depends on him. He must command and the crew must obey.

The Master has full authority over all officers and unlicensed personnel on the vessel and his orders must be obeyed in spirit and to the letter by all persons on board.

The above-described position and powers of a ship's master were not derived from the civil law of master and servant nor from the common law but arose instead from the common usages and jurisprudence of the middle ages. *The China*, 74 U.S. (7 Wall.) 53, 68, 19 L.Ed. 67 (1868). Statutes which

²⁷ International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) Article III

invade such long-established and familiar principles should be read with a presumption favoring their retention unless a statutory purpose to the contrary is evident. See *Edmonds v. Compagnie Generale Transatlantique*, 443 U.S. 256, 263, 99 S.Ct. 2753, 2757-58, 61 L.Ed.2d 521 (1979) (citing *Isbrandtsen Co. v. Johnson*, 343 U.S. 779, 783, 72 S.Ct. 1011, 1014-15, 96 L.Ed. 1294 (1952)

As we already have observed, ships' masters occupy positions that are markedly different from those of shore-based lead men or foremen, and the relationship of master and crewman is entirely different from that of employer and employee on land. See *Mt. Vernon Tanker Co. v. NLRB*, 549 F.2d 571, 575 (9th Cir.1977). "The duty of obedience owed by a deckhand to obey the orders of a licensed ship's officer is greater than that of a worker at a bench in a factory to obey the direction of his foreman." *Delaware-New Jersey Ferry Co.*, *supra*, 128 F.2d at 137.

III. LIABILITY

Three main ways that an accident involving autonomous or unmanned ship could happen:

1. If the system is defective and the defect causes the ship not to perform as it should;
2. If the operator improperly engages or disengages the autonomous system; and
3. If the system is forced to choose between two bad outcomes, such as between grounding the ship or colliding with another vessel.

A. Tort Liability

A tort is a "civil wrong, other than breach of contract, for which a remedy may be obtained, [usually] in the form of damages[.]"²⁸ Examples are when someone or something is harmed and there is no underlying contract between the victim and the tortfeasor. Although some torts involve intentional bad acts, businesses are more often sued for negligence or for strict liability- that is, unintentional harms.

General maritime law recognizes negligence and strict liability (including product liability), but to date has not yet had to deal with whether and how autonomous and unmanned technologies can fit into the existing legal framework.

1. Negligence

In a maritime context, negligence can apply to almost any situation where the defendant commits an act that damages someone else's interest and falls outside a contract. That would include, but not be limited to- causing a collision, losing a vessel, damaging cargo, improperly towing a vessel, polluting the seas. Given its broad reach it should be able to accommodate claims that involve autonomous and unmanned ships.

²⁸ Tort, *Black's Law Dictionary* (10th Ed. 2014).

Under federal maritime law, a negligence claim consists of four elements: (1) the existence of a duty of care owed by the defendant; (2) breach of that duty; (3) a causal connection between the conduct resulting in the breach and plaintiff's injury; and (4) actual loss, injury, or damage. See *Becker v. Poling Transp. Corp.*, 356 F.3d 381, 388 (2d Cir. 2004) (“[F]ederal maritime law incorporates common law negligence principles generally, and New York law in particular.”); *Pearce v. United States*, 261 F.3d 643, 647 (6th Cir. 2001) (The elements of a negligence action under maritime law are “essentially the same as those under land based common law,” i.e., “1) the existence of a duty of care owed by the defendant to the plaintiff; 2) the breach of that duty of care; 3) a causal connection between the offending conduct and the resulting injury, which is called ‘proximate cause’; and 4) actual loss, injury or damage suffered by the plaintiff.”) (citing 1 Thomas J. Shoenbaum, *Admiralty & Maritime Law* § 5-2 at 170 (3d ed. 2001)).

Whether a duty exists is a threshold inquiry. See *Eaves Brooks Costume Co. v. Y.B.H. Realty Corp.*, 76 N.Y. 2d 220, 226 (N.Y. 1990) (citing *Strauss v. Belle Realty Co.*, 65 N.Y.2d 399, 402-03 (N.Y. 1985)). A court's determination in this regard depends on “a number of factors including, most notably, the foreseeability of the harm suffered by the complaining party.” *In re Great Lakes Dredge & Dock Co., LLC*, 624 F.3d 201, 211 (5th Cir. 2010); (quoting *Consol. Aluminum Corp. v. C.F. Bean Corp.*, 833 F.2d 65, 67 (5th Cir. 1987)). Courts look to whether the plaintiff was within the zone of foreseeable harm and whether the accident was within the reasonably foreseeable risks. See *Di Ponzio v. Riordan* 89 N.Y. 2d 578, 583 (1997) (citing *Palsgraf v. Long Island R.R. Co.*, 248 N.Y. 339 (N.Y. 1928)). While foreseeability is generally a question for the factfinder, a court may make the determination when the risk was unforeseeable as a matter of law. See *Sanchez v. New York*, 99 N.Y.2d 247, 254 (N.Y. 2002). In maritime cases, a harm is considered foreseeable if the harm that occurred is of the general sort that “‘might have anticipated by a reasonably thoughtful person, as a probable result of the act or omission, considering the interplay of natural forces and likely human intervention.’” *Great Lakes Dredge & Dock*, 624 F.3d at 210 (quoting *Consol. Aluminum Corp.*, 833 F.2d at 68).

In addition to breach of an existing duty, to defeat summary judgment a plaintiff must also raise a triable issue as to causation. That is, to establish a claim for negligence, the breach of the duty must be the legal cause of the harm or injury plaintiff suffered. *Great Lakes Dredge & Dock*, 624 F.3d at 213-14; see also *Donaghey v. Ocean Drilling & Expl. Co.*, 974 F.2d 646, 649 (5th Cir. 1992). A “legal cause” is more than “but for” causation: the breach must constitute a substantial factor in bringing about the injury. *Donaghey*, 974 F.2d at 649; see also *Thomas v. Express Boat Co.*, 759 F.2d 444, 448 (5th Cir. 1985).

Of the four elements listed above, “duty” is the one most likely to raise issues for any company involved in manufacturing, owning or operating an autonomous or unmanned ship.

“Duty” comes from a variety of sources: laws, regulations, customs and what a reasonably prudent person would do under the same circumstances.²⁹ There are many regulations that would come into play with autonomous and unmanned ships. For example, federal regulations require that a master be in “command” of certain types of vessels.³⁰ If the ship has an automated system to reduce the number of crew on board, “it remains the responsibility of the vessel's master to determine when a continuous watch is necessary.”³¹ The law also requires the master or person “in charge” of a vessel that is involved

²⁹ Thomas J. Schoenbaum, *Admiralty and Maritime Law* §5-2 at 253 (5th ed. 2011).

³⁰ See 46 C.F.R. § 15.805 (“Master”)

³¹ See 46 C.F.R. § 15.715 (“Automated vessels”).

in a marine casualty to give assistance to anyone who is in danger because of the incident, if he can do so without seriously endangering his own vessel or people on board.³²

Currently, U.S. courts apply the Pennsylvania rule, which says that if the defendant is involved in a marine accident and has violated a law intended to prevent that sort of accident, then the burden shifts to the defendant to show that its violation could not have caused the harm.³³ The burden “has been described as ‘difficult, if not impossible’ to discharge.”³⁴

Besides, statutory and regulatory duties, questions will be raised as to whether it was reasonable under the circumstances for an autonomous or unmanned ship to operate. For example, courts have held that the “shipowner has a non-delegable duty to provide a competent master and crew” and that insufficient manning can make a ship unseaworthy.³⁵

2. Product Liability

Products liability law is “part of the general maritime law.”³⁶ The manufacturer and other entities in the chain of distribution can be held liable for harm caused by the ship.³⁷

A product is defective if, when it is sold or distributed, it has a manufacturing defect, a design defect, or inadequate instructions and warnings.³⁸

A manufacturing defect exists “when the product departs from its intended design even though all possible care was exercised in the preparation and marketing of the product.”³⁹ Therefore, if the product does not conform to its own design specifications, the manufacturer or seller can be at fault.

That is not the case with design and warning defects which require some showing of fault and are therefore more similar to negligence claims.⁴⁰ Here, a product defect exists “when the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design” or by the “provision of reasonable instructions or reasonable warnings” and failure to do so made the product not “reasonably safe”.⁴¹

A court has held that a shipbuilder does not have strict liability from building ships with components that contain asbestos.⁴² The court extensively discussed precedents that hold that as the policy underlying strict liability is to place the burden of preventing the harm on the party best able to prevent

³² See 46 U.S.C. §2303 (“Duties related to marine casualty assistance and information”).

³³ See *The Pennsylvania*, 19 Wall. 125, 86 U.S. 125 (1873); see also *Hatt 65, LLC v. Kreitzberg*, 658 F.3d 1243, 1251 (11th cir. 211).

³⁴ *MacDonald v. Kahikolu, Ltd.*, 581 F.3d 970-973-77 (9th Cir. 2009)(quoting *Trinidad Corp. v. S.S. Keiyoh Maru*, 845 F.2d 818, 825 (9th Cir. 1988).

³⁵ *Hercules Carriers, Inc. v. Claimant State of Fla., Dep’t of Transp.*, 768 F.2d 1558, 1565-66 (11th Cir. 1985).

³⁶ *E. River S.S. Corp v. Transamerica Delaval, Inc.*, 476 U.S. 858, 865 (1986).

³⁷ *Saratoga Fishing Co. v. J.M. Martinac & Co.*, 520 U.S. 875, 883 (1997).

³⁸ Restatement (Third) of Torts: Prod. Liab. § 2 (1998) see *McIndoe v. Huntington Ingalls Inc.*, 817 F.3d 1170, 1173 (9th cir. 2016) (explaining that courts generally look to the current Restatement of Torts for guidance on maritime product liability claims.).

³⁹ Restatement (Third) of Torts: Prod Liab. § 2(a).

⁴⁰ *Id.* § 2 cmt. (a).

⁴¹ *Id.* § 2(b) & (c).

⁴² *Hassebrock v. Air & Liquid Sys. Corp.*, 2015 U.S. Dist. Lexis 137775 (W.D. Wa 2015).

the harm, and as shipbuilders are in the business of selling finished ships rather than the components of those ships; thus they are not the party best able to prevent harm from resulting from those products. The same court also held that strict liability does not apply to defective services.

Will a manufacturer incur tort liability for defective software? At this time there is no established case law.⁴³ There has been a federal court decision that found a plaintiff had stated a design defect claim for software that made a phone repeatedly dial 911. Its finding premised on the fact that “presumably, the safer, alternative design here is software that does not make accidental, duplicative, or insufficiently identifiable calls, and protects against tampering.”⁴⁴

3. **NEGLIGENT ENTRUSTMENT OF A VESSEL**

The cause of action has four prongs: (1) entrustment of a vessel to another; (2) the person to whom the vessel is entrusted will, due to youth, inexperience or otherwise, likely involve risk to himself or others ; (3) the entrustor knows or should know of such likelihood; and (4) harm to others caused proximately by the conduct of the trustee. See *In re Complaint and Petition of Williams Sports Rentals, Inc.* 2018 AMC 193 (E.D. Cal. 2017)

B. VICARIOUS LIABILITY

The doctrine of vicarious liability or imputed negligence is fully applicable in admiralty unless excluded by statute.⁴⁵ Thus the negligence of employees is imputed to the owner of a vessel upon finding of master-servant relationship;⁴⁶ however, vicarious liability is negated by a finding that the employee was acting outside the course and scope of his employment.⁴⁷

Two inquiries are required : (1) whether the defendant is the employer of the tortfeasor; and (2) whether the tortfeasor committed the tort while acting in the course of his or her employment.⁴⁸

The traditional vicarious liability rules ordinarily make principals or employers vicariously liable for acts of their agents in the scope of their authority.⁴⁹ To state a claim for vicarious liability, plaintiffs must allege sufficient facts to show that the principal manifested an intent to grant the agent authority, the agent agreed, and the principal “maintain[ed] control over key aspects of the undertaking.

⁴³ See Mark A. Greistfeld, *A Roadmap for Autonomous Vehicles: State Tort Liability, Automobile Insurance, and Federal Safety Regulation*, 105 Cal. L. Rev. 1611, 1630 (2017).

⁴⁴ *Estate of Alex through Coker v T-Mobile US, Inc.*, No 3:17-CV-2622-M, 2018 WL 1122193, at *5 n.9 (N.D. Tex. Mar. 1, 2018).

⁴⁵ *Stoot v. D & D Catering Serv., Inc.*, 807 F.2d 1197 (5th Cir. 1987).

⁴⁶ *Eg. Muratore v. M/S Scotia Prince*, 845 f.2d 347, 1993 AMC 2933 (1st Cir. 1988); *De Centeno v. Gulf Fleet Crews, Inc.*, 798 F.2d 138, 1987 AMC 2462 (5th Cir. 1986).

⁴⁷ *Stoot v. D & D Catering Serv., Inc.*, 807 F.2d 1197 (5th Cir. 1987).

⁴⁸ *Id.*

⁴⁹ *Meyer v. Holley*, 537 U.S. 280, 285 (2003).

Under the common law of agency, the existence of the employment relationship hinges on “the hiring party’s right to control the manner and means by which the product is accomplished.”⁵⁰The respondent superior liability is predicated upon the control inherent in a master-servant relationship.⁵¹

It is established that a principal is not liable for the activities of an independent contractor committed in the course of performing its duties under the contract.⁵² A principal who hires independent contractors over which he exercises no operational control has no duty to discover and remedy hazards created by its independent contractors.⁵³ Maritime law has recognized three exceptions:

1. When the contractor performs a non-delegable duty of the employer;
2. When the contractor is engaged to perform inherently dangerous activities;⁵⁴
3. When the principal is negligent in selecting, instructing and supervising the contractor.⁵⁵

Some would say that the last exception is not an exception at all but the recognition of the parties liability for its own acts or omissions rather than the vicarious liability of the contractor.

The RESTATEMENT (SECOND) OF TORTS § 411 states the rule relative to negligent selection, instructing and supervising an agent or contractor:

An employer is subject to liability for physical harm to third persons caused by his failure to exercise reasonable care (a) to employ a competent and careful contractor to do work which will involve a risk of harm unless it is skillfully and carefully done, or (b) to perform any duty which the employer owes to third persons.

In *Guarascio v. Drake Assocs.*,⁵⁶the court explained that, “[t]o state a negligent hiring claim under maritime law, the plaintiff must establish that “the employer either failed to exercise reasonable care in the selection of the contractor or had actual constructive knowledge of the contractor’s insufficiency.”

The RESTATEMENT (SECOND) OF TORTS § 414:

One who entrusts work to an independent contractor, but who retains control of any part of the work, is subject to liability for physical harm to others for whose safety the employer owes a duty to exercise reasonable care, which is caused by his failure to exercise his control with reasonable care.

The retention of control of the work must exist as to the very thing from which the injury arose and relate to the operative detail of how the work is performed. The general rights to order the work stopped, to inspect its progress, to receive reports or to make suggestions and/or recommendations which need not necessarily be followed or to prescribe alterations and deviations are not sufficient.⁵⁷

⁵⁰ *Nationwide Mut. Ins. Co. v. Darden*, 503 U.S. 318, 323 (1992)(quoting *Cnty. For Creative Non-Violence v. Reid*, 490 U.S. 730, 751 (1989)).

⁵¹ *Barbetta v. S/S Bermuda Star*, 848 F.2d 1364, 1988 AMC 2650 (5th Cir. 1988).

⁵² *Johnson v. Globalsantafe Offshore Servs.*, 799 F.3d 317, 2015 AMC 2241 (5th Cir. 2015).

⁵³ *Wilkins v. P.M.B. Sys. Eng’g, Inc.*, 741 F.2d 795 (5th Cir. 1984).

⁵⁴ *Becker v. Poling Transp. Corp.*, 356 F.3rd 381, 2004 AMC 637 (2nd Cir.

⁵⁵ *Id.*

⁵⁶ 582 F.Supp.2d 451 (S.D.N.Y. 2008). See *Jurgens v. Poling Transp. Corp.* 113 F.Supp 2d 388, 400 (E.D.N.Y. 2000)

⁵⁷ *Gardner v. Greg’s Marine Constr., Inc.*, 2014 U.S. Dist. Lexis 469 (D. Md. 2014).

In a parent –subsidiary situation, the court in MSC FLAMINIA, provided an additional basis for finding liability where the parent retains authority over the subsidiary to make important decisions or otherwise maintain “control over key aspects of the undertaking” by the subsidiary agent.⁵⁸

1. **Borrowed Servant Doctrine**

The borrowed servant doctrine was developed in admiralty cases.⁵⁹ An employer will be liable through respondent superior for the negligence of an employee he has “borrowed”; that is, one who does his work under his supervision and control.⁶⁰

The court in *Gaudet v. Exxon Corp.*, 562 F.2d 351, 355 (5th Cir. 1977) In *Ruiz v. shell Oil Co.*, 413 F.2d 310, 312-313 (5th Cir. 1969) noted that in *Ruiz v. shell Oil Co.*, 413 F.2d 310, 312-313 (5th Cir. 1969) the court looked at nine factors that courts should consider when determining if an employee is a borrowed employee:

1. Who has control over the employee and the work he is performing, beyond mere suggestion of details or cooperation?
2. Whose work is being performed?
3. Was there an agreement, understanding, or meeting of the minds between the original and the borrowing employer?
4. Did the employee acquiesce in the new work situation?
5. Did the original employer terminate his relationship with the employee?
6. Who furnished tools and place for the performance?
7. Was the new employment over a considerable length of time?
8. Who had the right to discharge the employee?
9. Who had the obligation to pay the employee?

What the Ruiz decision did not do was advise which factors, if any, or to be given more weight than others. Instead, the court when on and said that ‘no one of these factors, or any combination of them, is decisive, an no fixed test is used to determine the existence of a borrowed-servant relationship.

Imputation of Knowledge

In general, when an agent is employed to perform certain duties for his principal and acquires knowledge material to those duties, the agent’s knowledge is imputed to the principal.⁶¹ As a result, a principal may “be charged with notice of facts that an agent knows or has reason to know.”⁶²

⁵⁸ In re M/V MSC FLAMINIA, 2015 AMC 2233 (S.D.N.Y. 2015).

⁵⁹ *Standard Oil Company v. Anderson*, 212 U.S. 215 (1909).

⁶⁰ *Gaudet v. Exxon Corp.*, 562 F.2d 351, 355 (5th Cir. 1977), In re M/V MSC Flaminia, 2015 AMC 2233 (S.D.N.Y. 2015). The “borrowed servant doctrine” may apply to make an employer liable for the negligence of a borrowed employee. *Washington v. Fieldwood Energy, LLC*, 2017 AMC 2031 (E.D. La. 2017). See also *Stires v. Carnival Corp.*, 243 F.Supp. 2d 1313 (M.D. Fla. 2002); *Santacruz v. Hertz Equip.*, 2015 Lexis US. Dist. Lexis 66007 (S.D. Tex. April 27, 2015).

IV. OTHER AREAS IMPLICATED

A. What about situations involving Pilotage and vicarious liability?

Much of the current discussion of autonomous vessels, as per above, centers around the notions of the flow of vicarious liability: to contractors providing autonomous capabilities in some way, and the reverse direction, namely imputation of knowledge to the principal from such contracts.

A particular type of service provider that poses interesting issues is the compulsory pilot. In most parts of the world, the vessel owner/operator/bareboat charterer is responsible to third parties for the actions of the pilot. There are very few places where it is possible to place significant recovery against the pilot for his/her errors. In the Panama Canal, the pilot's error may, after investigation of an incident, lead it way to liability with the Panama Canal Authority for damages caused (this is marked contrast to the Suez Canal, where liability remains solely with the ship's Master).

Presumably, pilots will be human beings coming aboard a ship, and thus their interplay with an autonomous ship may be not so different than what occurs today in the traditional mode of vessel control. Likely the human pilot will be furnished a means of communication with the remote operator or the computer controlling the ship's navigation, allow for advice and input – basically trading a human at the helm with a computer.

However, why can't the pilot likewise offer input remotely, to the ship's operator/mechanism of operation? This, in fact, is being anticipated. The Finnish Ministry of Transport and Communication has stated that the Finnish Pilotage Act will be amended to allow the pilot to perform his or her duties somewhere else than onboard the vessel. The remote pilotage authorisation defines the routes and parts of routes where remote pilotage is allowed. It also determines the vessels involved and the origin and destination of the remote pilotage. The authorisation will be granted for a maximum of five years and can be renewed if necessary.

A provision will be added to the Act stating that the Defence Forces will be able to exempt foreign state vessels from the obligation to use a pilot. The Defence Forces may exempt vessels that take part in a training or exercise organised by them, participate in another form of defence cooperation or are hosted by the Defence Forces.

It is anticipated that this law will have been approved by 18 Jan 2019 and go into force on 1 February 2019. Thus, it would appear that the practice of pilotage will likewise fall within the concept of autonomous controls, and offers both possible efficiencies, but also potential complications, to the movement and transit of autonomous ships in the future.

⁶¹ *Apollo Fuel Oil v. United States*, 195 F.3d 74, 76 (2d Cir. 2009) (citing Restatement (Second) of Agency §§ 9(3), 268, 272, 275 (1958)). *Accord Reino de España v. American Bureau of Shipping*, 691 F.3d 461, 473-74 (2d Cir. 2012).

⁶² Restatement (Third) of Agency § 5.03 cmt. a (2006).

[see press release of the Finnish Ministry of Transport and Communications, dated 17 Jan 2019 : <https://www.lvm.fi/en/-/remote-pilotage-allowed-995692> , reviewed on 22 Jan 2019]

B. What about offshore energy installations?

Again, much of the focus of the discussion of autonomous shipping is on short and long-haul cargo vessels, along with harbor and coastal ferries. In addition, there has been consideration in the offshore energy industry regarding the use of autonomous technology with work boats, crew boats, and other service vessels.

However, there is an additional vector with fixed and floating offshore energy installations, as they usually have the responsibility to interact with approaching vessels within a safety zone, usually at a fixed distance, e.g. 500 meters. To date, this has been done by a human controller working in the facility control room, monitoring vessel traffic and talking with vessel navigators, similar to an air traffic controller.

Now, Aker BP has announced that it is operating one of its staffed platforms operating in the Norwegian Continental Shelf area, 'Ivar Aasen', from a remote-control room located ashore in Trondheim, Norway.

Ivar Aasen was constructed with two identical control rooms – on the platform and in Trondheim. The plan has always been to move the control room to land. Other offshore staffing on the field will remain as before.

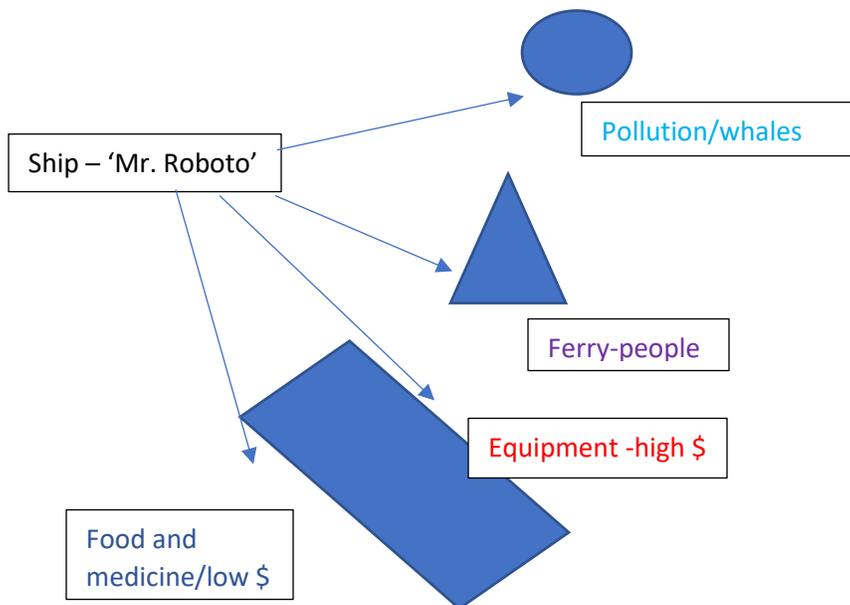
Aker BP states that there is a lot to be learned from this new method of managing the activity, both for Aker BP and for the industry. Aker BP sees a considerable potential for increased revenues because the subsurface experts are closer to the control room, which can give better mutual understanding and common goals.

Aker BP believes that the use of such technology will result in significant cost savings for the company, and for the further development of digital solutions that will influence the way of work in the offshore energy sector. Thus, in crowded and busy offshore energy fields, we may see a situation where several remote operators, on service vessels and on the offshore facility, will all be interacting via remote systems, offering again the two-sided equation of enhanced efficiency versus potential complexities and safety risks.

[press release of Aker BP, 16 January 2019; <https://www.akerbp.com/en/ivar-aasen-now-operated-from-trondheim/> ; viewed on 22 January 2019]

The Discussion Hypothetical – the Trolley Car Dilemma, ‘At Sea’:

Only one of these courses is possible -



Some suggested discussion points:

-assume the software logarithm that controls the autonomous navigation has knowledge not only of all of the factors for navigating the vessel, but also knows the content of the cargo manifests for all containers including market values and whether cargo is insured or not.

Should this influence the choice of ship course? How would this influence GA – is this a proper ‘sacrifice’ of cargo to minimize the collective loss?

-should environmental hazards rank above potential property damage? What if the damage and response costs would be equal – is there any legal basis for this choice?

-Should autonomous vessels enjoy the same COGSA defenses as manned ships? Should autonomous ships enjoy the Limitation of Liability Act of 1851 at all – is there ‘privity and knowledge’ with a fully autonomous ship (‘back to the future’ problem)?