

Autonomous technology in shipping: an increased role for product liability?

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The current liability framework

- Maritime liability regimes funnel third-party liability to *shipowner* (generally)

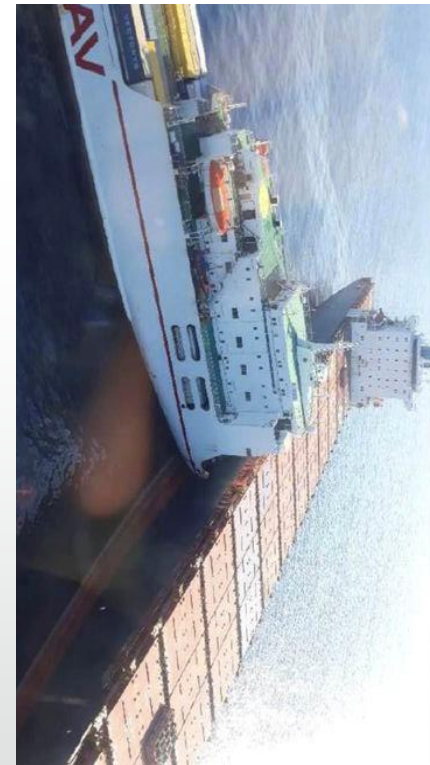


Strict liability regimes

- International Convention on Civil Liability for Oil **Pollution** Damage, 1969
- International Convention on Civil Liability for **Bunker Oil** Pollution Damage 2001
- Nairobi International Convention on the Removal of **Wrecks** 2007

Fault-based regimes

- Tort (negligence)
- Convention for the Unification of Certain Rules of Law with respect to **Collisions** between Vessels 1910

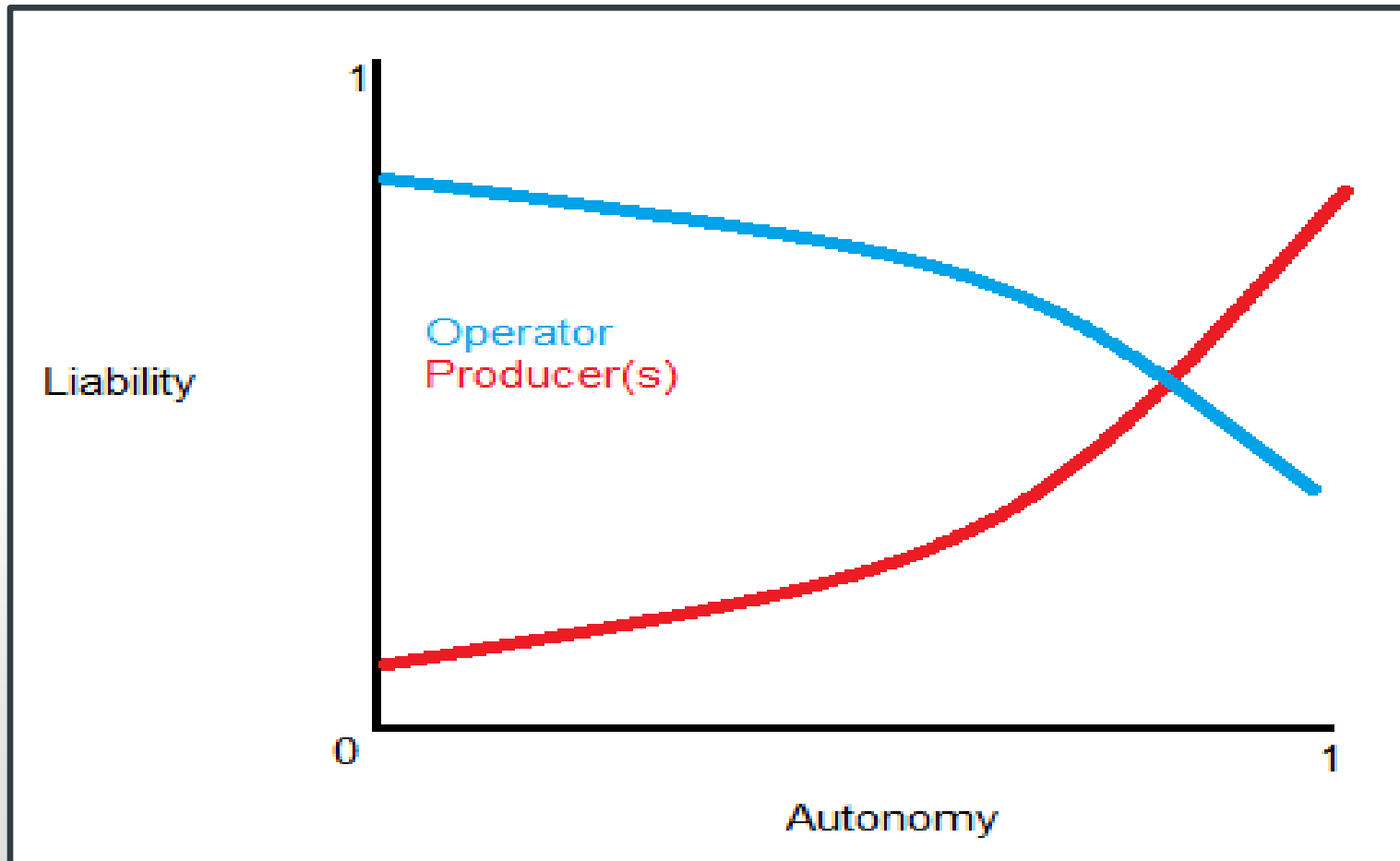


The current liability framework UNIVERSITY OF Southampton

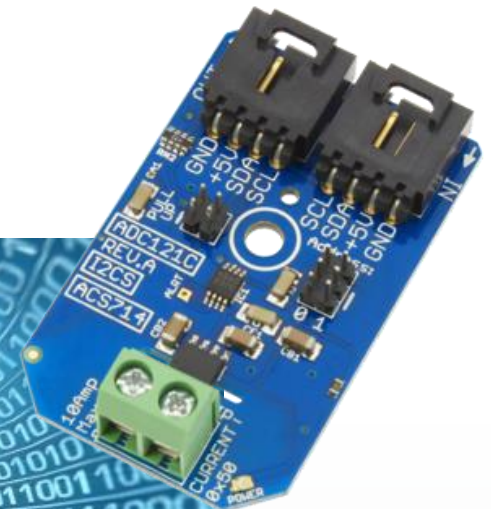
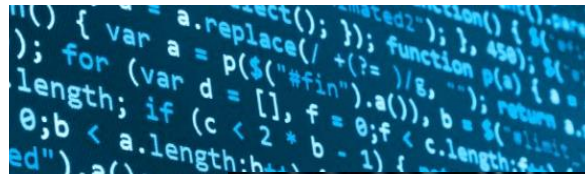
- **Third-party liability funnelled to *shipowner***



A shift in the liability trend?



Autonomous technology



- Hardware (sensors)
- Software
- Algorithms
- Components thereof
- **More than automation**

An increased role for product liability?

- **Product liability:** liability claims against manufacturers and designers of *products*
- **Will the increased reliance on autonomy mean an increased number of product liability claims?**

Product liability: sources of law

- No *international* framework
- Varies from state to state
 1. EU Product Liability Directive 85/374 concerning liability for defective products
 2. Tort of negligence (England and Wales)

EU Directive 85/374

- Article 1
 - *The producer shall be liable for damage caused by a defect in his **product**.*
 - **Is a MASS a “product”?**
- Article 2
 - *For the purpose of this Directive 'product' **means all movables ... 'Product' includes **electricity**.***
 - Hardware
 - Spatial sensors
 - Software?
 - Algorithms?
- Transposed into English law via the Consumer Protection Act 1987

EU Directive 85/374

- Article 1
 - *The producer shall be liable for damage caused by a defect in his product.*
- When is autonomous technology “defective”?
 - Article 4
 - 1 . A product is defective when it does not **provide the safety which a person is entitled to expect**, taking **all circumstances** into account, including :
 - (a) the **presentation** of the product ;
 - (b) the **use** to which it could **reasonably** be expected that the product would be put ;
 - (c) the time when the product was put into circulation.

EU Directive 85/374

- Article 7 – Defences to liability
- The producer **shall not be liable** as a result of this Directive if he proves :
 - (d) that the defect is due to **compliance** of the product with **mandatory regulations** issued by the **public authorities** ; or
 - (e) that the state of **scientific and technical knowledge** at the time when he put the product into circulation was **not such as to enable the existence of the defect to be discovered** ; or

EU Directive 85/374

- Article 9 – What claims does the Directive apply to:
- *For the purpose of Article 1 , 'damage' means :*
 - a) *damage caused by **death** or by **personal injuries** ;*
 - b) *damage to, or destruction of, any item of **property** other than the defective product itself, provided that the item of property :*
 - *(i) is of a type ordinarily intended for **private use** or consumption*
- **Excludes:** damage to commercial property
- **Includes:** personal injury at sea, damage to pleasure craft

The tort of negligence

- Manufacturers owe duty of care to users of product and public at large
- Relevant to *all* sectors
- **Applicable to all foreseeable personal and property damage**

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HOUSE OF LORDS

[1932]

[HOUSE OF LORDS.]

H. L. (Sc.)* M'ALISTER (OR DONOGHUE) (PAUPER) . APPELLANT ;

1932
May 26. STEVENSON AND RESPONDENT.

*Negligence—Liability of Manufacturer to ultimate Consumer—Article of Food
—Defect likely to cause Injury to Health.*

By Scots and English law alike the manufacturer of an article of food, medicine or the like, sold by him to a distributor in circumstances which prevent the distributor or the ultimate purchaser or consumer from discovering by inspection any defect, is under a legal duty to the ultimate purchaser or consumer to take reasonable care that the article is free from defect likely to cause injury to health :—

So held, by Lord Atkin, Lord Thankerton and Lord Macmillan ; Lord Buckmaster and Lord Tomlin dissenting.

George v. Skivington (1869) L. R. 5 Ex. 1 approved.

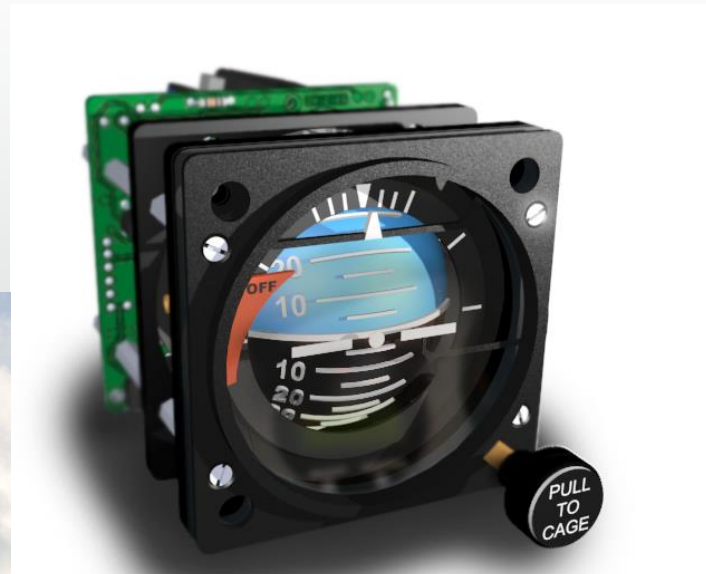
Dicta of Brett M.R. in *Heaven v. Pender* (1883) 11 Q. B. D. 503, 509–11 considered.

Mullen v. Barr & Co., Ltd., and *M'Gowan v. Barr & Co., Ltd.*, 1929 S. C. 461 overruled.



The tort of negligence

- Lessons from aviation ...
- *Lambson Aviation v Empresa Aeronautica* [2001] All ER (D) 152.
 - Crash after failure of Artificial Horizon gyroscope
 - Gyroscope manufacturers NOT negligent
 - Important factors:
 - Expectations of on-board crew
 - Compliance with CAA standards
 - “considerable but not decisive weight”



Product liability generally

• Important common factors:

1. Marketing, product warnings & management of expectations
2. Compliance with applicable regulations / industry standards, testing procedures

Safety Case	
Safety Case / Risk Assessment	Reference to attached Documents
Please specify the consequences in the event of a failure of command and control details:	
(e.g. propulsion will stop after a limited of 10 seconds) Include use of ground stoppage/ remote stoppage or an immediate stand by Irreversible salvage of vessel not under command (Total power loss or Command Link failure)	
Support craft	
Number and type of support craft	
Name / call sign	
Phone number	
MMSI if transiting on UAS	
Intended role during VET, and autonomously during VETOps	(including: Type to class to unmanned craft & station keeping requirement)
Unmanned craft recovery method	(including: role to tow vessel to and from harbour facility, if/when used)
Brief description of intended operations	
Please provide a description of intended operations:	
(e.g. - the UUV will be carrying a survey pattern in an area South of Bear Island, typically comprising a raster pattern of 20 lines, spacing 10m apart and 500m long. South of Bear Island and clear of shipping lanes, a manned support craft will remain in line of sight within 300m of the UUV for the duration of the trial)	
Additional information	
(e.g. - the UUV will be carrying a survey pattern in an area South of Bear Island, typically comprising a raster pattern of 20 lines, spacing 10m apart and 500m long. South of Bear Island and clear of shipping lanes, a manned support craft will remain in line of sight within 300m of the UUV for the duration of the trial)	
Approval	
Comments	
(e.g. approved for daylight operations, support boat to keep watch on Channel 12)	
Approval signatures	
Harbour authority	
Name	
Signature	

5 Vessel Design & Manufacture Standards

5.1 Objective

The objective of this Chapter is to provide a process to ensure that the design, manufacture, through life survey, maintenance and disposal requirements of the vessel are appropriately considered. This Chapter is written as a goal-based requirement to permit the maximum scope to introduce innovative ideas into the design.

5.2 Scope

5.2.1 The scope of this Chapter is to cover the design, manufacture and through life survey, maintenance requirements and disposal requirements of the vessel. The vessel in this context is taken as the structure, equipment and systems (including software) which constitute the waterborne elements of the MMS.

5.2.2 The MMSI should be designed, constructed and maintained in compliance with the requirements of a classification society which is recognised by the Administration or in accordance with applicable national standards of the Administration which provide an equivalent level of safety.

5.2.3 For the intended operational life of the MMSI 3 should be designed and constructed to:

- Enable the MMSI to operate in all Reasonably Foreseeable Operating Conditions (RFOC);
- Carry and support all crew tasks in a predictable manner, with a level of integrity commensurate with operational and safety requirements;
- Ensure the subweight and weightlifting integrity, to meet buoyancy and stability requirements;
- Minimise the risk of rubbing the and explain;
- Minimise the spread of fire;
- Enable the maintenance and repair in accordance with the maintenance philosophy

5.2.4 Operators should be provided with adequate access, information and instructions for the safe operation and maintenance of the MMSI.

5.3 Selection of Design Build and Survey Requirements

5.3.1 MMSI shall be certified to demonstrate compliance with the requirements of the Code. Certification requirements are covered in Chapter 12.

5.3.2 The vessel builder is to provide evidence and justification to the MO to demonstrate that the vessel is fit for the intended role and meets the goals of this Chapter. This evidence is to include the following information:

10 System Integrity Certification & Test Procedures

10.1 Objective

The objective of this Chapter is to outline the certification and test procedures required for the situational awareness, control and other mission-critical systems within a MMS.

10.2 Scope

10.2.1 Verification shall be undertaken to provide assurance that the Situational Awareness and Control System complies with the provisions of this Code and remains compliant throughout its life.

10.2.2 The Risk Assessment for the MMSI shall be reviewed in detail, to check that no critical single point failures have been overlooked. The Risk Assessment shall be confirmed as being thorough and conservative in its safety assessment.

10.3 System test based on Risk Assessment

10.3.1 All safety critical items covered by failure sensing and remedial action, or by dual or multiple redundancy, having been highlighted in the Risk Assessment, shall be individually tested by simulating each failure mode of each sub-system or component and verifying that the backup measures are effective in mitigating any critical consequences.

10.3.2 The effects of power failures shall be checked, to ensure that simultaneous power failures on several sub-systems do not invalidate critical safety measures that rely on dual redundant systems.

10.3.3 System integrity testing shall be performed in a hierarchical manner in such a way as to ensure that each sub-module functions in accordance with performance requirements. Integration testing shall be performed to test the interfaces and the performance of the combined systems.

10.3.4 Electronic systems shall be installed in the same manner as for manned vessels. This includes EMC compliance, use of accessories and connectors with suitable marine grade IP ratings, communications standards (GPR-42, EIA-232, NMEA 0183 and NMEA 2000 and others as appropriate).

10.3.5 Simulators may be used to verify levels of performance of some but not all systems. This includes adapted performance, collision avoidance algorithms, though not the systems whose performance is critically dependent on real-world stimuli, such as optical and inertial sensors.

10.4 Sensor tests

10.4.1 Any sensor whose performance is critical to MMSI safety shall be tested and certified to give reliable results. As far as possible, this may be done for each sensor type, in some cases, the sensor performance is largely independent of the platform on which it is mounted.

10.4.2 Where indicated by the Risk Assessment, and where sensor performance is to some degree influenced by the platform on which it is mounted, tests shall be performed using the sensor/MMSI combination, to test external and internal sensors in a real maritime environment that meets or exceeds the most demanding environments for which the MMSI is to be certified.

10.4.3 In some cases, the dependence of sensor performance on the host platform is such that the tests may be performed using a representative platform, i.e. one where the sensor performance is expected to be equivalent or worse than on the MMSI itself. This means that the sensor may be certified, on the basis of one set of tests, for many MMSI platforms. In such cases, the critical parameters of the test and MMSI platforms in question shall be recorded for comparison and justification. For example, if sensor performance depends positively upon antenna height above sea level, the test may be performed on a trial vessel using a lower antenna height, to provide accreditation for use on all MMSI with higher antenna mountings.

10.5 Emergency Stop test

10.5.1 The Emergency Stop systems shall be tested, using all defined methods of triggering Emergency Stop, singly and in combination, and under realistic failure conditions, to demonstrate that the Emergency Stop system is fit for safe.

10.6 Cyber security

10.6.1 Cyber security is defined as the protection of information systems from theft or damage to the hardware, the software, and to the information on them, as well as from disruption or manipulation of the data for the services they provide.

10.6.2 MMSI shall have cyber security measures to protect sensors and control systems as far as practicable and necessary.

10.6.3 Key risks are identified as (but not limited to):

- Backdoors
- Denial of Service
- Direct Access
- Eavesdropping
- Tampering

10.6.4 Key systems to be protected are those concerned with vital situational awareness and the display thereof (e.g. position sensors, heading sensors), control (steering, waypoint generation), operator override (including Emergency Stop processes).

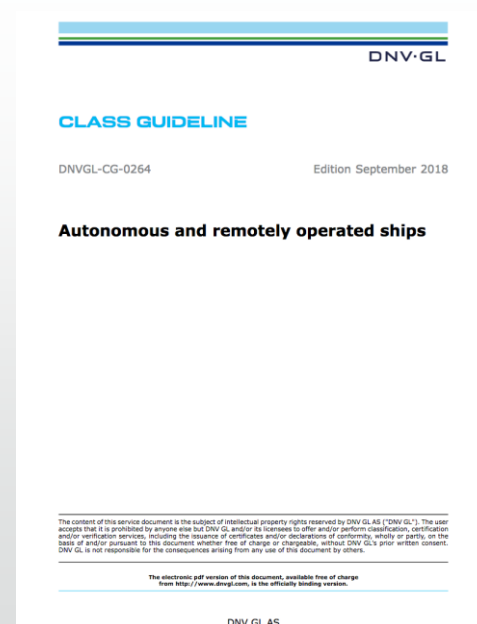
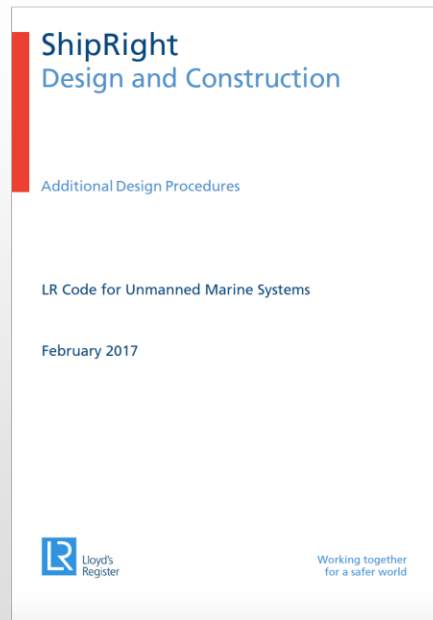
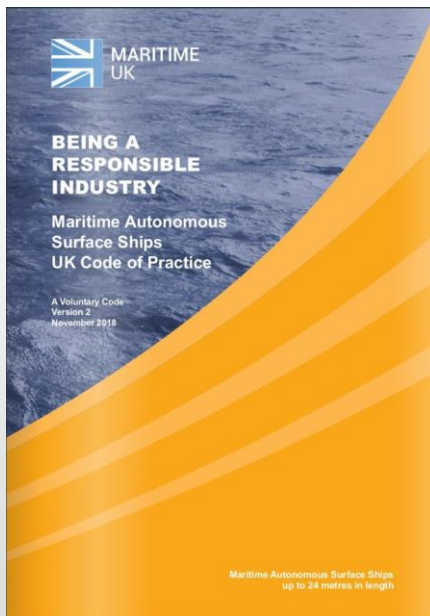
“Reasonable” usage, operations and expectations of MASS

- **What MASS usage is “reasonable”?**
 - What kind of operations?
 - Relevance of manning?
 - *Degree* of autonomy?
- *Hindustan Steam Shipping Co Ltd v Siemens Bros & Co Ltd* [1955] 1 Lloyd's Rep. 167.
 - Expectation of human intervention often prevents liability in *automation* context
 - Same expectation for *autonomy*?



MASS compliance with relevant standards

- Regulation and best practices still developing
- Importance of industry self-regulation
 - Compliance is important but *not* conclusive evidence of due care (under tort *and* Directive 85/374)



Concluding thoughts

- ✓ Advent of autonomy *may* place more onus on system producers
- ✓ Liability risk can generally be managed
- ✓ Regulatory framework (and the technology) still developing
- ✓ Importance of management of consumer (and public) expectations of autonomy
- ✓ Importance of proactive engagement and prudent industry self-regulation

Thank you

For more information on MASS product liability,
please contact R.Veal@soton.ac.uk