Defence
Safety Authority

DSA03-DMR Guide to Regulation of Maritime Autonomous Systems

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1: Introduction

Background

1.0. Defence Regulations for Health, Safety and Environmental Protection (HS&EP) for UK MOD Shipping activity, DSA02 DMR [Ref.1] apply to all UK Defence Maritime activity, throughout its full lifecycle. The United Kingdom (UK) Ministry of Defence (MOD) currently operates surface and submersible platforms that are capable of autonomous operation, with varying degrees of autonomy.

1.1. The Defence Maritime Regulator (DMR) supports Maritime Autonomous Systems (MAS) as it is a growing area within the maritime domain. DMR aims to provide clear and supportive regulation to aid the development of the area of MAS. The regulations will be strengthened by national and international legal frameworks.

1.2. Where the MAS has been determined to meet the definition of MOD Shipping[1] and has been further classified as a MOD MAS vessel, the DMR regulations apply. The Defence Shipping category[2] will be decided during the Registration process and marked accordingly on the Defence Shipping Register (DSR). The authority for decision-making regarding categorisation lies with the Registrar of MOD Shipping and platforms should consult with the Registrar if clarification is required (DSA03 DMR Guide to Registration of MOD Shipping [Ref.32]).

1.3. This guide is intended to provide a handrail to assist the Accountable Persons in making informed decisions. It does not modify, amend, or replace the overarching regulations; where there is any doubt about how to achieve compliance with the regulations for specific projects, advice should be sought from DMR. DMR should be consulted as early as possible in the Concept, Assessment, Demonstration, Manufacture, In- service and Disposal (CADMID) cycle to ensure regulations can be met and do not hinder the procurement or operation of MAS. Each Accountable Person (AP) is responsible for demonstrating that the requirements within the regulations are met.

1.4. The Merchant Shipping (Small Workboats and Pilot Boats) Regulations 2023 is underpinned by the Workboat Code Edition 3 (WBC3), which provides UK legislation for the operation of Unmanned Surface Vessels (USVs). The code is published by the UK Maritime and Coastguard Agency (MCA), under the auspices of the Department for Transport (DfT). The MCA have also provided Marine Guidance Note (MGN) 664 (M+F) Certification Process for Vessels Using Innovative Technology [Ref.37], which can be used as guidance to certification through Naval Authority and Technical Group (NA&TG) for new

[1] MOD shipping reflects the definition provided by DMR Regulatory Terms [Ref.2]: “Ships owned by, operated by or operated on behalf of the Ministry of Defence. This includes Warships, Government Ships and any shipping services provided under Charter, a Financial or a Managed Service, employed on Defence Activity for the benefit of the Crown.”
[2] See DSA03-DMR Guide to Registration of MOD Shipping, Issued October 2023[Ref. 32]

projects. The DMR regulates all Defence Maritime Activity, and can set regulations where Defence has Disapplications, Exemptions, or Derogations (DEDs).

1.5. WBC3 may provide a suitable baseline for autonomy. However, the operational envelope and certification strategy (as agreed with the NA&TG) of the MAS should dictate the extent WBC3 applies.

1.6. The International Maritime Organisation (IMO) has completed a review of standing International Maritime Conventions, and their applicability to Maritime Autonomous Surface Ships (MASS) and there is an aspiration for a 'MASS Code' to be issued to address any perceived gaps in international law. However, this non-mandated code is not expected to be issued before 2025; a mandatory version is expected in 2028. In the meantime, this guide is designed to assist operators to work within the bounds of the current UK legal regime and MOD policy.[3]

Purpose and scope of the guide

1.7. This document has been produced by the DMR to provide the Defence maritime community with a guide to the regulation of MAS within MOD owned and operated shipping[4]. It provides an overview of:

a. Categorisation and registration of MOD MAS vessels;

b. The process by which MOD MAS are assured;

c. The maritime legal framework that applies to MOD MAS.

1.8. The Goal of DSA02-DMR [Ref.1] is the management of Defence maritime activities such that work-related fatalities, injuries, ill health, and health and safety risks are reduced to a level that is As Low As Reasonably Practicable (ALARP) and the environmental impact and risks are minimised so far as is reasonably practicable; this includes responsibility to reduce risk to third parties[5] from MOD activity.

1.9. It should be recognised that many aspects of MAS as a vessel and its systems continue to fall within the remit of existing legislation, regulation, and standards. Some elements of automation, such as autopilots, are relatively well understood with mature rules, while other aspects, such as the autonomous determination and execution of vessel manoeuvre, are novel and do not fit within the existing regulatory framework.

[3] The MAS industry has been proactive in the development of MAS including the formation of the Maritime Autonomous Systems – Regulatory Working Group (MASRWG). The guidance issued by MASRWG is useful but designed for civilian shipping. The DMR Guide should be viewed as the authoritative statement for the operation of Defence MAS.
[4] See footnote 1.
[5] The term third-party is employed in the context of a generic legal term for any individual who does not have a direct connection with the operation of the MAS but who might be affected by it.

In accordance with the Secretary of State's for defence's policy statement, any vessel including MAS should comply with existing legislation, regulation and standards appertaining to a vessel of comparable size and employment. This guide provides the objective tests and indicative thresholds that should be applied to determine when a MAS should be considered as a vessel. The MAS specific assurance requirements, which are reflective of current understanding of development and capabilities of MAS, will form a small subset that address areas of novel command, control and monitoring systems that support decision making. Part 3 of this guide provides further details on regulatory compliance for MAS.

1.10. If any further clarification is required after reading the guide, email DMR Group Mailbox DSA-DMR-GROUP@mod.gov.uk.

Introduction of MAS terminology

1.11. There are several key terms that apply to MAS that need to be defined to ensure a clear understanding of this Guide. Where generic terms are used that apply to MOD Shipping, the DMR Regulatory Terms [Ref.2] should be used. Where relevant, terms have been taken from the Maritime Autonomous Surface Ships (MASS)[6] UK Industry Conduct Principles and Code of Practice [Ref.3] to maintain consistency with current UK best practice:

a. **Autonomous** – Pertaining to a system that has the ability to decide and act to accomplish desired goals, within defined parameters, based on acquired knowledge and an evolving situational awareness, following an optimal but potentially unpredictable course of action [Ref.46];

Degrees of Autonomy (DoA) – The level of autonomy applied to a MAS. The degree of autonomy should be considered as defined in the International Maritime Organization (IMO) Regulatory Scoping Exercise for the Use of Ships MASS;

a. **Principle of Equivalence** – An approach to the application of rules, regulation, and standards to MAS based on extant requirements for conventional crewed vessels, as defined further in paragraphs 5.3 to 1.5.7 of this document;

b. **Maritime Autonomous System (MAS)** – A system that is capable of being operated autonomously on the surface or sub-surface, and for which the Level of Control (LoC) may encompass any of those levels as defined in figure 2.1. It encompasses a vessel and all associated onboard, offboard and remote-control systems;

[6] Note that MASS is the term used in the civil maritime sector and relates only to surface ships at this time. DMR has adopted the term MAS to apply to all types of maritime systems (including sub-surface) and to reflect the adopted NATO terminology.

c. **MAS vessel**[7] – A maritime platform used in navigation and/or delivery of a Defence Task where there exists a capability of operational control of some, or all, vessel operations at a point remote to the vessel and/or without human intervention, for the full or limited periods of the operations or voyage;

d. **MAS equipment**[8]– Any MAS that does not meet the definition of a MAS Vessel;

e. **Remote control** – Operational control of some or all MAS vessel/equipment operations or functions, at a point remote from the vessel for the full or limited periods of the voyage;

f. **Remote Operating Centre** (ROC) – Any location other than a remotely operated unmanned vessel from which a remotely operated unmanned vessel/equipment is operated. The ROC may be located either ashore or afloat and may exercise varying degrees of control as defined under LoC. An ROC may consist of more than one Control Station or Room;

g. **Remote monitoring** – Monitoring some or all MAS operations or functions at a point remote from the MAS, where that monitoring is expected to support Command and Control;

h. **System of Systems (SOS)** – A set or arrangement of systems that results when independent and useful systems are combined into a larger system that delivers capabilities that are not delivered by any individual system[9];

i. **Wreck** – A vessel, craft, or property that, for any reason whatsoever, has become sunken, stranded, or adrift and may be subject to the provisions of the International Convention on Salvage, 1989.

[7] Status as a Vessel vice Equipment will be confirmed during the registration process.
[8] Status as a Vessel vice Equipment will be confirmed during the registration process.
[9] Definition aligned with Knowledge in Defence (KiD) SOSA Glossary (https://www.kid.mod.uk/maincontent/business/sosa/content/sosa_glossary.htm)

2: MAS categorisation and MAS vessel registration

Introduction

2.1. Part 2 of the MAS Guide provides an overview of the considerations for the categorisation of MAS, as either a MAS vessel or MAS equipment; and registration of MOD MAS vessels on the Defence Shipping Register and associated threshold criteria.

Categorisation of MAS

2.2. The distinguishing factor that differentiates MAS vessels from conventional crewed vessels is that the MAS can employ various degrees of autonomy to perform functions that would otherwise be performed by embarked seafarers. DMR has two distinct categories of MAS:

a. Vessels[10]; and

b. Equipment.

2.3. The legal definitions are offered for completeness; at this stage of technological and civil regulatory development, classification by DMR will include an assessment of a MAS' concept of operations and physical attributes which will be discussed at registration committee as part of initial registration. The registration committee will decide if the MAS is deemed a vessel or equipment and the appropriate certification approach.

2.4. Of particular note, if the MAS is classed as a vessel, then it will be bound by the legal instruments described in Part 5 (International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) [Ref.7], International Convention for the Safety of Life at Sea (SOLAS) [Ref.15], etc). If the MAS is classed as a piece of equipment, the operator still has an obligation to operate the MAS in a way that provides for the safety of both operators and third parties at sea. This may, in itself, require adherence to COLREGs if the MAS is being operated near other shipping. Navy Legal Services should be consulted if there are any concerns about the legal status of the system and how that will affect operation outside UK territorial seas.

[10] For the purposes of categorisation, the words "ship" and "vessel" are viewed as synonymous.

Entry of MAS vessels on the Defence Shipping Register

2.5. The Merchant Shipping Act, 1995 (MSA95) [Ref.12] requires that all UK shipping is registered. DSA02-DMR [Ref.1] Regulation 601 requires all UK MOD Shipping to compile and register similar basic data to that on the UK Ship Register. The DSR holds this data. The entry of a vessel onto the DSR enables vessels to operate under either the White or Blue Ensigns, and utilise Derogations, Exemptions and Disapplications as permitted under the relevant Statutes and agreed by the Secretary of State. For vessels registered on the DSR, the MOD AP may be granted an Approval to Authorise MOD Shipping (AtAMS), which allows them to operate the vessel. Further guidance can be found in DSA03-DMR Guide to Registration of MOD Shipping [Ref.32].

2.6. The Defence Shipping Register also includes a section facilitating categorisation of all MAS projects.

2.7. The DMR registration process requires that there is a MOD AP for each MAS vessel.

2.8. The Platform Authority (PA) and AP are responsible for ensuring that MOD MAS vessels are registered on the DSR and should follow DSA03-DMR Guide to Registration of MOD Shipping [Ref.32].

2.9. At the discretion of the Registrar of MOD Shipping, it may be deemed appropriate for MAS not to be entered on the DSR; for example, where there is no statutory requirement for registration and the risk posed is determined to be low. These are likely to have been deemed equipment at the registration committee.

MAS vessel risk category for registration and certification

2.10. In recognition that the risk category for a particular MAS may change through its project lifecycle and/or phases of deployment and operation, the risk criteria should be considered in context. Changes that may impact on any of the risk criteria should be identified and the PA/AP should engage with NA&TG then DMR to establish whether these changes will result in a different risk category being allocated to the MAS at different times. The corresponding implications to assurance should be established and agreed.

MAS Vessel particulars

2.11. The physical attributes of the MAS vessel comprising:

a. Length overall (m);

b. Maximum capable speed (knots);

c. Standard displacement deployed (loaded) or submersible deep displacement (kg / tonnes); and

d. Physical appearance to other mariners.

Autonomy:

2.12. Figure 2.1 should be used as a handrail to understand what supporting evidence should be presented at registration committee. The higher levels of control will require more evidence of safe operation and assurance to support the registration application. Lower levels of control and within Line of Sight (LoS) will require less.

Operational profile:

a. Role;

b. Geographical area and scope of operations, including environmental categories, Suitably Qualified and Experienced Personnel (SQEP);

c. Potential for interaction with first, second and third parties;

d. LoS / Beyond Line of Sight (BLoS) autonomous or remote operations;

e. Operated by itself or as part of any wider SOS (i.e., swarming/collaborative operations, integration, etc.);

f. Phases of operation (trials, training, operations, etc.); and

g. Degree of novelty/experimentation, technology readiness level (Commercial Off The Shelf (COTS)/Military Off The Shelf (MOTS)/Bespoke), mission complexity, etc.

Visual appearance (linked with Operational Profile):

a. Military role and/or other belligerent features; and

b. Flag status, to be considered in accordance with the guidance in the DMR Guide to Red, White and Blue Ensigns [Ref.4].

Hazard considerations:

a. Certification Requirements (Key Hazards, Other Statuary Certification requirements);

b. Software (Safety) integrity of control systems and sensor equipment and outputs, considered in accordance with NA&TG NAN 09.1/2020 – Software Integrity [Ref.24];

c. Payload (carriage of or deployment of people, weapon systems, cargo including Ordnance, Munitions and Explosives (OME) and/or dangerous goods, etc.); and

d. Security Aspects (sensitive communication/information; cyber threats).

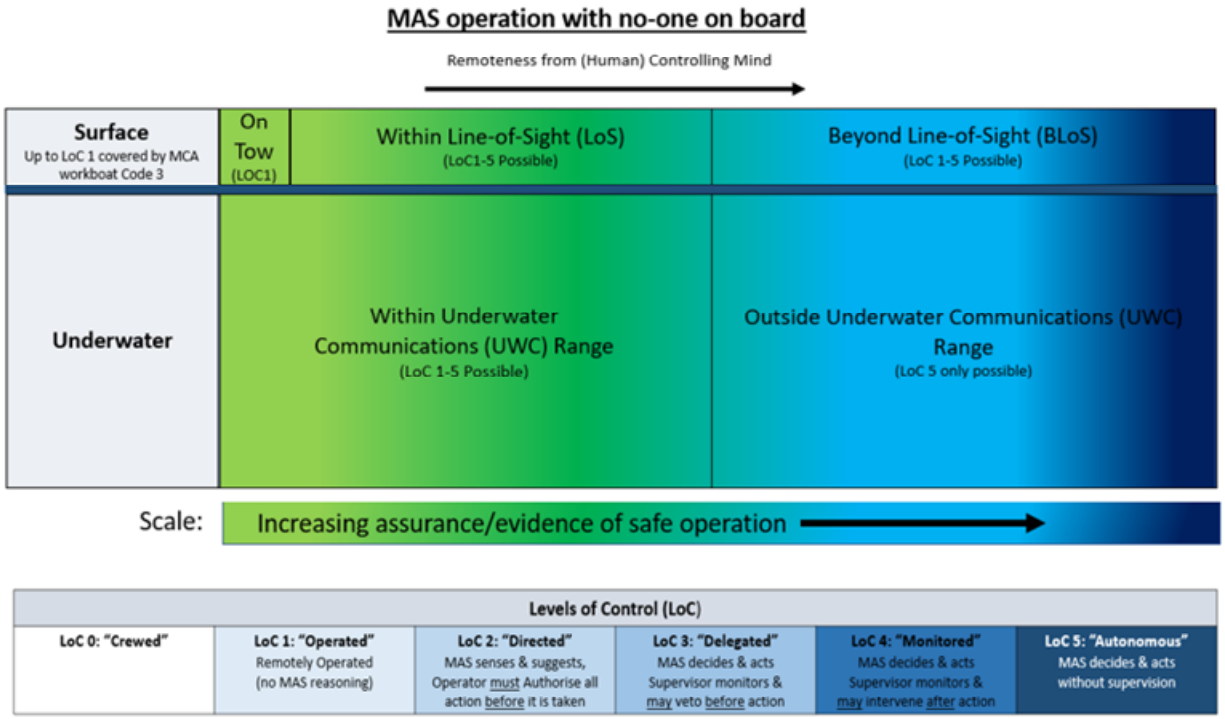

Figure 2.1 – Operation of MAS with no-one on board and corresponding LOCs and assurance required.

2.13. Figure 2.1 shows areas of operation for both Unmanned Surface Vessels (USV) and Unmanned Underwater Vessels (UUV). The table covers all possible LoCs for both type of craft. DMR anticipate that MOD operated MAS will mature and, in time, will move further up the LoCs and further from the controlling operator (if required). As this happens as part of the safety argument it is anticipated that those operating at greater range or with higher levels of autonomy will have greater levels of assurance and/or evidence of safe operation than at lower levels, or within visual range. The colour gradient (green to red) is used to visually represent the increasing assurance required when operating at greater range or with significantly reduced or no communication with the MAS.

2.14. The AP and PA should engage with the DMR to establish if registration on the DSR of a particular MAS is required, considering all criteria identified and any other pertinent risk factors. If initial registration is being sought, Figure 2.1 may be used as a guide to understand the body of evidence that the MAS is capable of being Safe to Operate and Operated Safely.

3: Assurance of MAS

Introduction

3.1. It is recognised that the risk posed by MAS will vary depending on a variety of factors and characteristics and that the means of achieving assurance for MAS should be proportionate to the risk. Part 3 of this MAS Guide provides:

a. An overview of the DMR and NA&TG Assurance Model for Maritime Autonomy and associated project requirements for full assurance.

Overview of the assurance model for maritime autonomy

3.2. Figure 3.1 is a flowchart presenting the Assurance Model for Maritime Autonomy, covering the process by which MAS vessels will be assured through NA&TG Certification and compliance with DSA02-DMR regulations. The model addresses both 'Safe to Operate' and 'Operate Safely' assurance aspects.

3.3. The model provides the key process stages and decision points that should be followed. Engagement by the PA/AP with DMR, the Navy Safety Centre (NSC) and NA&TG is highlighted at decision points, where advice and agreement should be sort on the appropriate route to full assurance.

The application of the threshold criteria, as addressed in Part 2, will be used in determining whether a MAS vessel will be entered on the DSR. The vessel particulars, as described in this Part of the MAS Guide, are then applied to determine the risk category (High (H)/Medium (M)/Low (L)) applicable to the MAS.

The risk category defined will inform the requirements for NA&TG Certification. Higher risk MAS H and M will require key hazard certification. Other key supporting documentation is Maritime Acquisition Publication (MAP) 01-151 Guidance for Certification of Maritime Autonomous Systems11.

3.4. Compliance with DSA02-DMR [Ref.1] will be assessed at baseline or risk-based audits. For organisations operating MAS, DMR will issue an Approval to Authorise MOD Shipping (AtAMS), if not already held. This will allow the MOD AP to authorise vessels that are listed on their AtAMS.

3.5. Figure 3.1 identifies key milestones in the introduction of MAS to the DSR:

a. Milestone A – An appropriate Subject Matter Expert (SME) should identify the requirements for a project and what type of MAS is required. At this stage of the project, DMR remain open to engagement to discuss the application of the regulations and what assurance may be required from the project team.

b. Milestone B – Once sufficient information has been gathered about the project, the requirements of the MAS, and how/where it will be operated, APs looking for registration are required to apply to attend the Committee to propose the registration of a vessel. The application will be discussed at the next registration committee, where it will formally be decided if the MAS is equipment or a vessel. The registration committee will be attended by project team SMEs, NA&TG, and the

[11] MAP 01-151 is in development at the time of issue of this version of the MAS Guide.

DMR registration team. A formal letter stating the class of MAS from DMR will be sent following the committee.

c. Milestone C – The requirement for NA&TG Key Hazard certification will also be clarified through the registration committee. Following on from this, the project team should engage with NA&TG to seek relevant certification.

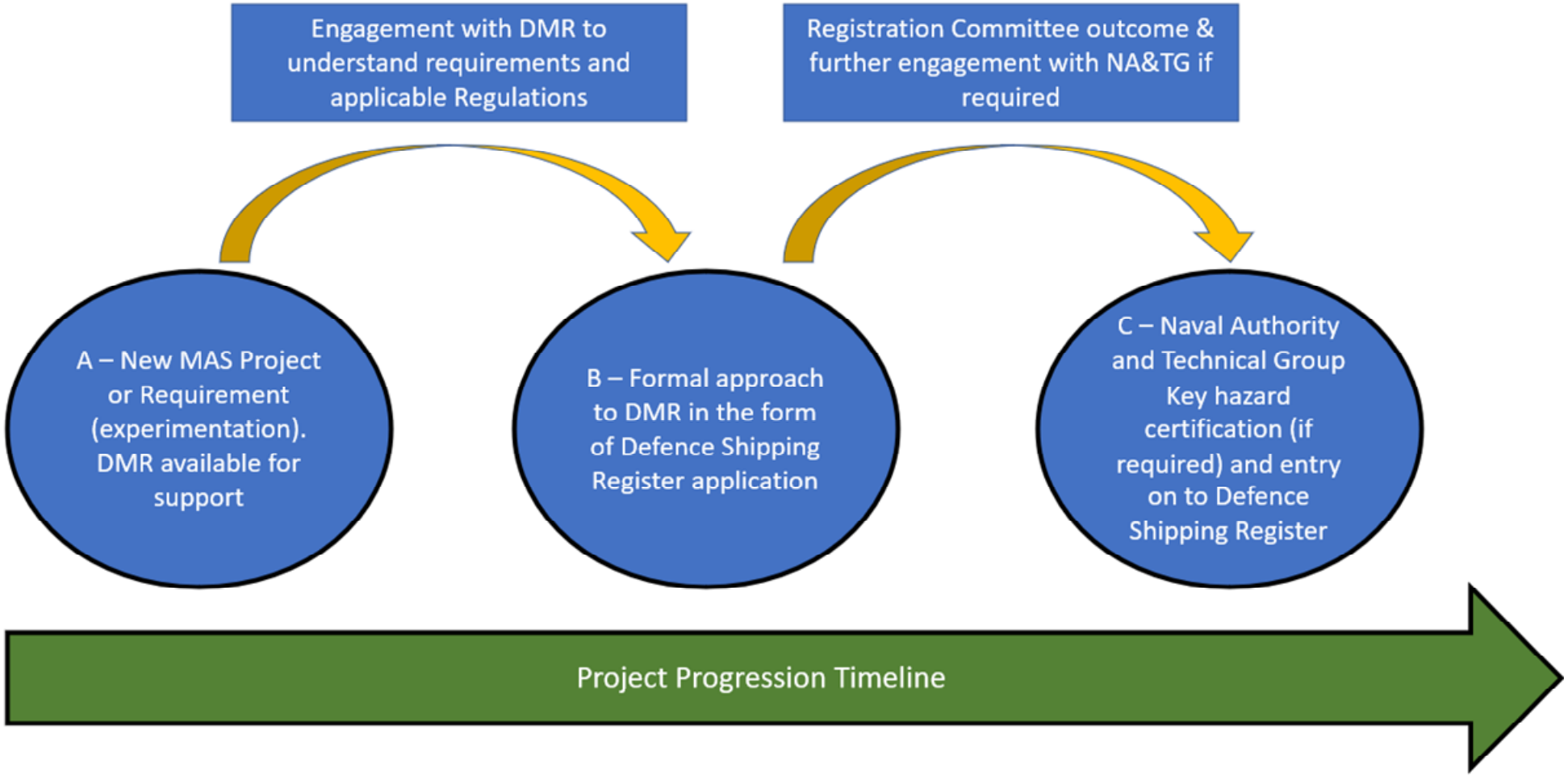

Figure 0.1 – Engagement model from concept to in-service/trials

4: Application of DSA02-DMR Defence Maritime Regulations for Health, Safety and Environmental Protection for MAS

4.1 DSA02-DMR [Ref.1] identifies that to prevent, eliminate and control hazards Defence Maritime activities adopt a systems approach to platforms, equipment, software, human systems integration, procedures, and training. This approach is applied to the governance of multiple systems as a 'system of systems'.

4.2 Applying the DSA02-DMR [Ref.1] regulations to each aspect of the MAS and building this up through a System of Systems Approach (SOSA) will provide the AP with the evidence they need to demonstrate that the MAS meets the requirements of these regulations.

5: MAS and the Maritime Legal Framework

Introduction

5.1 The DMR is authorised under the DSA Charter to produce Defence Maritime Regulations, and to assure and enforce them. The DMR regulates all Defence Maritime Activity, and can set regulations where Defence has Disapplications, Exemptions, or Derogations (DEDs) from legislation; hence, many of the regulations have been developed from applicable legislation. Further information can be found in DMR Regulations.

5.2 This Part of the MAS Guide provides an overview of relevant international and domestic legal provisions that apply to shipping. It also addresses MOD HS&EP policy that relates to the MOD's commitment to protect its employees under the Health and Safety At Work, etc. Act 1974 (HSAWA) [Ref.46]. It identifies the intent of those requirements and provides guidance on interpretation and application to MAS, including application of the equivalence principle.

5.3 The underlying principle is to avoid collisions and incidents at sea, injury and loss of life, and damage to the environment. APs are required to manage the applicable legal requirements for their Defence Maritime Activities, including any DEDs.

Principle of equivalence for MAS

5.4 The principle of equivalence will be applied to MAS where direct compliance with requirements for crewed shipping may not be possible due to the physical characteristics of MAS and its mode of operation. Equivalence requires an understanding of the ***intent*** of the legal requirement being addressed such that the solution for MAS can be demonstrated to meet that ***intent***.

5.5 To meet the principle of equivalence, MAS must be able to demonstrate that it meets the ***intent*** to a standard that is ***at least as good as*** that which would be expected for a conventional crewed vessel when complying with extant legislation and regulations. This may mean that a greater emphasis needs to be put on evaluation methods and the provision of other evidence to demonstrate that the MAS will behave in a predictable manner that is safe, and that all risks are managed to ALARP in reasonably foreseeable scenarios and hazards, and that environmental impacts are minimised. This will need to be demonstrated across the MAS's intended scope of operations and in any emergency scenarios that may be reasonably foreseen.

5.6 The application of the equivalence principle to MAS, where that equivalence will impact on the key hazard areas covered under NA&TG certification, will need to be documented and agreed with the NA&TG in the Certification Strategy for MAS. The NATG has produced a Naval Authority Notice that addresses the certification of MAS [Ref.5]. DSA03-DMR-Naval Authority Rules for Certification of MOD Shipping, Chapter 21, provides detailed requirements for certification of Autonomous Systems.

5.7 The MASS UK Industry Conduct Principles and Code of Practice [Ref.3] provides further guidance on the interpretation of equivalence for the maritime legal framework to civilian MAS vessels.

UNCLOS

5.8 The United Nations Convention of the Law of the Sea, 1982 (UNCLOS) [Ref.6] is the international legal framework within which maritime activities are governed. The principles enshrined within UNCLOS are implemented through a range of instruments that address safety at sea, facilitate trade among seafaring states, and protect the maritime environment. The IMO, as an agency of the United Nations (UN), is responsible for the implementation of those instruments.

5.9 UNCLOS [Ref.6] contains a number of provisions relevant to Defence operated MAS including the definition of the term 'Warship', and associated rights and privileges in relation to warships and government ships on non-commercial service. It also covers limits of state jurisdiction, rights of navigation and transit and, the duty to render assistance to vessels and persons in distress at sea.

5.10 As the principles in UNCLOS [Ref.6] are implemented through IMO conventions, this guide provides no further detail on the articles within UNCLOS in relation to the regulation of MAS, rather it describes the applicable IMO conventions and their incorporation into UK law.

COLREGs

5.11 The COLREGs [Ref.7] are published by IMO and codify elements of the wider legal obligation for the operation of a vessel with due regard to the observance of Good Seamanship. COLREGs [Ref.7] have legal status under UK law as enacted by The Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations, 1996 [Ref.8]. Crewed vessels comply with this and the same principle is applicable to Defence Shipping, including MAS. DMR's policy is that COLREGs [Ref.7] will apply to all MAS classified as vessels on the DSR. This can be achieved organically within the vessel or by the wider SOS. Equipment will be looked at on a case by case basis and evidence should be provided by the AP/PA to support a decision as to whether COLREGs will need to be complied with or not.

MARPOL

Intent

5.12 MARPOL [Ref.11] aims to minimise pollution from ships due to both accidental and/or operational reasons. Certification is required to demonstrate compliance to MARPOL [Ref.11] and is dependent upon the type of ship, gross tonnage, type of cargo, and if the ship is conducting domestic or international voyages. The responsibility for compliance with MARPOL [Ref.11] is vested in the owner, operator, master, and crew of a vessel. Responsibilities include maintenance of certification; operation in accordance with the certification and maintenance of appropriate records including environmental protection data.

Equivalence for MAS

5.13 It is, therefore, necessary to interpret the requirements for application to MAS where:

a. Systems are to be capable of identifying and reporting a pollution incident; and

b. It may not be possible to respond to own platform pollution.

5.14 The MAS may be dependent on wider SOS arrangements, where functionality supporting pollution incidents may be distributed or alternative means of compliance may be applied, such as host platform support.

5.15 The physical size, shape, and layout of the MAS vessel, as well as its intended operational role, may enhance the ability to prevent a pollution incident but where it constrains the ability to prevent pollution incident types, it may require consideration of exemptions to certain provisions of MARPOL [Ref.11].

SOLAS

Intent

5.16 SOLAS [Ref.15] is the international convention that is intended to protect life at sea. It obligates those setting requirements, ship designers, and builders to ensure that the vessel delivered is to a standard where it may be safely operated, and that the vessel owners, operators, master and crew also comply with defined standards allowing the vessel to be operated safely. It also places obligations on mariners to provide assistance to persons in distress whilst at sea.

5.17 The provisions in SOLAS [Ref.15] are intended to ensure that the risk of loss of the ship is minimised by preventing collision, allision[12], or grounding and that it may stay afloat in the event of an incident for a period of time that facilitates the safe egress of persons onboard, recovery of the ship, and may minimise the potential of pollution to the marine environment from loss of the ship.

Equivalence for MAS

Whilst naval and other government vessels have an exemption from SOLAS [Ref.15], all Defence shipping is to comply with its provisions with outcomes at least as good as those described in SOLAS [Ref.15]- related certification is required to be maintained against SOLAS [Ref.15].

Although an aspiration for MAS is to be operated with no persons onboard, noting the intent of SOLAS [Ref.15] is to minimise the risk associated with the operation of the ship, this is still relevant. Compliance, either directly or through equivalence, with certain provisions of SOLAS [Ref.15] mitigates risks inherent in collision, allision, or grounding.

5.18 Where a MAS is not, by virtue of its size, subject to comply with SOLAS [Ref.15], equivalent provisions for the safe construction and operation of vessels may be derived from other codes and is to have appropriate certification agreed with the NA&TG (see DSA02-DMR [Ref.1] Regulation 604). Of note are the following codes:

a. MCA Work Boat Code [Ref.10] - A Code of Practice for small workboats in commercial use to sea and all pilot boats;

b. MCA Marine Guidance Notice 280 [Ref.37] – Small vessels in commercial use for sport or pleasure, workboats, and pilot boats – alternative construction standards;

c. MCA Small Craft Codes (Brown / Yellow / Blue and Red) [Refs.38-41];

d. IMO Maritime Safety Committee (MSC) Circular 645 'Guidelines for Vessels with Dynamic Positioning Systems [Ref.42]; and

[12] The running of one ship upon another ship that is stationary.

e. IMO Resolution A.694(17) General Requirements for Shipborne Radio Equipment Forming Part of The Global Maritime Distress And Safety System (GMDSS) and for Electronic Navigational Aids [Ref.43].

5.19 A MAS that may embark one or more persons should comply with either the applicable elements of SOLAS [Ref.15] or an equivalent Code for non-SOLAS [Ref.15] vessels. In short, this means that if there is a reasonable expectation that humans will be carried in the vessel, even if not controlling it, then the provisions under SOLAS [Ref.15] and UK domestic law for life saving appliances apply and should be followed.

The obligation to render assistance at sea

5.20 The requirement to render assistance to persons in distress at sea under SOLAS [Ref.15] Chapter V Regulation 16, is an important but qualified international obligation.[13] The relevant obligation applies to masters of ships "in a position to be able to provide assistance". This qualification goes to both proximity and technical capability; the precise form or method of assistance is not specified. Therefore, the master or operator of a MAS will not be in breach of this obligation by virtue of the MAS's inability to take persons on board. The obligation would, however, require remote controllers of MAS once they are aware of an incident at sea, to inform appropriate authorities of persons discovered in distress and, in some cases, provide practical assistance by holding position to form a communications hub for oncoming search and rescue personnel.

5.21 It should be noted that the IMO has yet to produce instruction with regard to the responsibilities of MAS rendering lifesaving assistance. Pending IMO direction, the following advice is provided:

a. If humans are involved in operating the vessel in any way, then the UK's obligations to render assistance under UNCLOS [Ref.6] and SOLAS [Ref.15] must be followed, as far as is practicable given the capability of that vessel;

b. If an autonomous vessel is designed and built or operated by the MOD, the baseline assumption should be that the technology will need to be constantly reviewed with the obligations to render assistance in mind, pending further direction from the IMO.

Standards for Training and Watchkeeping (STCW)

Intent

[13] Although warships and government vessels on non-commercial service are exempt from Regulation 16, the treaty still asks that efforts are made to render assistance if possible. Further, as a matter of MOD policy, all MOD shipping is to follow the provision wherever practicable [Ref.4].

5.22 The intent of the International Convention on STCW for Seafarers is that the vessel may then be operated safely because the human element are SQEP, having met clearly defined training requirements, and will maintain safe watchkeeping practices.

Equivalence for MAS

5.23 This convention, as interpreted through DSA02-DMR [Ref.1] and appropriate Books of Reference (BRs), is applicable to all MOD shipping.

5.24 Where crew members are embarked in a vessel and have responsibilities for any aspect of the operation of that vessel, they should, irrespective of the degree of autonomy the MAS is operating under, be either STCW or equivalently qualified to conduct those duties.

5.25 Where operators are conducting duties as part of the MAS's wider SOS, such as operators in remote control centres, the MAS operator should consider the guidance contained within Chapter 13 (Operator Standards of Training, Qualifications, Competence and Watchkeeping) of the UK Industry Conduct Principles and Code of Practice [Ref.3].

5.26 The MOD, through the Operational Sea Training Authority certification scheme, will assure the competence of the crew/remote operator for individual MAS and any wider SOS arrangements.

ISPS Code

Intent

5.27 The intent of the ISPS Code and related provisions of SOLAS [Ref.15] is to ensure the protection of information on ship systems from theft or damage to the hardware, software, or information on them, and protection from disruption or manipulation of the data. Identifying how, where, and what impact compromised security could have on a MAS may include potential safety risks and/or environmental impacts.

Equivalence for MAS

5.28 Physical and cyber security requirements for Defence projects are defined in Joint Service Publication (JSP) 440 [Ref.23]. The NA&TG has developed specific and detailed requirements on the application of Software Integrity [Ref.24] to support certification, which includes requirements to consider the impact on key hazard areas for potential cyber security compromises.

5.29 Equivalence on the application of ISPS for MAS should consider:

a. Occasions where the security of the MAS could be compromised, whether operated remotely or autonomously;

b. Where technical requirements have considered protection from third-party interference, including regaining control or implementing shutdown of the MAS, whether operated remotely or autonomously;

c. Identification of possible threats (both physical and cyber) to the safety of the MAS, and security measures, procedures, and operations that can be implemented, whether operated remotely or autonomously;

d. The protection of sensors and control systems, whether operated remotely or autonomously; and

e. The MAS is part of a SOS, where functionality supporting security may be distributed or alternative means of compliance may be applied, such as host platform support.

IMO resolution MSC.428(98), cyber risk management

5.30 IMO resolution MSC.428(98) [Ref.25] adopted in 2017, established a clear intent that the regulatory requirements of the organisation for cyber risk management were embodied in the provisions of SOLAS [Ref.15] Chapter IX and the ISM Code [Ref.16]. This has been communicated to UK mariners through Marine Information Note (MIN) 647 (M) [Ref.6] as this is time limited information. The Workboat Code, Edition 3 details that cyber security measures put in place are proportionate to the size, complexity, and type of operation the vessel undertakes. It states the minimum requirement of cyber security that should be included into a MAS and provides several measures that must be undertaken by the owner/operator following a cyber-attack.

Intent

5.31 The intent of MIN 647(M) [Ref.26] is to advise of the need to incorporate Cyber Security within the management procedures for UK Registered Ships where required. It also advises other operators to whom UK registration does not apply (UK MOD) to recognise and address the risks associated with breaches in cyber security.

Equivalence for MAS

5.32 It is necessary to interpret the requirements of MSC.428(98) [Ref.25] for application to MAS where:

a. Through continuous improvement of safety management systems, cyber risks are to be considered;

b. The threat of a cyber-attack and its implications on the operation of the MAS are understood and managed, whether operated remotely or autonomously; and

c. The MAS is part of a SOS, the cyber risk is managed for the entire system of systems and where mitigations may be distributed or alternative means of compliance may be applied, such as host platform.

International convention on salvage

5.33 The IMO International Convention on Salvage [Ref.7] sets out how salvage is to be managed and has legal status under UK law as enacted by the MSA95 [Ref.12]. Following the ratification of this convention, the IMO Nairobi International Convention on the Removal of Wrecks, 2007 [Ref.8] placed additional requirements on States to manage wrecks that pose a threat to shipping or the environment.

Intent

5.34 MSA95 [Ref.12] provides the rules by which UK mariners may conduct and make claims against salvage.

5.35 The Convention on the Removal of Wrecks, 2007 [Ref.28] intends to ensure that any wrecks do not pose a risk to other shipping and where they may pose a threat to shipping or the environment they are dealt with suitably.

Equivalence for MAS

5.36 The MOD retains a high readiness Salvage & Marine Operations Team (SALMO) to undertake the salvage and/or recovery of all MOD property requiring salvage services in the maritime environment. When one of His Majesty's ships or vessels, including those chartered by the MOD or carrying MOD cargo, requires salvage assistance, the nearest available Navy salvage resources are to be used whenever possible. Commercial or private assistance is to be accepted only in emergency when Navy resources are not available or cannot be contracted in by SALMO within a safe time frame. Thus, the person fulfilling the function of the Master/Commanding Officer should avoid signing a Lloyds Open Form (LOF) for salvage services unless it is deemed that failure to do so would lead to the loss of the platform or loss of life.

5.37 Consideration should be given to how MAS meets the requirements, whether operated remotely or autonomously, to be identified as UK MOD Shipping on the Defence Shipping Register.

5.38 BR 2 Chapter 46 [Ref.44] sets out the requirements by which the UK MOD may accept salvage assistance or offer salvage services[14]. DSA02-DMR [Ref.1] Regulation 620, details the MOD regulation that enables UK MOD Shipping to meet the intent of the Convention on the Removal of Wrecks, 2007 [Ref.28].

[14] Pending legal advice as to whether an unresponsive MAS vessel is equipment or a vessel from a salvage perspective.

Health and safety at work

5.39 The HSAWA [Ref.45] is a primary piece of legislation and applies to Defence Maritime activity as a matter of policy within the 12 nautical miles' territorial limit of the UK. It is also applied as a matter of policy, where possible, to MOD vessels operating overseas. Health and safety at work is managed in the UK through The Workplace (Health, Safety and Welfare) Regulations, 1992 [Ref.29] and its Sister Rule, the Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations, 1997 [Ref.30][15].

Intent

5.40 The intent of this legislation is to detail the responsibilities of employers and employees in ensuring the health and safety of all persons involved in or impacted by their activities.

Equivalence for MAS

5.41 The Workplace (Health, Safety and Welfare) Regulations, 1992 [Ref.29] and its Sister Rule apply to all employers and employees. It is necessary to interpret these Acts for application to MAS where:

a. The Workplace (Health, Safety and Welfare) Regulations, 1992 [Ref.29] apply to the persons working in a land-based ROC; and

b. The MAS is part of any wider SOS arrangements, and health and safety at work is managed by the entire system of systems and where mitigations may be distributed or alternative means of compliance may be applied, such as host platform.

5.42 JSP 375 [Ref.31] is the MOD corporate publication that provides guidance to Defence in meeting its legal health and safety obligations. DSA02-DMR [Ref.1] provides the regulatory framework to implement MOD regulations deriving from the Health and Safety at Work regulations for MOD Shipping.

[15] These regulations do not apply to warships or government vessels on non-commercial service.

6: References

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2. DSA03-DMR-SHIPPING, Regulatory Terms for DSA02-DMR Defence Maritime Regulations
3. MASS UK Industry Conduct Principles and Code of Practice
4. Secretary of State for Defence Policy statement on Health, Safety and Environmental Protection
5. Naval Authority Notice (NAN) 08.1 / 2020 – Naval Authority Requirements for the Certification of Maritime Autonomous Surface Ships
6. United Nations Convention on the Law of the Sea, United Nations, 1982
7. The International Regulations for Preventing Collisions at Sea, 1972 – as amended (in 1981, 1987, 1989, 1993, 2001, 2007 and 2013)
8. The Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations of 1996
9. Marine Guidance Notice 599 – Pleasure Vessels – Regulations and Exemptions – Guidance and Best Practice
10. Workboat Code Edition 3.
11. International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978
12. Merchant Shipping Act 1995
13. Merchant Shipping (Pollution) Act 2006
14. Merchant Shipping (Prevention of Air Pollution from Ships) and Motor Fuel (Composition and Content) (Amendment) Regulations 2014
15. International Convention for the Safety of Life at Sea (SOLAS), 1974
16. International Safety Management (ISM) Code
17. Safety for High-Speed Craft (HSC Code)
18. The International Code for Ships Operating in Polar Waters (Polar Code)
19. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978
20. Merchant Shipping (Training and Certification) Regulations 1997;
21. The Merchant Shipping (Safe Manning, Hours of Work and Watchkeeping) Regulations 1997
22. International Ship and Port Facility Security Code (ISPS Code)
23. JSP 440 Defence Manual of Security
24. NAN 09.1/2020 – Software Integrity
25. Resolution MSC.428(98) - Maritime Cyber Risk Management in Safety Management Systems
26. MIN 647 Incorporation of Cyber Security measures within Safety Management Systems
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28. The Nairobi International Convention on the Removal of Wrecks, 2007
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30. The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997
31. JSP 375 Management of Health and Safety in Defence
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34. A Guide to Red, White and Blue Ensigns, DMR, 1 October 2019
35. Outcome of the Regulatory Scoping Exercise for the Use Of Maritime Autonomous Surface Ships (MASS), IMO, MSC.1/Circ.1638, 3 June 2021
36. NGM 664 (M+F) Certification Process for Vessels Using Innovative Technology
37. MCA Marine Guidance Notice 280 – Small vessels in commercial use for sport or pleasure, workboats, and pilot boats
38. MCA Small Craft Code – Brown Code
39. MCA Small Craft Code – Yellow Code
40. MCA Small Craft Code – Blue Code
41. MCA Small Craft Code – Red Code
42. IMO MSC Circular 645 'Guidelines for Vessels with Dynamic Positioning Systems
43. IMO Resolution A.694(17) General Requirements for Shipborne Radio Equipment Forming Part of The Global Maritime Distress And Safety System (GMDSS) and for Electronic Navigational Aids
44. BR 2 Chapter 46
45. Health and Safety At Work, etc. Act 1974
46. EXTAC 103 MARITIME UNMANNED SYSTEMS TERMINOLOGY AND TAXONOMY