

AUTONOMOUS SHIPS MASRWG CONFERENCE

- 1 ASHOK MAHAPATRA. Talked about IMO role and trying to reduce the adverse effects of ships to the environment and safety of people. Rapid changes in Technology and in particular man/machine interfaces. Mariners don't like change and can cause acrimony. Proceeding at a very fast pace and needs a Code of Conduct and stressed role of IMO and failing in his duty if he did not mentions the challenges MAS will face.
 - a. Protect the Marine environment –
 - b. What is the definition and have a common understanding of what it means.
 - c. Mentioned E-Nav that turned out to be not about Nav, but all about big Data etc.
 - d. Stressed they are not like Air drones, but will be stuck at sea
 - e. Construction will be mechanised whether manned or not and therefore breakdowns. How to deal with this without manpower and regular maintenance.
 - f. COLREGS. Will present challenges for the prevention of collision at sea. Went back to how they were different in different parts of the world. Nav marks not standardised etc. Advent of steam power meant there had to be regulations to add to those of the Sailing vessels. 1840 TH London drew up a set of rules to incorporate both. These led to the Common understand of COLREGS. IMO in 1972 – 1977. Introduced TSS in Dover. With Tecj advances of unmanned surface craft we need to have a review to see if they are fit for purpose to avoid collisions. Will be required to be directed by specialised people whether manned or unmanned. Convention is based on competences – 7 and are essential for vessels safe operations. Also for vessels conduction Special Operations. Therefore need to eb=nsure MAS can operate to the same level.
 - g. Comms are an issue and need bandwidth and own Freq
 - h. Reg 113 when a nation wants to do a trial on a particular type of vessel it informs nations 6 months in advance. If a country objects the trial cannot take place in that country.
 - i. Liability and Insurance needs to be considered
 - j. How do they respond to SAR Request.
 - k. Significant challemgnes that need to be addressed and shipping being a global business needs common rules and terminology. Role of IMO and that MAS people need to continue liaison with IMO to hel and overcome the challenges.

Professor Hendrik Ringbottom Future Legal benefits from unmanned Surface Vessels

1. Problem with the words "future legal benefits" – for whom
 - a. Real benefit is for MAS to be integrated into the current legal system
 - b. Benefits in comparison to manned ships – different implications in different fields of law. Are legal benefits for USV desirable eg COLREGS, Liability etc
1. Current Legal Challenges.
 - a. Law of the Sea
 - b. Technical Rules (IMO)
 - c. Private Maritime Law
 - i. Liability rules (tort/contract)
 - ii. Others
 - d.
 - e. UNCLOS -f they are Vessels in the Law of the Sea Convention then MAS will automatically be incorporated as no different as do not refer to crew.
 - i. See Art 94.3.b for Flag states and that ships should be manned by Master and Officers
 - f. IMO Technical Law different as refer to manned and laid down in the form of functions to be performed. SOLAS has Exemptions equivalences. V/14 Safe Manning.
 - i. STCW – no personnel onboard!
 - ii. COLREGS – Lookout R5 easy, but R2 Decision Making (nothing in these rules etc)
 - g. Practical Issues (documentation, PSC, Pilotage etc)
 - h. National Law –Port states can refuse entry
 - i. Private Maritime Law – who is liable. Usual starting point is shipowner. Broad range of helpers are covered. For what acts/omissions is liability triggered –
 - i. What is fault in an automated issue
 - j. What are the benefits
 - i. Traceability(proof)
 - ii. No contradictory statements or lies to save own skin
 - iii. No emotional decisions, hidden motives, little discretion in decision making
 - k.

2. The Future is Large USVs – Eshan Rajabally. Engineering Consultant
 - a. RR White Paper needs reading.
AAVA – redefining shipping supports development of remote controlled and autonomous shipping and will enable proof of concept demonstration.
 - b. Technology, Safety and security, Societal and legal acceptance and economy and Business Models.
 - c. 2 companies already brought in 1 RORO Ferry and a Bulk Operator
 - d. Remote Control with Operator and Autonomous with none, but many scales of autonomy with scales of manning
 - e. Level autonomy will be different for different parts of the passage and the level of risk – congestion etc. Leave under supervisory Control mode from a remote Control Room allowing direct intervention as required. Once out of close navigational constrained waters it then goes into remote monitoring mode Autonomous evade – presently working on algorithms that fit current regulations. Operator could take over if needed. Very congested waters it will go into Autonomous Pan Pan Mode. In deepsea Autonomous normal mode and then back into pilotage waters to get back into port.
 - f. A Lot of concepts at this stage

3. Creating the right conditions for growing the MAS Industry. John Murray.CEO of Matic Maritime Industries.
 - a. Maritime Culture is an issue.
 - b. Need to get copy of his slides but market is Offshore renewable, oil and gas, logistic transport, science and survey, military(Maritime security etc
 - c. Innovate UK and defence S&T Lab have invested £5M in Rand D projects
 - d. MAS currently total £200M sector with Europe the strongest area of business
 - e. Barriers – price of oil, finance cashflow, lack of funds etc. Skills shortage
 - f. Raising the profile of MAS can be seen in the MAS/1 Annual Review 2016.
 - g. Unmanned Warrior 2016, House of Lords Inquiry into Autonomous Vehicles, including Maritime, UK Govt discussion Paper on Industrial strategy by end of Nov , international Conference on business of MAS and Ocean Business on 6 Apr 2016 and LISW Conference on 14 Sep 2017 – Need to get to this.
 - h.

4. A Framework for UMS Certification incorporating the Human Element. Tim Kent. Technical Director Marine and Offshore Lloyds Register.
- a. How Manned Vessels are regulated – Conventions at IMO to Class Rules, National International Codes and Standards. The Applicability is all about how big, where what type and operated by competent crew but does not define what competent is. There is an implicit description of how it should operate.
 - b. For Unmanned we need to look at the Risk to decide how this will affect these vessels. Regulatory safety framework is paramount and therefore Safe Design (Design Code for UMS), cannot damage the environment (MARPOL) and safe operation (UK MIA MASRWF Code of Practice, and needs to take account of Risk Based Assessment, but this would be the same for all nations).
 - c. Design Code applicable to all UMS above and below the water and cover the whole gambit of all area of a ship eg structures, stability, control systems, electrical, engineering etc
 - d. It is not a prescriptive set of rules, but a framework taking into account of what is in place for manned vessels so as to promote good practice and not constrain design through prescription. ShipRight – Design and Construction Oct 2016. Goal based standards. Each Chapter has Tier 1 Goal for the chapter, Tier 2 – Functional Objectives and tier 3 Performance requirements. Where possible it looks to the Class Rules.
 - e. Risk Based Assessment – Technical Qualification Process which is the key part of the application of the design Process. Process for assurance of novel technologies for which nothing presently exists.
 - f. EG for a Cyber Enabled System there are Six Key Risk Areas – Human – System considerations, network and communications, software, data assurance, configuration Management and cyber security.
 - g. The Human element within the design code, the Human appears all over the Autonomous system. Currently there is not a chapter on the Human in the Code, so it is now being produced and will look at,
 - i. Is the role of people in the system feasible
 - ii. Are the interfaces useable
 - iii. Will the required level of human performance be sustainable will the organisation support the business objectives for the system.
 - h.

5. The Legal Viewpoint – Professor Erik Van Hooydonk. Professor Antwerp University and partner Erik Van Hooydonk Lawyers.
 - a. Autonomous Ships will not bring about a revolution in Maritime Law.
 - b. Over the years of Maritime Law they have stayed very much the same from 17th Century through the sail and steam era but there was change during the 2 World Wars but then passed to the IMO and since then little change.
 - c. The maritime world is used to changes as we now see to 20,000 TEU ships etc.
 - d. Unmanned shipping will be no different. Status of legal research.
 - i. Unmanned Vehicles (UMVs)
 - ii. EU Project Munin 12,c
 - iii. Paper in Journal of International Maritime Law (2014) 20
 - e. Working on a Draft Belgian Shipping Code, basis for derogations from safety and manning requirements and clarification of other issues.
 - f. Flemish Pilot Project on Unmanned Inland Navigation – EU Funded RAVEN Project. Includes an Inventory of legal obstacles for unmanned – manning, dangerous goods, nautical regs etc
 - g. Regulatory issues – Is it still a ship – Yes as they fit into all these
 - i. No uniform definition
 - ii. UN Law of the Sea Convention
 - iii. Public Law Conventions
 - iv. Private Law Conventions
 - v. National Laws and regulations
 - h. Does not affect the jurisdiction of the Flag State and the manning can be virtual instead of a genuine link, but where is the position of the Shore Based Controller.
 - i. The Captain – will become a romantic memory and the end of the Captain's Law
 - j. The shore based controller is not a seafarer (definition under STCW) and seafarer law is not relevant but they will assume huge responsibilities. COLREGS will need to be applied with, but what about the reporting of Duties and existing Port State Control duties and Inspections etc.
 - k. Ship Documentation and Voyage Data Recorders how will this be done
 - l. Passenger Transportation – Captain has the responsibility of maintaining order.
 - m. What about the on bridge team if they come onboard and the role of the Pilot may disappear eventually but local nautical knowledge will be required.
 - n. What is the role of VTS and Harbour Master and the Tug.
 - o. the stowaway, the pirate and terrorist will not be affected!
 - p. Phantom Contracts and Phantom Liability etc
 - i. Responsibility and the Path of Control
 - ii. The Charter Party
 - iii. Etc none will have any significant issue and will remain the same but will have an affect on Ship/Crew Management.

6. Skills for the Safe Operation of USVs – Dr Bev Mackenzie and Glenys Jackson, Tech and Policy Director at IMarEST and Head of Merchant Navy Training Board.
 - a. Competency Framework – a mixture of skills, experience and attitude
 - b. Aviation Sector has found that this is the best route to go rather than a pure Qualification system. These have Core Competencies and Optional Competencies and these will show where the person sits in a table on the level of their ability in each of these thereby giving an overall picture of what that particular person can do and can be applied to MAS.

7. A perspective from the Shipping Industry – John Murray, Director of Marine at the International Chamber of Shipping.
 - a. Manned ships will remain into the foreseeable future and they do not see a fast change. Stated the costs for the current ships and change in regulations like the Ballast Water etc will cost Billions worldwide.
 - b. Stated the position that it will be a more gradual change and a move to SMART, semi – autonomous to then full autonomous many years ahead.
 - c. Stated his concern about some of the issues found from the aviation industry and autonomy and MAS must learn from this. Reliance on automation leads to skill fade.
 - d. Was very negative over the technology being produced by Industry.
 - e. Supports International Regulation and not Regional Regulation.
 - f. ICS want to put road blocks in the way. There must be a formal safety Assessment. In favour of Autonomy at various levels but primarily smarter semiautonomous ships.

8. Autonomy v the Human – Commodore Jim Scorer, Sec Gen IFSMA.

9. Insurance for MAS – Andrew Higgs, Marine Legal Risk Management Consultant
 - a. Need to pen An open letter of reply to Michael Grey MBEs article "Keep it Simple."
 - b. MAS is a relatively small market at the moment but as long as it keeps to territorial or Coastal waters is making it Insurable. Offshore would be a different issue.
 - c. Military Autonomous vessels are self-insured and immune from other Flag State Control. Or Autonomous vessels going offshore are a very long way off.
 - d. Big issue for the Insurance people is definitions of Ships/Vessels and that for Autonomous ships to be capable of being called a ship is that it has to be capable for being manned unless it has specific dispensation from a state or states.

10. Code of Practice – Andy Higgins, Quinetic
 - a. Very much in draft form and being produced by the MASRWG which IFSMA is a member of to keep an eye on it and influence how it fits in with present COLREGS and Codes etc.
 - b. Code of Conduct was published in Mar 2016 and was full of good intent but little practical help. Code of Practice can only be achieved through an accredited set of procedures and standards that demonstrate that:
 - i. Thorough understanding of Requirements
 - ii. Comprehensive understanding and mitigation of hazards and risks
 - iii. Clear and robust solutions to mitigate risk
 - iv. Universally understood best practices
 - v. Proportional requirements given characteristics of vessels and proposed operations
 - c. They will look like the equivalence of IMO Instruments and National Statutes so that it reassures other Maritime Stakeholders.
 - d. The new Code will also look like existing codes such as the Large Yacht Code LY3 Code from Royal Yachting Association, The Hovercraft Code (CoP23), Workboat Code (MGN280) and best Practice Guide – SARUMS.
 - e. Code will be compatible with IACCS Goal Based Standards
 - f. As soon as it has been drafted it will be critiqued around the Maritime Industry.

THE INTERNATIONAL PERSPECTIVE

11. Key Note Speaker – Sir Alan Massey, CEO UK Maritime and Coastguard Agency
 - a. MAS has huge potential across the industry.
 - b. MCA has been directed by the Department of Transport to go ahead and look at Regulatory and Safety requirements and keep up the momentum
 - c. Difficulty in finding funds to take this on properly
 - d. Raised the lack of communications bandwidth.
 - e. How do we fit MAS into the complex and congested Maritime environment.
 - f. What policies and rules should we put in place to reduce the risk, safety and environmental issues.
 - i. Sensibly assess the risk
 - ii. Put pragmatic in how we develop rules
 - iii. Avoid unnecessary complexity
 - iv. Do it in conjunction with the Industry
 - g. Looking forward to seeing the first Draft Code of Practice
 - h. Goal Based Design code with 6 different levels of Autonomous Ships
 - i. How the MAS fit into the COLREGs
 - j. MAS at the moment are typically small and being used for scientific purpose and therefore a light touch regulation is being used, but there needs to be a much tougher structure in place to cope with bigger vehicle in both the coastal water. International Codes will need to be in place to cope with the offshore element.
 - k. Training of people involved – need to have the structure in place

- l. MASRWG introduced the issue into the IMO at MSC 96 and this will continue as Ashot Mahapatra came to open the Conference and it may be on the Agenda for MSC 98.
- m. Need to start the dialogue with the MCA now and tell them what they need to do to help ease the process

12. Autonomous ship and COLREGS – Professor Zhang Renping – Director International Maritime Convention Research Centre, Dalian Maritime University, China

- a. Autonomous Ship update in china
 - i. Chinese have been working on an automatic collision avoidance simulator since 2002.
- b. China Class Soc have Rules for Autonomous Ships and entered into force March 2016 and cover Ships Hull to cargo management. However, it does not really cover autonomous ships, but Smart manned ships.
- c. R&D for Autonomous ships is going on in Energy efficiency, Remote control and Fault diagnosis on line.
- d. First construction for Autonomous is a 38,800 Bulk Carrier was constructed by CSSC in Sep 2016. Called I-Dolphin and will be delivered next year. Investigation has revealed it is a SMART Ship and not Autonomous
- e. Nations involved in MAS is Denmark, Norway, Finland, Sweden, China, Korea, UK , USA
- f. Challenges will be the legal regime and standards to regulate MADS, Traffic environment for safe operation of MAS schemes Monitoring of MAS.
- g. Rules for preventing the collision between MAS and manned ships, Unified standard performance of autonomous ship system developed by different countries and companies.
- h. Need to think about the Human element in remote control, navigation, pilotage, berthing and unberthing, and traffic separation.
- i. What do we do with COLREGS
 - i. His view is that they need a complete revamp to take account of MAS so a full review should be done. China are looking at this and are going to submit a proposal to IMO MSC 98.

13. Towards the Establishment of USV Regulation in Korea – Dr Sun Young Kim Korean Research Institute of ships and ocean Engineering, Dr Yeon Min Kwak, Korean Register, Prof Jung Sik Jeong, Mokpo National Maritime University.

- a. Korean government expect rapid growth in this area of MAS and have concerns about safety and the use by private individuals
- b. Need to develop terminology have not yet got a test bed,
- c. Very much at the beginning of their journey and have very little in place at the moment. And are constructing a Development Programme for 2016 – 2020 which will look at R&D, facility, construction of MAS, Communications and regulations.
- d. Military have surveillance ships for development in MAS

e.

14. UMS Safety and Regulation – Magnus Ornfelt, Chairman, Safety and Regulations for European Unmanned Maritime Systems (SARUMS)

- a. Umbrella org for MAS and supported by European Defence Agency(EDA)
- b. Have been developing MAS regulation since 2010 and produced Best Practice Guidance in 2015.
- c. Producing a Best Practice Guidance for Design and Operation and cooperating with the UK MASRWG to develop.
- d. Producing a MAS Sense and Avoid Policy
- e. Definitions are still under discussion.
- f. Denmark are planning for MAS in the future.
- g. Finland hope to have MAS Cargo ships running in the Baltic by 2020
- h. Norway working on an Autonomous ship in Coastal Waters
- i. Sweden holding a Conference 5-6 Dec 2016

15. USVs in the USA – Regulators Perspective – George Detweiler, Marine Transport Specialist, Navigation Standards Division, Office of Navigation Systems US Coast Guard

- a. Need to have International definitions for categories of MAS
- b. Navigation Safety Advisory Council (NAVSAC) will be looking at giving advice to MAS in US. Started working with US Military on this in 2008.
- c. Produced rules for Unmanned Surface Vessels in 2011 (11-02)
- d. 2013 agreed to develop Best Practice Guide.
- e. 2015 Best Practice delivered to NAVSAC for consideration
- f. 2016 BP approved by NAVSAC and now being turned into Navigation Vessel Inspection Circular (NVIC) similar to MGN which will provide policy concerning MAS by USCG and finalising Best Practice Guide.
- g. USCG looking at developing a detailed IMO proposal to include actual wording of amendments, MAS Lighting requirements, protect the Mariner and Environment and don't want to over regulate
- h. They are going to pursue potential changes to the COLREGs

16. MAS and COLREGs, an Industry perspective – Rand D LeBouvier, Chair of Association for unmanned systems International (AUVSI) COLREGs Subcommittee.

- a. The current COLREGs as they are, work and really do not need change. Industry should comply. Any change should be minimal to recognise MAS.
- b. AUVSI will take other the best of other Nations Best Practice and endorse them.
- c. Agreed strongly with IFSMA presentation in that as MAS develops there will be lots of jobs in the industry for mariners.
- d. Need clear and common definitions.
- e. Need to have certification

17. Who/What is CMI. Unification of International Maritime Law required amends. Coordinating. Formed at end of 19th C and did most of the drafting of current Conventions and are represented on the IMO Legal Committee. Talking to all other Nations to get their feedback on UMS/MAS to assess what needs to be done with the Conventions and Regulations.

18. There followed a Panel Discussion that covered many aspects of Autonomy and the day's presentations. Key points raised were:

- a. How do you replicate the important role of seamanship from remote operation ashore. How do you teach those skills and not lose them.
- b. **The UK proposed the setting up of a Correspondence Group, coordinated by the IAIN and IMrEST, to coordinate the work needed for input into the IMO.** I agreed that this is a very good idea but that any recommendations for change to Conventions Codes etc need to be kept as simple as possible and based on the understanding that the Autonomous ships must fit into the current regulations Conventions, Codes etc and resist trying to make major changes. If they do not follow this, when it gets onto the Agenda at MSC etc, it has the likelihood of clogging up much of the work that needs to be done in the IMO as it will be very difficult to build consensus. It could take a lot of IMO time which would be bad for the Industry. International Chamber of Shipping(ICS) agreed with my view. In addition, ICS stated that they would need to put forward a good case as to what the benefits to the shipping industry would be and sell it to the IMO.
 - i.