



**U.S. MARITIME LAW ASSOCIATION
JOINT MEETING OF THE COMMITTEES ON REGULATION OF
VESSEL OPERATIONS, SAFETY, SECURITY AND NAVIGATION
AND GOVERNMENT COUNSEL
30 OCTOBER 2020**

AUTONOMOUS SHIPS: NEW DEVELOPMENTS AND ISSUES

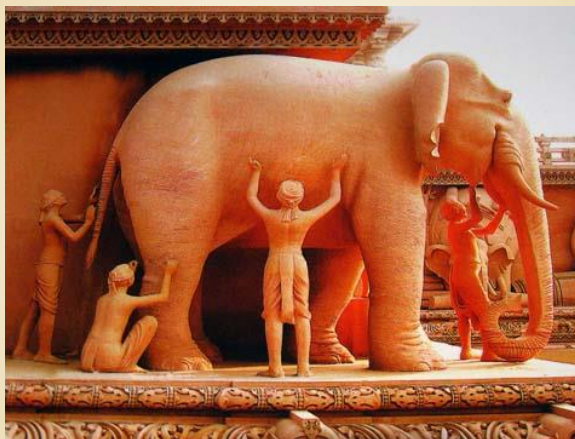


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**“UNMANNED” AND “AUTONOMOUS” VEHICLES
THE DEFINITIONS WILL MATTER**



The Blind Men and the Elephant Fable,
Ancient Buddhist text *Udana* 6.4 (ca. 1,000 BCE).



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**UMV ADVOCATES UNDERSTAND HOW INCREMENTALISM WORKS.
WALK AUTONOMOUS SHIPS IN ONE STEP AT A TIME.**

The Windowless "Bridge"



MASTER AND CREW ARE IN A "VIRTUAL BRIDGE" CONTAINER IN THE STERN
IN THE NEXT STEP, THE CONTAINER WILL BE "MOVED" TO A SHORESIDE CENTER

[HTTPS://WWW.YOUTUBE.COM/WATCH?V=ZUXS0FDIII0](https://www.youtube.com/watch?v=ZUXS0FDIII0)

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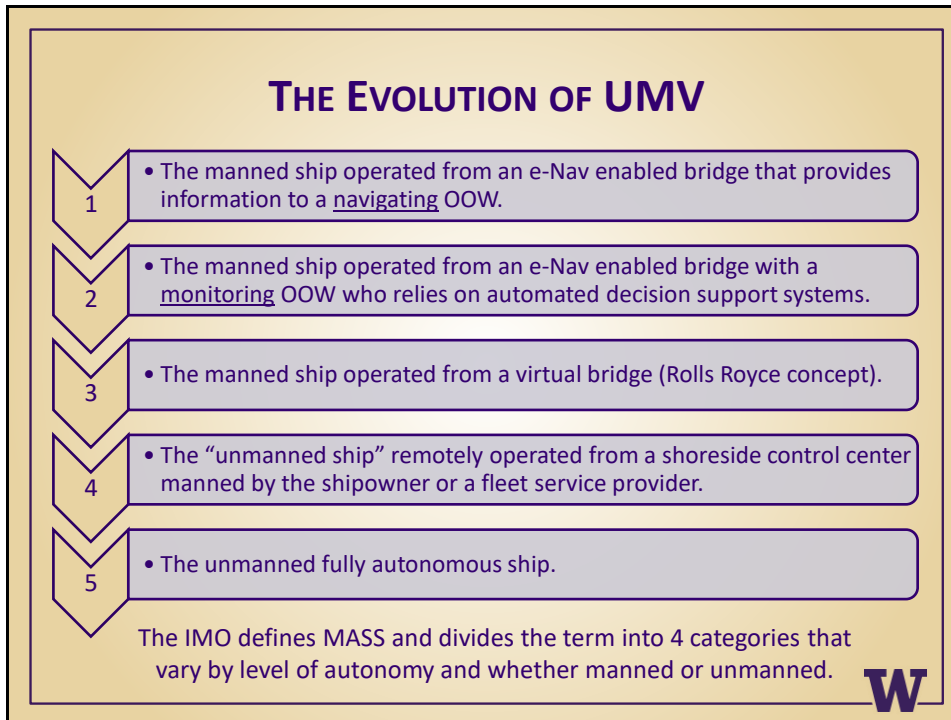
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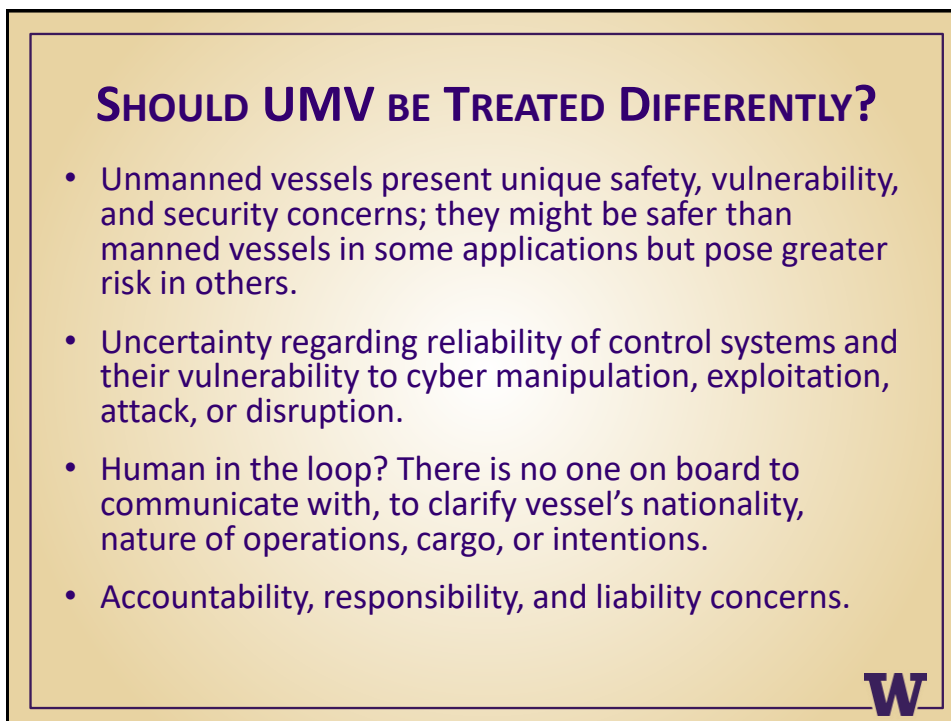
THE REMOTE OPERATIONS CENTER. SOURCE: ROLLS-ROYCE PLC
THE WINDOWLESS "BRIDGE-AT-THE STERN" MOVES ASHORE
THERE MAY OR MAY NOT BE ANY MARINERS ABOARD THE VESSEL.

**Our faith in software-driven systems was
badly shaken by 737-Max disasters.**

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SCOPING

- UNCLOS Issues (navigation rights, “master”).
- SOLAS/MARPOL/STCW/MLC Issues.
- COLREGS Issues:
 - Rule 2: Good Seamanship/Special Circumstances
 - Rule 3: Definitions
 - Rule 5: Look-out
 - Rule 7: Risk of Collision (undefined)
 - Rule 9: Narrow Channels (undefined)
 - Rule 10: Catalyst for Positive Shoreside Control?
 - Rule 11: Vessels “In Sight”: The key to B-II or B-III rules.
 - Rule 19: Restricted Visibility (rules on lights/sound signals)



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RESULTS OF CMI SURVEY

Question: Do you foresee any problems in treating unmanned ships as “vessels” or “ships” under the Law of the Sea in your jurisdiction (i.e., such that such ships would be subject to the same rights and duties such as freedom of navigation, rights of passage, rights of coastal and port states to intervene, and duties of flag states) in the same way as corresponding manned ships are treated?

| State | Answer |
|-----------------|---|
| Canada | Not insofar as Canadian law applies |
| China | No (i.e., China foresees no problems) |
| Denmark | Some questions would need to be addressed. |
| Japan | Japanese law seems to imply a master will be aboard |
| Netherlands | We see no major problems |
| United Kingdom* | “An absence of clarity” in UNCLOS |

* See the CMI “Work” page for Maritime Law for reports on MASS.



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IMO REGULATORY SCOPING EXERCISE (RSE): MARITIME AUTONOMOUS SURFACE SHIPS

- In the first step of the RSE, relevant IMO committees will identify IMO instruments that:
 1. Apply to MASS and, as currently drafted, prevent MASS operations;
 2. Apply to MASS, do not prevent MASS operations, and require no action;
 3. Apply to MASS, do not prevent MASS operations, but may need to be amended or clarified, and/or may contain gaps;
 4. Have no application to MASS operations

The IMO's Maritime Safety, Facilitation, and Legal Committees are now engaged in the RSE for the instruments within their remit. Reports on Step 2 RSE/Gap Analysis will be reviewed in late 2020.



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IMO INTERIM GUIDANCE ON MASS TRIALS (2019)

- Maritime Autonomous Surface Ship (MASS) trials should be conducted in a manner that provides at least the same degree of safety, security and protection of the environment as provided by the relevant instruments.
- Risks associated with the trials should be appropriately identified and measures to reduce the risks, to as low as reasonably practicable and acceptable, should be put in place.

Michigan Tech's Great Lakes Research Center has established test sites.



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IMO'S FOUR MASS DEGREES OF AUTONOMY

- MASS: a vessel that is capable of being operated without a human on board in charge and which has alternative control arrangements available.
- The IMO divides MASS into 4 degrees of autonomy that vary by degree of autonomy and whether it is manned or unmanned.
 - An “unmanned” vessel is defined as one that is not operated or controlled by on-board “seafarers.”
 - On any given voyage, a MASS may operate in more than one of the four degrees of autonomy.



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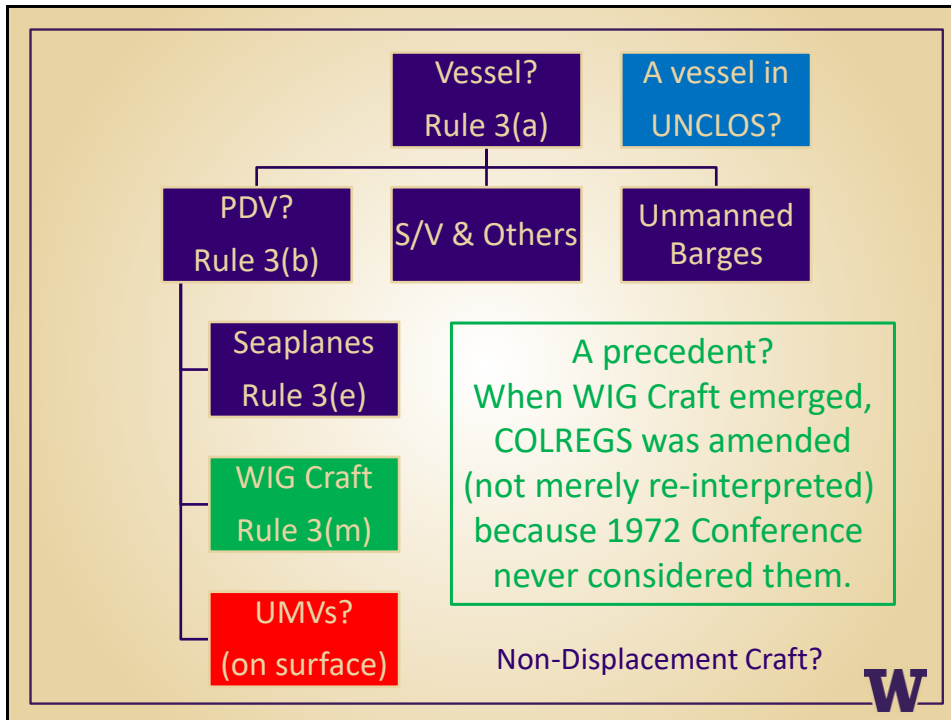
THE IMO'S FOUR DEGREES OF AUTONOMY

1. Ship with automated processes and decision support; seafarers operate and control the vessel, but some may be automated.
2. Remotely controlled or operated, but with seafarers aboard, who can intervene if and when needed.
3. Remotely controlled [by licensed seafarers?] and without any seafarers aboard.
4. Fully autonomous ships. The ship's operating system is able to make decisions, choose courses of action and execute them, without human intervention.

Don't underestimate the increased risk of #2 (disengaged crew).



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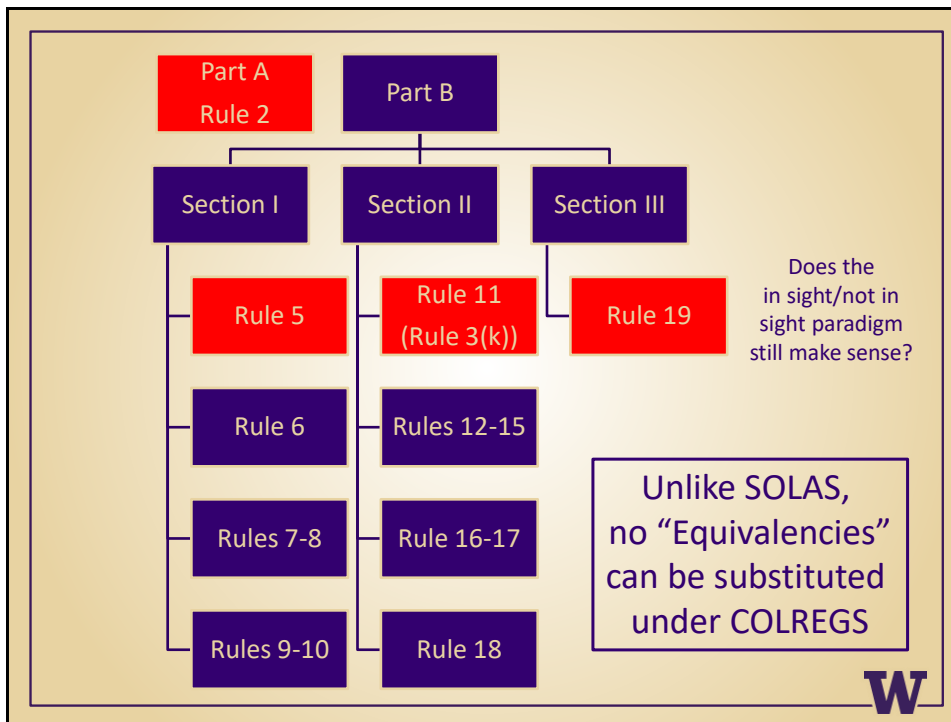
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COLREGS 1972

- Rule 3(a) "vessel includes every description of water craft, including non-displacement craft, WIG craft and seaplanes, used or capable of being used as a means of transportation on water."
- Rule 3 then goes on to define several classes of vessels, such as power-driven vessels, sailing vessels, WIG effect craft, and seaplanes (when on the water). Collision avoidance requirements vary by vessel type, among other things.

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TREATY INTERPRETATION

- 1969 VCLT (mostly a codification of CIL):
 - Ordinary meaning given to its terms.
 - In light of context, object, and purpose.
 - Role of subsequent practice of states.*
 - Effect of IMO "unified interpretations"?
- ICJ Advisory Opinion on MSC Representation.
 - Issue: How to interpret the IMO founding treaty?
 - Opinion pre-dates VCLT but anticipated its articles.

* Effect of the U.S. "claim" made in the 2007 USN/USCG/USMC Commander's HB?
UMV not addressed in the Draft Understandings of Senate Foreign Relations Comm.
In any event, as a nonparty, the U.S. is not construing UNCLOS.

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RESPONDING TO THE ADVOCATES' POSITION ON RULE 5'S "BY SIGHT AND HEARING" REQUIREMENT

- "When I use a word,' Humpty Dumpty said in rather a scornful tone, 'it means just what I choose it to mean — neither more nor less.'
- 'The question is,' said Alice, 'whether you can make words mean so many different things.'
- 'The question is,' said Humpty Dumpty, 'which is to be master — that's all.'
- Lewis Carroll, *Alice Through the Looking Glass*



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MAXCMAS (2015-2017)

- *Machine Executable Collision Regulations for Marine Autonomous Systems*: two-year project to evaluate COLREGS (and good seamanship) compliance by autonomous ship navigation systems.
- Participants: Rolls Royce (project lead), Lloyd's Register, Atlas Elektronik, Queen's University Belfast, and Warsash University.
- Testing conducted: desktop, simulator (two-ship and multiple ship encounters using historical case studies), and on an USV.

On-the-water COLREGS compliance testing also conducted with *Sea Hunter*.



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OTHER POSSIBLE RESPONSES TO UMV

- Larger role for class societies (certifying the collision avoidance system/software).
- Safety (and security) minded states will likely insist on shoreside control over UMVs in their waters by increasingly automated VTS; that control will likely be extended to manned vessels (drawing on the Air Traffic Control model).
- Pilotage may also shift shoreside—if the states permit.
- UMV owner liability for collisions will be strict, not requiring proof of “operator” negligence.
- It is unlikely UMV owners will be able to meet the privity or knowledge standard for limitation of liability.



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THE CONSEQUENCES FOR MANNED VESSELS

- R&D \$\$ being shifted to UMV.
- IMO’s MSC focus may be diverted to MASS.
- Will likely lead to greater reliance on automation on manned vessels.
- More downward pressure on manning levels.
- Need for mariner training to deal with UMV.
- Knowing that UMV will strictly follow the rules, manned vessels must do likewise.
- Greater shoreside control will erode the storied role of the “master.”



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USCG MASS REQUEST FOR INFORMATION

- Title: *Integration of Automated and Autonomous Commercial Vessels and Vessel Technologies Into the Maritime Transportation System.*
- The Coast Guard published its RFI on Aug 11, 2020.
- It asked for feedback on 16 questions: For example,
 - What existing statutes or Coast Guard-issued regulations, policies, or standards may present a challenge or barrier to the development, demonstration, deployment, or evaluation of automated and autonomous commercial vessels and vessel technologies? [obvious parallels to the IMO MASS RSE].

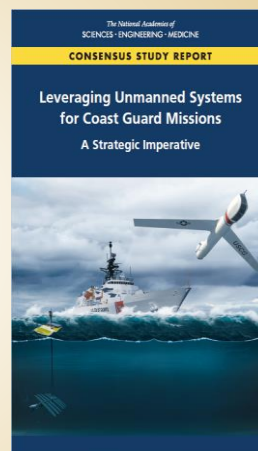
The comment period closed Oct. 13, 2020



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THE COAST GUARD AS A UXS OPERATOR

- The National Academy of Sciences convened an ad hoc committee to identify, examine, and make recommendations to guide the U.S. Coast Guard's priorities for developing, testing, and deploying unmanned technologies.
- NAS/TRB will posted the report on November 12, 2020.



October 2020: USCG R&D Center testing a 29' USV off Hawaii with a view to maritime domain awareness applications.



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THANK YOU



THE "DASHBOARD" OF THE 2020 GENERAL MOTORS CRUISE AV