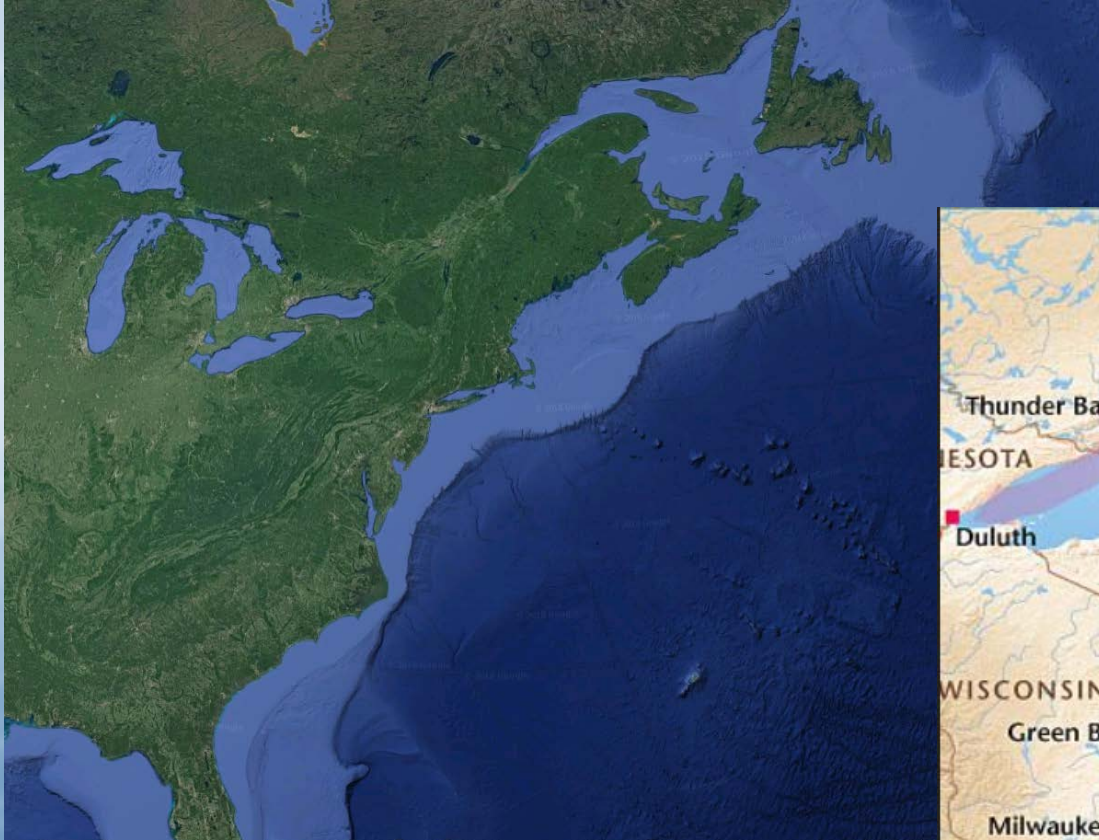


GREAT LAKES PERSPECTIVE - AUTONOMOUS SURFACE VEHICLES & US COAST GUARD RULES OF THE ROAD

Michael Beaulac

Michigan Office of the Great Lakes

GREAT LAKES–ST. LAWRENCE RIVER SYSTEM



GREAT LAKES-ST. LAWRENCE MARITIME STRATEGY

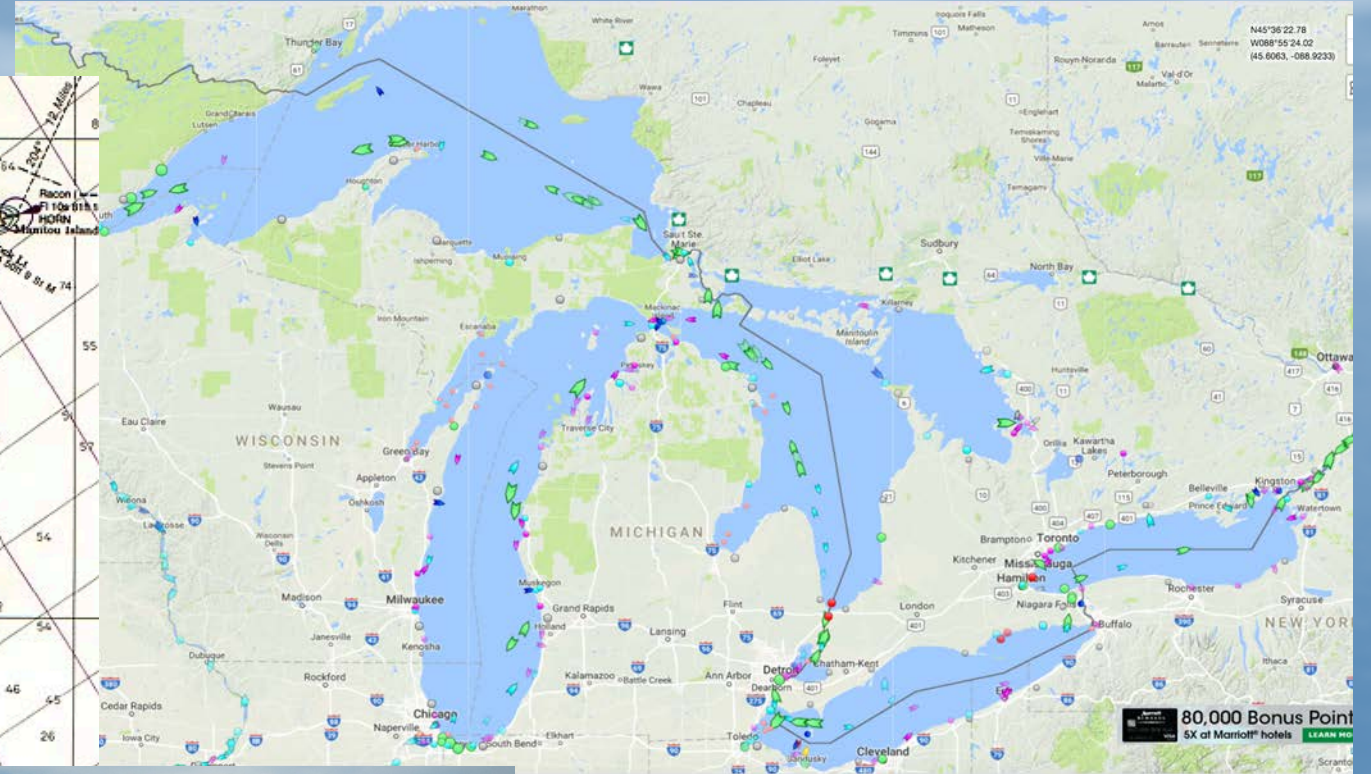
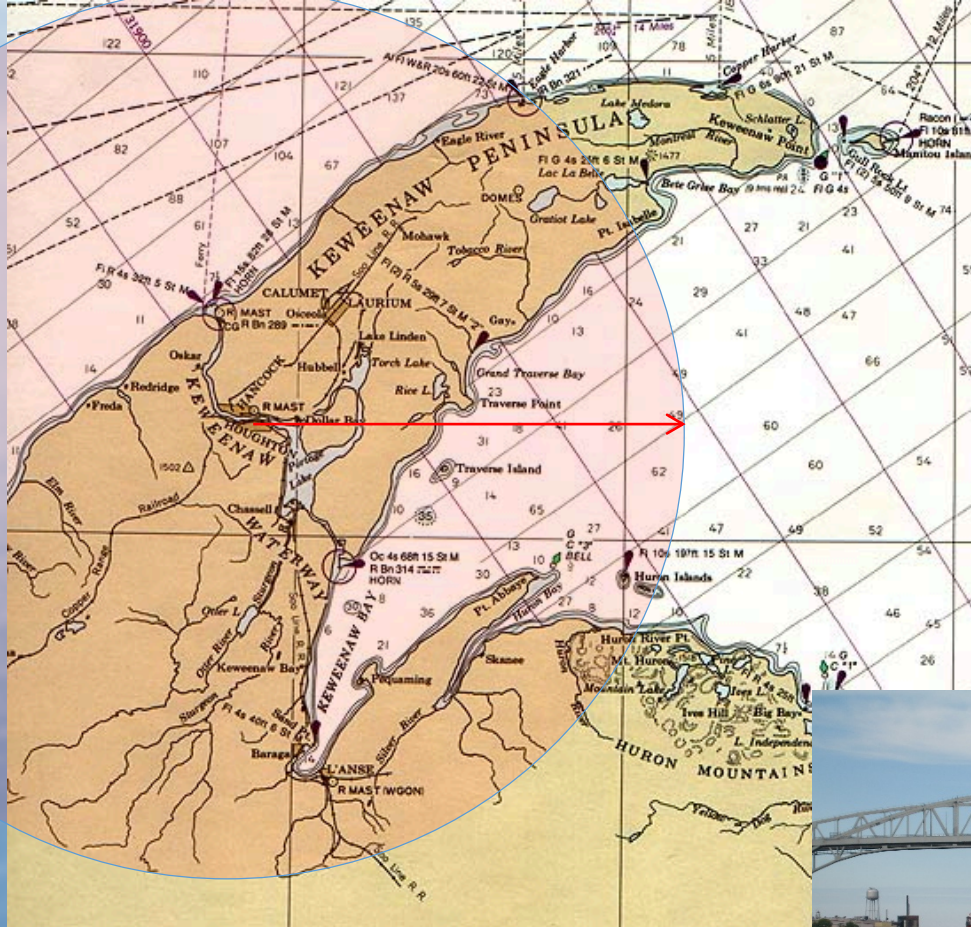


- Governors' & Premiers' Maritime Initiative - multi-year effort to double maritime trade.
- Focus includes autonomous vessels, related efficiencies
- Regional strengths - maritime, automobile manufacturing, IT
- Smart Ships Coalition launched:
 - Collaborations w/Norwegian Forum for Autonomous Ships (NFAS)
 - Establish Great Lakes Test Bed
- Develop recommendations w/in one year - improve technology, safety & public acceptance

GREAT LAKES AUTONOMOUS VEHICLES



PROPOSED GREAT LAKES TEST BED



US COAST GUARD & AUTOMATION

- Tough Job Ahead: IMO mandates a ship's lookout
 - What is a lookout (statute and practice)?
 - What are “lookout” performance standards?
 - ID viable tech alternatives
 - equipment approval process to validate acceptable safety level



US COAST GUARD & AUTOMATION

- Great Lakes Region moving forward w/Autonomy - IMO Scoping Exercise = 3-5 year effort
- IMO Regulatory Framework: 3 elements ensure safety, security, environmental protection



CURRENT US COAST GUARD RULES & STATUS

- “... until numerous conventions, laws and/or regulations are amended *there is no such thing as an unmanned self-propelled vessel.*”
 - All vessels require a lookout
 - Commercial trade vessels require at least one licensed mariner
- Michigan’s Test Bed proposal involves **noncommercial** watercraft ... few controlling regulations
 - USCG’s position: All autonomous vessels pose **risk to navigation** safety.
 - District Commander has discretion for regulating
 - Test Bed proposal delegated to local USCG authority - familiarity with local conditions

TEST BED & AUTONOMOUS “GUIDELINES” TIME FRAME

- December 2017 – notify US Coast Guard of potential autonomous vehicle/vessel test bed & regulatory impacts
- January 2018 – Test Area/autonomous vehicle concept submitted to USCG Headquarters
- February 2018 - Delegated to Cleveland District USCG w/meetings => Duluth Unit USCG w/info requests (template creation)
- March 2018 – Submission of required template information
- April 2018 – Status Meeting
- Spring - Summer 2018 – Establishment of Safety Zone (around vehicle/vessel)
- Fall 2018 - Publication in Federal Register - 30-day public comment (safety zone)
- Late Fall 2018 – Official designated Safety Zone w/broadcast info

US COAST GUARD RESPONSE & INFO REQUEST

U.S. Department of
Homeland Security
United States
Coast Guard



Michigan Department of Natural Resources
Office of the Great Lakes
Attn: Mr. Michael Beaulac
MI DNR Constitution Hall
525 West Allegan Street
Lansing, MI 48909-7528

Dear Mr. Beaulac:

Thank you for meeting with Marine Safety Unit (MSU) Duluth staff, Ninth District representatives, and me on February 21, 2018 to discuss the autonomous vessel testing project planned for the Keweenaw Peninsula area in summer 2018. This unique project is a great example of the innovative work ongoing in the Lake Superior region and will challenge operators and regulators alike to meet the challenges of this growing field.

The level of risk this project poses to other waterway users and the maritime environment is based on a number of factors. These include the level of autonomy of the vessel, operating conditions, and type of vessel. Each of these risk factors will shape the specific risk mitigation measures required by the U. S. Coast Guard. In order to determine the potential impact this project may have on other maritime users and needed risk mitigation measures, please provide the information requested in enclosure (1).

Maritime safety is a collective effort between maritime operators and the U. S. Coast Guard. We highly value your commitment to protecting our Nation's ports and the Great Lakes Maritime Transportation System. Please keep me informed of the project as the many moving pieces fall into place. Strong communication will help to inform the maritime community, mitigate impacts to commerce, and ensure the safety and security of the public.

All requested information may be sent via email to DuluthWWM@uscg.mil. Please provide documents at least 30 days in advance of the planned operation date. Should you have any question please contact me at (218) 725-3818 or John.V.Mack@uscg.mil

Sincerely,

J.V. MACK

Chief, Waterways Management Division
U.S. Coast Guard

Commanding Officer
Marine Safety Unit Duluth

515 W. Franklin Ave., 145
Duluth, MN 55802
Phone: (218) 725-3800
Fax: (218) 725-3850

16600/076-18
February 27, 2018

Autonomous Vessel Testing Project
from Lloyd's Register

U.S. Coast Guard
Marine Safety Unit Duluth

Autonomy level	Description	Operator Role
1	Manual steering. Steering controls or set	The operator is on board or performs remote control via radio link

Autonomy: The level of autonomy of the vessel from manual to fully autonomous operations will determine the need for autonomous operations

US Coast Guard
Marine Safety Unit Duluth

Potential notification and documentation requirements: Ongoing evaluation of technology will be needed to determine effectiveness of risk mitigation measures. Notifications to Coast Guard

US Coast Guard
Marine Safety Unit Duluth

Operations:

Describe the collision avoidance abilities or technology installed on the vessel?

Operating area:

Where will the autonomous vessel operate? Be as specific as possible

US Coast Guard
Marine Safety Unit Duluth

Autonomous Vessel Information Request

Vessel information: Please provide information for each autonomous vessel to be used.

General Information	
Vessel Name	
Official registration number	
Country and/or US State of registration	
Vessel owner/operator and contact information	
Autonomous Vessel Specifications	
Length	
Breadth	

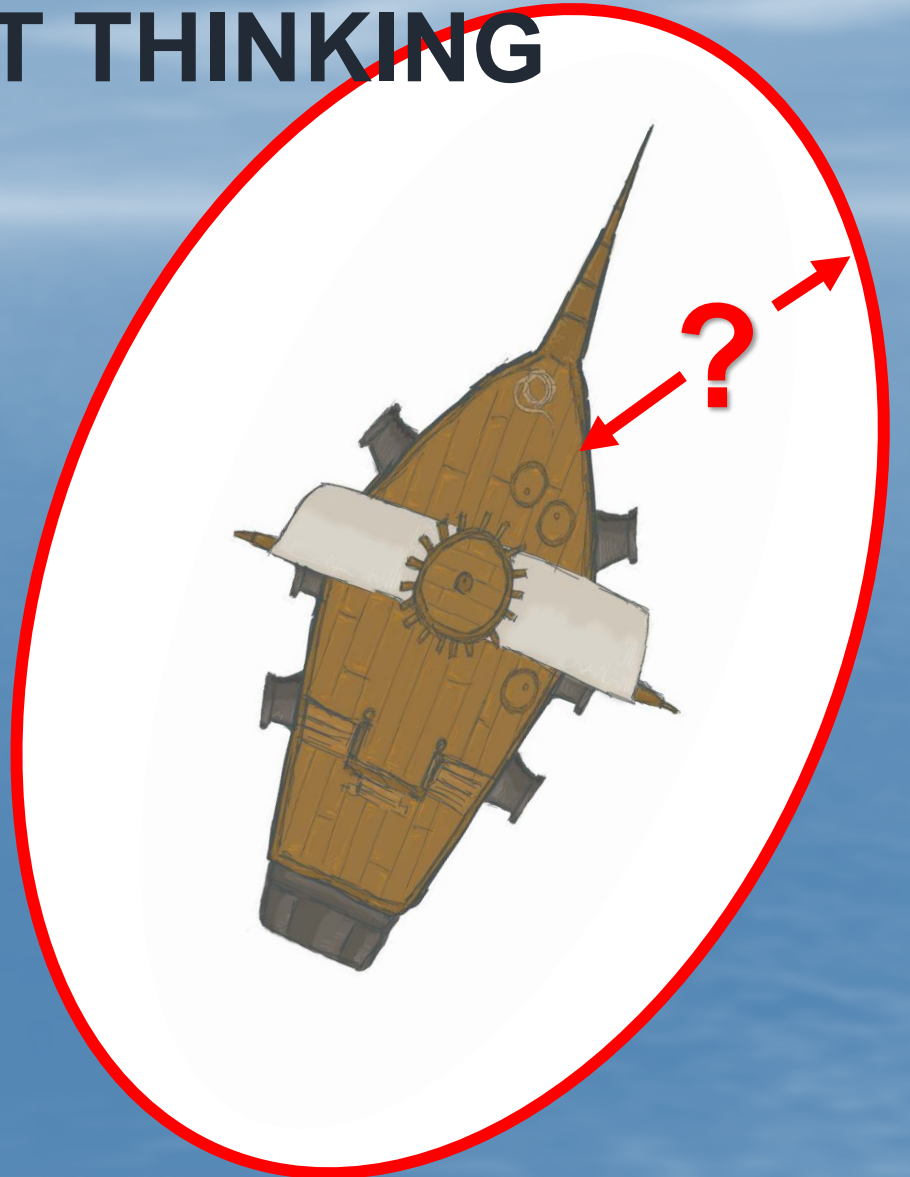
US COAST GUARD INFO REQUEST TEMPLATE

- Template Components:
 - Vessel Information: specs, equipment, escort vessel, etc.
 - Operating Area: where, when vessel will operate, conditions
 - Operations: collision avoidance, control system redundancy, emergency procedures
 - Notification & Documentation Requirements: risk mitigation measures
 - Autonomy: What level? Level changes? Vessel operator?
- ***Info Request Template expandable to autonomous commercial vessels!***



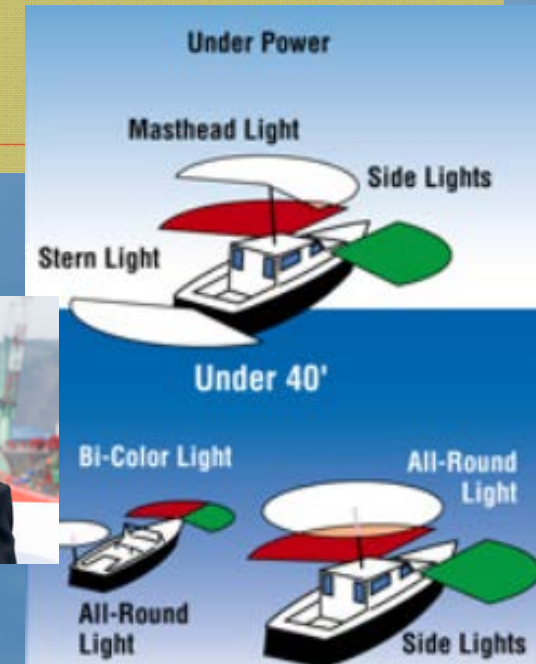
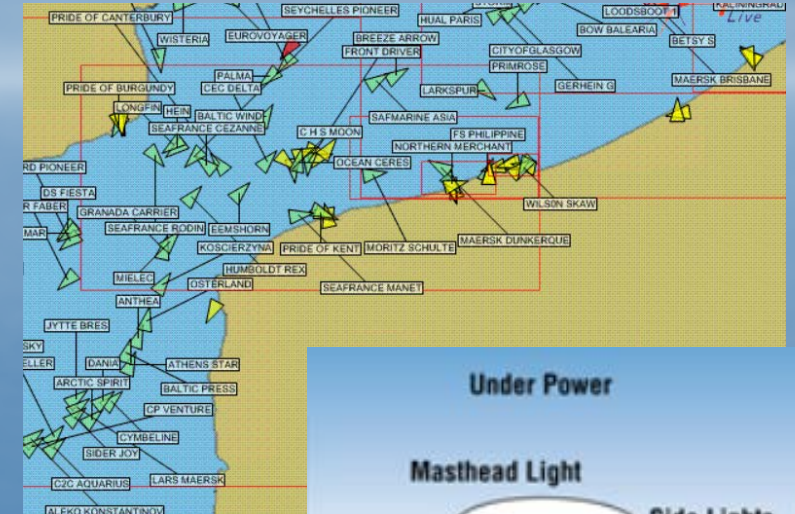
US COAST GUARD CURRENT THINKING

- Focus: **safety, security, environmental protection**
- Must handle **notification requirements**
 - Eg., What to do in an emergency (loss of signal)?
 - Based on industry's capabilities
- Boundary Establishment: **Safety Zone** around vessel
 - USCG will not/cannot designate a test bed!
 - Driver: Hazards to public & environment
 - Test bed by itself is not a hazard
 - Autonomous vessel is considered a hazard
 - Safety Zone Keep other vessels away!



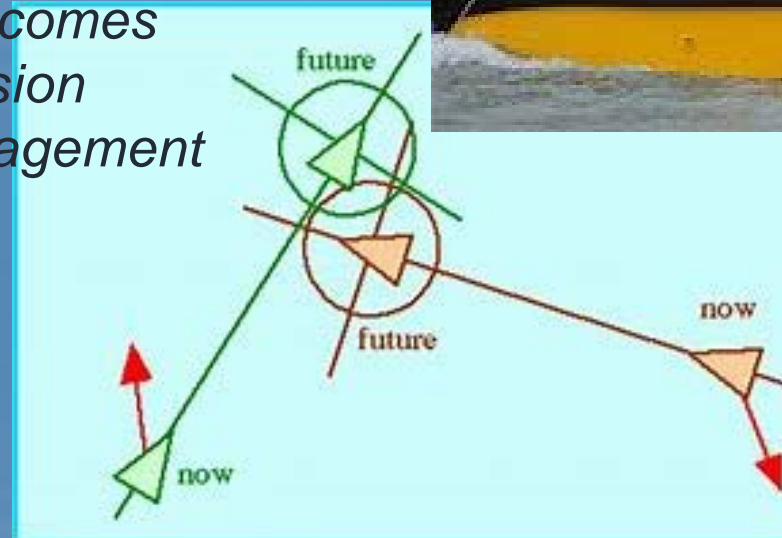
US COAST GUARD – CURRENT THINKING

- US Coast Guard secure **“awareness” broadcast** (Channel 16) every half hour (*“Autonomous vessel operating in this area!”*)
- **AIS broadcast** “autonomous vessel underway, etc.”
- Experienced **licensed mariner** must be present (somewhere)
- **Best practice options** (paint color, white lights, etc.)
- **Collaborative testing:** vessel collision avoidance capabilities
- Focus on surface vehicles/vessels: USCG *“will not poke their finger into autonomous underwater vehicles at this time.”*



HOW DOES RISK CHANGE BETWEEN HUMAN-BASED AND AUTONOMOUS DECISION MAKING?

- Is anyone looking at:
 - Risk-based approach for safety measures?
 - Risk-based approach for liability?
 - Risk-based approach for decision-making?
 - *Process organizing **possibility/probability** info for one or more unwanted outcomes into orderly structure helping decision makers make more informed management choices.*



QUESTIONS?



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