An Affordable, Capable Maritime Emergency Response System

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ABSTRACT

Responding to emergencies for coastal communities in remote regions often involves a maritime (Coast Guard) component. However, Coast Guard ships can be few in number, widely dispersed, difficult to crew, and expensive to operate and build. A solution to this problem from a Naval perspective has been proposed by the US Naval Postgraduate School; a relatively small and inexpensive vessel, lightly crewed operating with a flotilla of uncrewed surface vessels. From a Coast Guard perspective, this could assist with response to coastal community, offshore infrastructure and maritime emergencies, while at the same time provide maritime domain awareness, enhance coastal sovereignty, protect critical underwater infrastructure (an increasingly important part of life in the Arctic and worldwide) and respond to maritime search and rescue and pollution incidents. The Need, the Problem, a Solution and its Technology are explored. Potential applications are described.

Keywords

Uncrewed Surface Vessel, Coast Guard, maritime sovereignty, rescue.

INTRODUCTION

“Nunavut officials press for an Arctic search and rescue base: 'If we have a major incident up here, we are in a very bad position to be able to respond ... it would have taken the Canadian Coast Guard about two days to reach the ship ..." (Sahar Zerehi, 2016)

"They can put up an aircraft for a number of hours at a time and monitor the situation but there’s no substitute for having a naval ship on station," said Independent Teachta Dála (Deputy) Cathal Berry, speaking to the Irish Times. "They were no more than 13 nautical miles off the coast of Kerry and (not having a ship available is) simply just not good enough for a sovereign state." (Russian Subsea, 2023)

At the meeting in Helsinki, Mr. Rutte (NATO Secretary General) announced the launch of a new military activity by NATO to strengthen the protection of critical infrastructure. “Baltic Sentry” will enhance NATO’s military presence in the Baltic Sea and improve Allies’ ability to respond to destabilizing acts. (“NATO launches”, 2025)

Many remote communities, such as those in Polar Regions, are situated along the coast. They have traditionally made their living from the sea and benefited from marine transportation for both their products and necessary supplies. In more recent times they have also benefited from critical underwater infrastructure (CUI), in particular the subsea cables which can connect remote communities to the global digital grid, a place where communities thrive with access to digital communication, telehealth, education, and economic opportunities. (In fact, subsea cables are the unsung arteries of modern communication, carrying 99 per cent of intercontinental data traffic). (Kennah, 2024). Subsea cables have always been susceptible to environmental and accidental damage, requiring specialized ships to repair them. In recent years they have become pawns in geopolitical politics. Ships have ‘innocently’ dragged their anchor for a hundred miles, destroying subsea cables and pipelines. Unless the perpetrator is caught 'red-handed' these acts are subject to 'plausible deniability', but the implicit threat is clear, the economic damage real.

Other threats such as illegal fishing in territorial waters, illegal migration, overt military challenges, and pollution require maritime domain awareness. Arguably, aircraft, drones and satellites can provide surveillance. However, this surveillance may be temporary, and aircraft and drones cannot remain on scene for extended periods.

Many 'more traditional' maritime risks also arise. Seagoing issues such as shipwreck, persons overboard, marine pollution, aircraft crashes over water, emergencies involving offshore infrastructure such as oil platforms and wind farms are some of the incidents which may occur. In remote communities, shore-based emergencies may benefit from the presence of a vessel, with the potential of providing emergency response, much needed supplies, fire response, shelter, first aid, command, control and communications facility and other functions; assisting both the victims of an incident and the first responders.

In some cases, additional resources, perhaps portable medical clinics, could be provided to remote coastal communities, improving local medical outcomes and quality of life and possibly reducing overall costs. It is even possible that cable repair equipment could be fitted, enhancing remote region cable repair by having a ship on station and flying in the specialized cable repair personnel. Finally, the vessel(s) could be fitted for, if not with, armament for policing or military deterrence.

THE NEED

Maritime and shore-based emergencies will continue to occur. Rapid response may be required to save human life. Rapid response may also reduce the severity of an incident, potentially saving a vessel along with the crew, perhaps averting a pollution incident. For shore-based incidents, rapid response may also required. Although this may be by air, or by land-based resources, the severity of the incident, the weather conditions, or local transportation infrastructure may all impact response. Whether or not a sea-based resource would be helpful would be dependent on many factors.

Coastal security challenges will also continue. Aerial surveillance may be temporary, as aircraft and drones cannot remain on scene for extended periods. For rescue, helicopters may be effective, but have limited range, time on scene and capacity. As the Arctic opens up due to global warming and military threats intensify in our increasingly dangerous world, a viable and visible presence to supplement crewed patrol ships could be an additional level of deterrence.

Subsea infrastructure is increasingly part of life in northern communities, and protection of this infrastructure is a growing concern. The subsea fibre-optic cables in eastern Hudson Bay (Figure 1) serve as an example of recent development of critical underwater infrastructure.

For remote coastal communities and maritime incidents, such as security issues and pollution prevention/response, and search and rescue, a ship-based response capability is necessary to complement other resources which may be available.

In summary, the need for improved response may be addressed by a ship, or fleet of ships, capable of:

- Maritime coastal sovereignty and defense
- Maritime domain awareness
- Protection of Critical Underwater Infrastructure (CUI)
- Maritime SAR response
- Coastal community medical and emergency response
- Other

THE PROBLEM

Canada and many other countries have a shortage of ships capable of maintaining the necessary offshore patrols to provide emergency response, maintain maritime domain awareness, and exert national sovereignty over large and remote areas. Ships are expensive to operate, require a technically competent supply chain, and require a seagoing crew. In particular, many countries are finding it increasingly difficult to crew their patrol ships in order to keep them at sea.

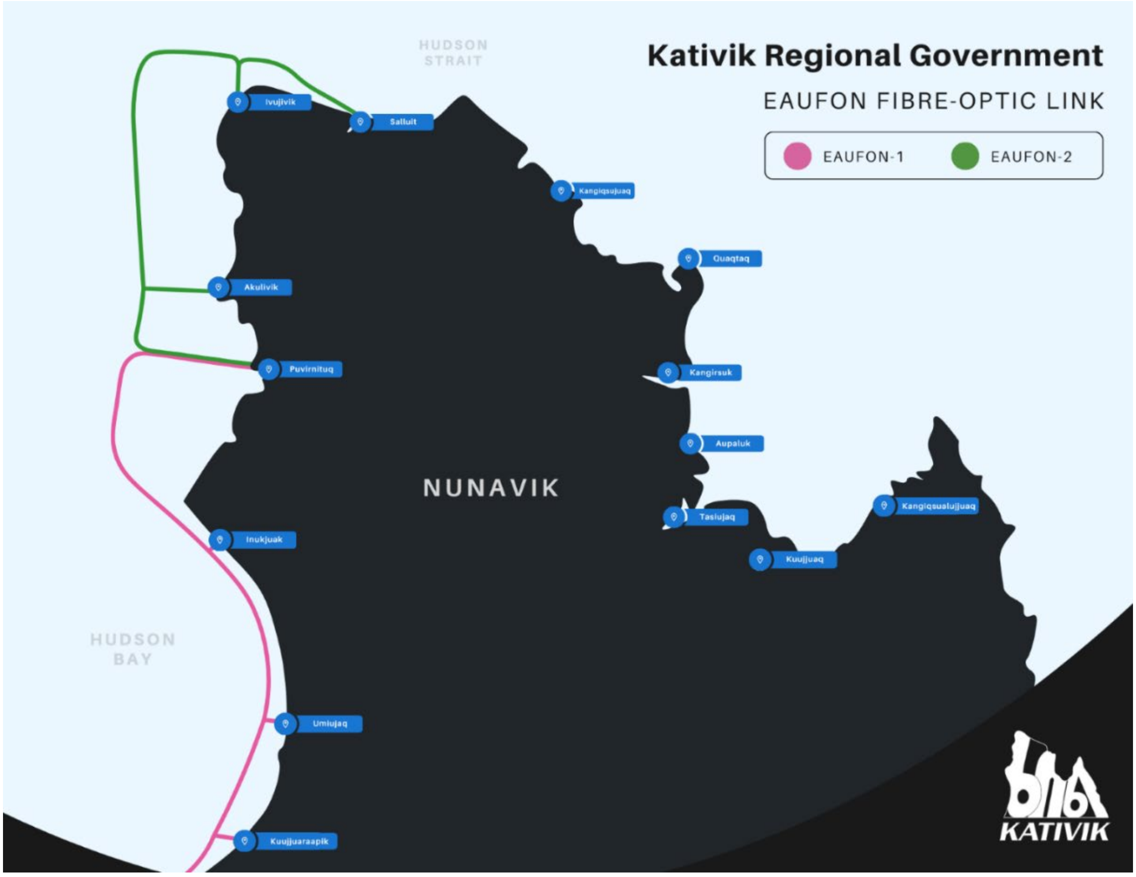

Figure 1. Eastern Hudson Bay subsea Fibre-optic cables (Kativik Regional Government, 2024)

These issues are particularly evident in regions that are subject to heavy weather. The patrol ships for these regions tend to be large, and expensive to build, operate, maintain and crew. It is increasingly difficult to find the trained seafarers willing to bounce around in the winter North Atlantic and similar regions; although modern lay day crewing arrangements allowing month on, month off have improved seafarer quality of life, they have increased the number of crew required and significantly increased costs. In responding to shore-based or near shore incidents, the larger ships required for offshore patrols or operations in ice-infested waters may be limited in their ability to respond.

A final, but very significant, issue is the inability in many western countries to build a government vessel in a timely manner. The current Canadian flagship icebreaker, the 'Louis S. St-Laurent', sailed her maiden Arctic voyage in 1969 (56 years ago). After her four-year mid-life refit, she returned in 1993 to the Arctic (32 years ago). The Louis S. St-Laurent's replacement, the 'Diefenbreaker', was first planned in the 1980s, but the replacement vessel has yet to enter service. Naval procurement often follows similarly protracted timelines and cost escalations.

Leveraging technological advances in automated vehicles for maritime patrolling is a rapidly developing field. To complement the overview of some recent developments that can serve as platforms for emergency response as detailed below, the (relatively sparse) literature related to maritime search and rescue runs the gamut from quite specific aspects to broader implications of such implementations. For the latter, Yoo et al. (2020) provides an overview of the need, requirements, and governance aspects of using autonomous vessels in the Canadian north for search and rescue service. This provides excellent context for consideration of the practical solutions described in the remainder of this paper. Other papers describe general developments in the field of autonomous ships for emergency response or defense (Jonze et al. (2023); Mun and Gallup (2020)), of which this paper provides some updates. Finally, a significant number of technical papers focus on specific aspects of operating remote vessels such as the communications processes, required sensors, lifesaving capability and coordination (e.g. Cristea et al., (2023); Bugra Sar (2023)).

A SOLUTION

A proposed solution to fulfill the needs identified above is a command/control mother ship working with a flotilla of Uncrewed Surface Vessels (USVs). Maritime coastal sovereignty and defense and maritime domain awareness are enhanced by having a persistent on-water presence which can monitor (and perhaps be seen to monitor) maritime activities. Critical underwater infrastructure protection can similarly be enhanced by a persistent on-water presence, deterring both vessels which may cause accidental damage (such as fishing trawlers) as well as bad actors (such as cargo ships dragging anchors) who will be aware that there will be no 'plausible deniability' for any damage. Maritime search and rescue response is enhanced by an on-water presence, however, the contribution a USV can make may be limited. The ability of a USV to assist survivors in the water or in lifeboats / liferafts is the subject of ongoing research at the International Maritime Organization (IMO), with MASS (Maritime Autonomous Surface Ship) being the IMO terminology. In any case the presence of a surface vessel should be a source of comfort for air rescue crews and may be able to assist in mass rescue situations (such as passenger vessel incidents), or work with helicopters in cases where the number of survivors exceeds the helicopter's capacity. In other cases, such as responding to coastal community medical and other emergencies, pollution incidents, and many other needs, a mother ship accompanying USVs could provide emergency shelter, medical facilities, communications hub, and base for emergency supplies. The range of possibilities is very broad with the mother ship and USVs being tailored to their respective requirements.

Concept: Command/Control Mother Ship & Small Flotilla of Uncrewed (Optionally Crewed) Surface Vessels

The concept is a command/control mother ship suitable and seaworthy for the purpose intended. For example, for the Labrador Coast case in eastern Canada, it could be based on a vessel type such as a 45 - 50 M offshore tug (suitably modified) or a standby emergency response and rescue vessel (ERRV) with a small flotilla of USVs. The specifics could vary with the various regions; however, they must always be vessels seaworthy for the intended purpose. As outlined in the following sections, the mother ship and the USVs must also be designed and outfitted, as far as possible, to fulfill the specific needs of their application. This concept is based on studies by the US Naval Postgraduate School (US NPS) for Naval applications, as outlined in the following section.

Technology Innovations for Lightly Manned Automated Combat Corvette with a Flotilla of USVs

The field of technology has seen unprecedented advancements over the past few decades, revolutionizing industries and redefining the way we live and work. For the Lightly Manned Automated Combat Corvette (LMACC, Figure 2), embracing these innovations is crucial to maintaining military advantage in near-peer competition and deterrence in critical areas of the world's oceans.

Most innovations supporting LMACC are already available. Some will need to be adjusted to the maritime and operational environment. There are two categories of innovation in LMACC. First, are those that support a high level of automation. Second are innovations that are needed to meet operations. These categories are wide, with needs to include other innovations and technologies.

First, regarding automation (note that we are not saying autonomy here), there has been a great deal of effort put into the U.S. Navy's Sea Hunter class medium unmanned surface vessels (MUSV). Automation brought over from Sea Hunter, and other vessels, are maturing constantly. Without going into specifics, we can note here that automation (navigation, hull maintenance and machinery controls) is here and adaptable to LMACC. For this class of warship, it is highly weaponized for its deterrence and combat role in the western Pacific. This is dissimilar to the role of search and rescue but overlaps in many innovations.

Secondly regarding the operational innovations, these are further divided into human-machine partnerships (the ability to "dialogue" between humans and AI, artificial intelligence, for improved and more timely decision making), command and control for flotilla operations (a flotilla here is 6 LMACCs and 6 MUSVs), since for USN (United States Navy) purposes the measure of combat effectiveness is related to the number of long-range surface to surface missiles available. This flotilla brings 48 long range missiles, and the anticipated 3 flotillas brings in 144 missiles. This is very competitive with 2-3 DDGs (guided-missile destroyers) in a theater in which DDGs are very vulnerable. The human factors considerations are likewise very important. Innovations to improve sleep and watch standing are included in LMACC, for example, work on demand versus watch sections.

Also within the operational capability there is a need for command-and-control capabilities. LMACC is considered a long-range mission command capability, meaning that operational command is at the level of the

LMACC flotilla, adhering to the current ROE (rules of engagement) and strategic intentions of higher echelons. Command and control are intended to remain primarily low probability of intercept or deception using new communications innovations. The intention is to be as electronically quiet as possible, which can be scaled up or down as needs require. For example, in its peacetime deterrent operations role, satellite communications and GPS are available. If conditions move toward conflict, satellite communications and GPS will degrade. The flotilla will then start to employ other communications technology, towards complete electronic warfare darkness, with employment of AI-compensated inertial navigation.

Coordination of sensor information from unmanned sensors at the outer edge of the flotilla will need to be coordinated to create a useful common operational picture that is relevant to all the vessels. There are interesting variables to be employed here. Microwave technology has large bandwidth, but short range (extensible through a tethered or free flight Unmanned Aerial Vehicle (UAV)). Laser comms, proven at sea to be successful, is very high bandwidth but within a narrow field of view. Focused low-power high frequency comms provides over the horizon communications, or within an annulus created in near-vertical incidence skywave (NVIS comms) and good out to 300 miles across the annulus. Even flashing light, created through an automated controller could be employed.

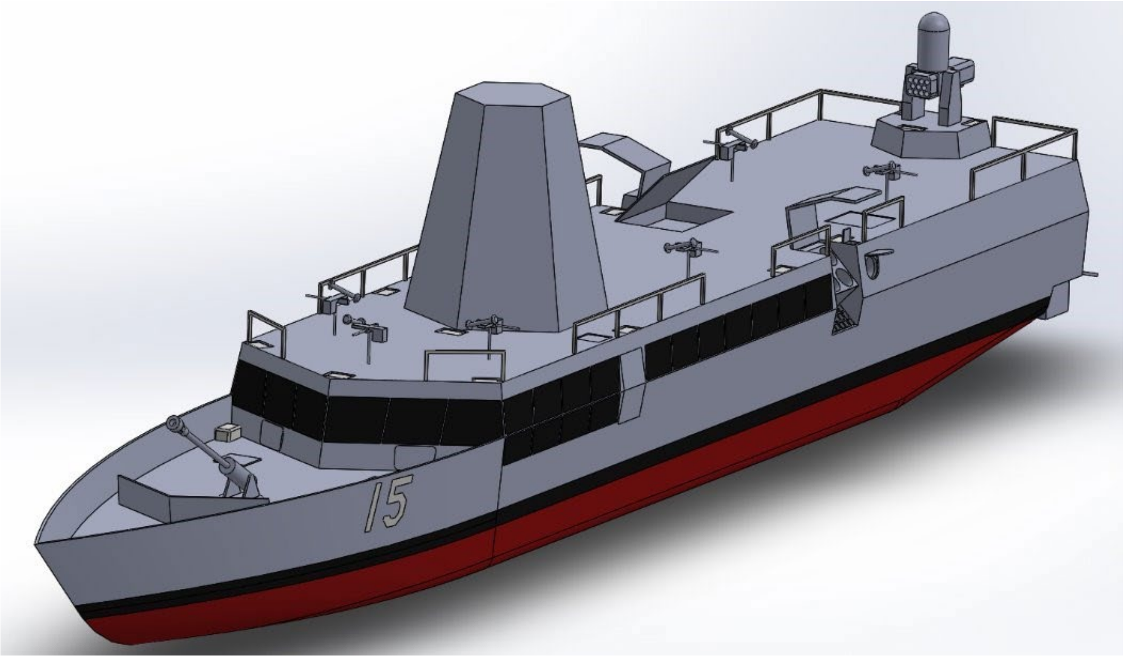

Figure 2. Conceptual Lightly Manned Automated Combat Corvette (LMACC)
Characteristics – LOA 76 m, 7500 nm range at 15 knots. (Naval Postgraduate School, 2025)

The integration of these technology innovations can significantly enhance the capabilities of LMACC, providing a modern and efficient educational environment. By embracing AI, IoT (Internet of Things), VR/AR (Virtual Reality/Augmented Reality), blockchain, cloud computing, and 5G technology, LMACC is poised to lead the way in this transformative journey. Everything in LMACC is possible, with some innovations appropriate to other missions, such as coast guard persistent operations.

SAMPLE APPLICATIONS FOR EMERGENCY RESPONSE

We will first focus on the case for the Labrador Sea, the Atlantic east of Newfoundland, and the eastern side of Hudson's Bay. Other cases will also be briefly explored.

Canada – Newfoundland to Baffin Island, & eastern Hudson Bay

The Canadian East Coast ranging north from Newfoundland to Baffin Island, and also the eastern coast of Hudson Bay (Figure 3) borders extensive sea areas, have limited rescue response resources and are subject to heavy weather. The riskiness of the region was further cemented with the near-tragedy of the Atlantic Charger in 2015:

> *"We got no life-saving equipment down there. We've got a lot of men on the water, a lot of seafarers, and if they go in the water, if there's not another commercial vessel in the area then there's not much hope."* ("Owner of the Atlantic Charger", 2015)

A proposed Coast Guard / emergency response system could consist of a 'command/control' mother ship and a small flotilla of USVs. The mother ship could be based on a 45 – 50 m offshore tug or standby ERRV. The ship hull form and layout could be modified in many ways, such as:

- Accommodation moved aft towards amidships, and hull form modified, to increase comfort and reduce fatigue in heavy weather;
- Rescue facilities including rigid hull inflatable boat (RHIB), Dacon Rescue Scoop or equivalent, survivor reception facility, winch zone to work with an airborne helicopter, communications hub for command and control of a flotilla of USVs and for coordinating emergency response;
- Moderate towing capability;
- Capacity for a modest amount of cargo and/or special purpose small container with associated crane;
- Fuel and stores sufficient for 60 days.

A small flotilla, say up to four USVs would work in conjunction with this vessel as follows:

- Extend monitoring range of mother vessel, possibly up to 400 NM total.
  - o This could allow two or three flotillas to monitor the coast from Newfoundland up through Baffin Bay. Similarly, one flotilla could monitor much of eastern Hudson Bay;
- Ability to monitor several vessels simultaneously;
- Automated with control from mother vessel, could operate autonomously under specified conditions;
- Sufficient fuel capacity for 40 to 60-day endurance at moderate speed.

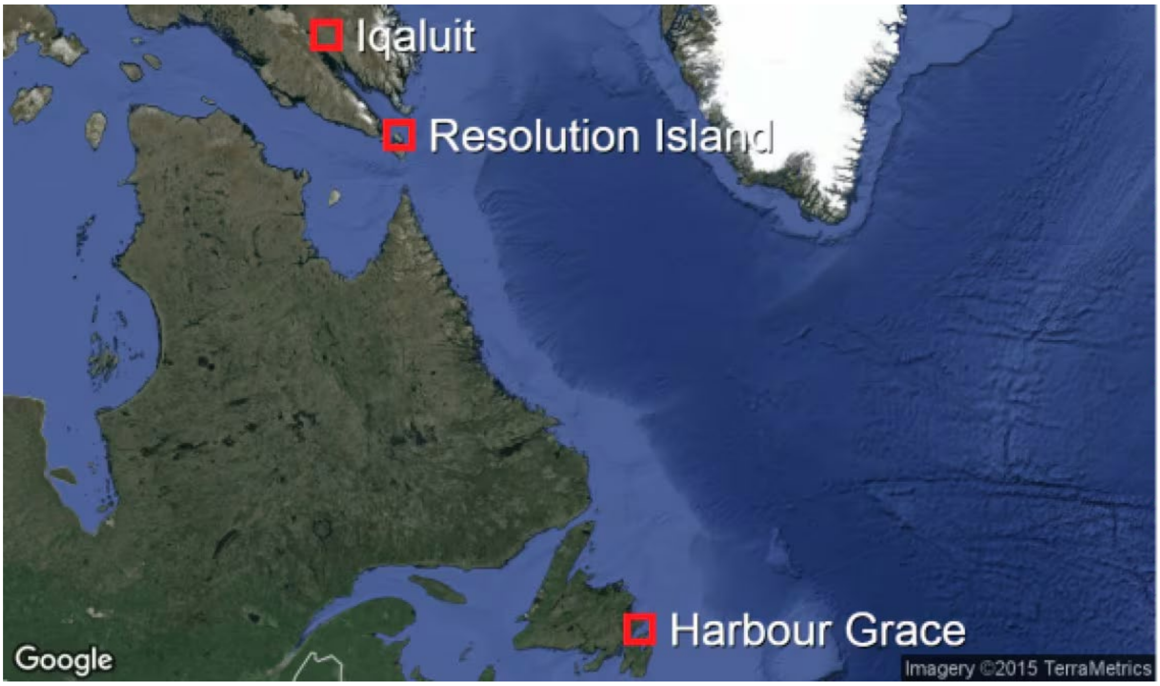

Figure 3. Eastern Canadian Coast ("Owner of the Atlantic Charger", 2015)

Command/Control Mother Ship

The intent is for the command/control mother ship to sail with a small crew (say 10 to 20), and work on a lay day system – such as month on month off. It could be small enough to work from a northern base, but able to return to a southern port if required. The mother ship may be reinforced to withstand moderate ice conditions, but it is not intended to operate these flotillas in conditions other than open sea or very loose broken ice. The ship would be able to attend emergencies, have facilities to rescue survivors, provide first-aid treatment, and work with other resources, such as helicopters, if required. It could also be fitted for emergency response equipment or pollution control containers and medical facilities.

Consideration could be given to fitting equipment and facilities for subsea cable repair, whereby the ship would be on station, but the specialized technicians and repair crew could be flown from the nearest airport. This may or may not be practical, and presumably would require a larger ship, although the general daily operating costs may not significantly increase. The mother ship could also be fitted for armament, but perhaps not with armament.

Uncrewed Surface Vessels (USVs)

The USVs would have to be seaworthy for the purpose intended. They would need to be able to survive the sea states and wind conditions likely to be encountered. They would need to be able to survive reasonable damage with hazards such as broken pack ice, growlers, floating debris, etc. Accommodation could be provided for 'optional' crewing, or survivors of a maritime incident. The ability for 'survivors' to board the USV and enter the accommodation area could be necessary the ability of uncrewed vessels to rescue survivors is currently the subject of international research. The ability to work with rescue helicopters could be an asset, perhaps acting as a base of refuge for survivors if required. Fuel capacity would be required for the voyage intended. Emergency towing arrangements would be useful, both so that the USV could temporarily assist other (small) vessels, and also that it can be towed to port by the mother ship if required. The vessels could be fast or slow depending on the expected application. Some existing examples follow below.

Command & Control System

The command & control system would require further design and evaluation which is beyond the scope of this paper. Systems have been proposed by the US NPS, outlined in a previous section and also promoted by various commercial firms, as noted in a following section.

Eastern Greenland / Denmark Strait

A proposed Coast Guard / emergency response system for east Greenland/Denmark Strait could be similar to that proposed for eastern Canada. Due to the increasing demands of Arctic Security, emerging threats and to bolster sovereignty the mother ship(s) could be paramilitary/military vessels. As an interim step, a suitable USV could work with one of the existing patrol vessels, to evaluate this concept and work out any bugs.

Baltic / North Sea

Several cases of damage to Critical Underwater Infrastructure, subsea telecom and power cables, and even pipelines have taken place in the past couple of years. In most cases there was 'plausible deniability' by the perpetrator due to a lack of closeby maritime surveillance. An affordable response could be similar to that in the previous sections, but based on a moderate sized seagoing tug, or patrol vessel, type command/control mother ship and a flotilla of medium size (10 – 20m) moderate speed (20-30 knot) USVs. These could provide close-up surveillance of ships passing near critical underwater infrastructure and remind them that they are being watched in case they 'accidentally' drop an anchor.

Anti-piracy patrol – Indian Ocean

A command/control mother ship could be a naval vessel, patrol vessel, or ocean-going tug. The flotilla of USVs could be disguised, above the waterline, to resemble local craft, potential targets of pirates. In addition to security patrols, these vessels could also fulfill the other Coast Guard functions (Schuler, 2024).

A MATURING TECHNOLOGY

There are related proposals by commercial firms, generally for military or offshore support purposes. The following are offered as several examples of Technology that is rapidly maturing. The concepts presented here are within reach in the near-term, but careful consideration of any technology would be required for any proposed 'affordable, capable, emergency response system'.

Proposed System of Mother Ship with USVs/UAVs

Kongsberg of Norway describes their Vanguard system (Figure 4) of mother ship with unmanned systems as "An innovative system for territorial waters Surveillance & Protection" and goes on to state the following: "*A key* *national security requirement is the effective understanding of all activities, events and trends in the maritime domain that could threaten the safety, security, economy, or environment of a state. VANGUARD is a maritime system adaptable and affordable to every role relevant to achieve this understanding and to act accordingly. The effective area covered by VANGUARD is the combined areas of the mother ship and the UAVs/USVs acting in manned, remote or autonomous modes*." (Kongsberg, 2021).

Figure 4. Kongsberg Vanguard mother ships with unmanned systems (Valpolini, 2023)

Some examples of vessels which could be Command/Control Mother Ships

Figures 5, 6 and 7 are additional examples of vessels which could act as command/control mother ships for service in regions such as eastern Canada. Note also that in Figure 5 the helicopter 'WINCH ONLY' and the survivor 'RESCUE ZONE' are clearly depicted. A wide range of vessels could fulfill the task of command/control mother ship, ranging up to icebreakers and naval ships. The larger ships may, of course, have additional capabilities, such as a helicopter landing pad.

Figure 5. ESVAGT CHRISTINA, 46 m Standby Emergency Response & Rescue Vessel (ESVAGT, 2025)

Figure 6. Tundra class coastal ice reinforced tug (Robert Allan Ltd., 2025)

Figure 7. Royal Netherlands Navy proposed multifunction support low-manned vessel (Scott, 2024)

Some examples of vessels which could form the Flotilla of Uncrewed Surface Vessels (USVs)

Figures 8, 9 and 10 are some examples of USVs which, with suitable modification, could form the flotilla for service in regions such as eastern Canada. A wide range of USVs, some of which could be optionally crewed, could fulfill this task, provided they are suitable for the intended purpose. Figures 8 and 11 show 'person in the water' recovery systems. Considerable testing and training, and possibly redesign, would likely be required for these systems, particularly when operated in the uncrewed mode. Figure 8 also shows a helicopter 'WINCH ONLY' zone.

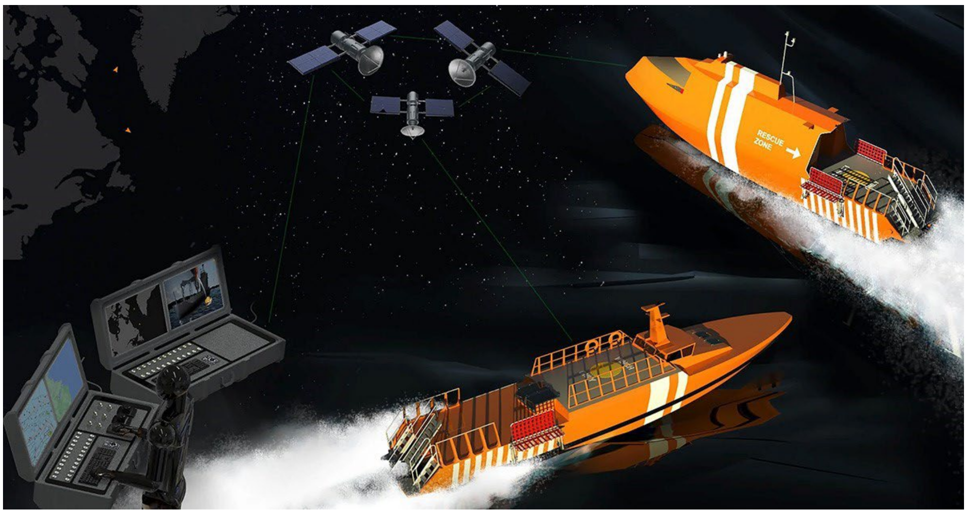

Figure 8. Remote, Uncrewed, & Ready to Respond, Docksta Loitering, Optionally Crewed, High Speed Rescue Vessel ("Remote, Uncrewed", 2023)

Figure 9. REACH Remote 1, 23.9 m Offshore Survey & Subsea Vessel, 2025, Kongsberg remote control / autonomous system (Kongsberg, 2025)

Figure 10. Fugro Sea-Kit. 12 M USV 'Maxlimer' (Amos, 2020)

Figure 11. Dacon RSB rescue scoop on small rescue vessel, available in larger and smaller sizes to suit vessel size and configuration (Dacon, 2025)

MOVING FORWARD

This paper has outlined the need for a greater maritime Coast Guard capability – to provide maritime Search and Rescue and pollution response, assist with emergency response for remote coastal communities, ensure maritime domain awareness, protect coastal sovereignty, protect critical underwater infrastructure, and any other responsibilities which may be required to ensure a Capable Maritime Emergency Response System.

This paper has also outlined the difficulties of making the system affordable. Ships suitable for these tasks are relatively large and slow, are expensive to build, maintain and operate, and are increasingly difficult to crew. To address the issue of affordability, this paper proposes a system of a command/control mother ship with a flotilla of USVs.

There is a great deal more thought required to evaluate whether this concept could fulfill a realistic need, what it should consist of, how it could integrate, and complement, other maritime Coast Guard related resources.

In their excellent book 'HOW BIG THINGS GET DONE', authors Bent Flyvbjerg and Dan Gardiner, provide Eleven Heuristics for Better Project Leadership (Flyvbjerg & Gardner, 2023). Some of these Heuristics that are particularly relevant to this endeavour are copied below (*with some relevant comments in italics).*

1. Hire a Master Builder – *a prime contractor firm with the relevant experience to take the project forward.*
2. Get Your Team Right - *the prime contractor, construction and operational contractors, crew, technical staff and government project officers must be experienced, visionary, competent, and able to respectfully question each other.*
3. Ask "WHY"- *always keep in mind what is the purpose of the project, how to best achieve its objectives, and periodically question those objectives.*
4. Build with LEGO (a piece at a time, if the project allows) - *perhaps start slowly, use an existing ship as the command/control mother ship, and one USV as the flotilla. Remember this requires trials to learn lessons, to refine technology, operational procedures, objectives, and safety protocols.*
5. Say No and Walk Away - *if the project clearly and objectively will never fulfill reasonable objectives, know when to stop, and accept it as a lesson learned.*
6. Know that Your Biggest Risk is YOU**. -** *remember this is NOT 'A put the key in the ignition and drive away project', problems will be encountered.*

The proposed system of command/control mother ship and flotilla of USVs could be brought into service within a reasonably short time frame. The following is an estimated project time frame, assuming limited bureaucratic hurdles:

1. Exploratory sheltered water tests and trials using an existing small vessel as mother ship with one or two RHIBs as USVs – all fitted with suitable command/control systems. This would allow progressive tests and trials and familiarization. Timeframe to start: one year. Tests and trials one additional year. After the initial test and trials period, the system could be used for training.
2. Initial command/control mother ship and USV system: define, design, build (or convert), test and trials, put into service: three years from start of the project. During the early years of service there would be a continuing learning curve as to operations, capabilities and limitations.

CONCLUSION

This paper has outlined the need for a greater maritime Coast Guard capability – to provide maritime Search and Rescue and pollution response, assist with emergency response for remote coastal communities, ensure maritime domain awareness, protect coastal sovereignty, protect critical underwater infrastructure, and any other responsibilities which may be required to ensure a Capable Maritime Emergency Response System.

It has also outlined the difficulties of making the system affordable. Ships suitable for the task are relatively large and slow, are expensive to build, maintain and operate, and are increasingly difficult to crew.
To address the issue of affordability, it proposes a system of a command/control mother ship with a flotilla of

USVs. This may take various forms, depending on operational and environmental circumstances. This could even be in the form of a small flotilla of USVs operating with an existing ship, such as a Coast Guard or naval icebreaker or patrol vessel.

The command/control mother ship with a flotilla of USVs system could allow response resources to be put in place, which would otherwise be prohibited by cost and crewing constraints if large, fully crewed vessels were required. However, the command/control mother ship with a flotilla of USVs system could work in conjunction with, and augment, other Coast Guard and other response capabilities.

There is a great deal more thought required to evaluate whether this concept could fulfill a realistic need, what it should consist of, how it could integrate, and complement, other maritime Coast Guard related resources.
This paper is intended to promote discussion on the concept of a command/control mother ship with flotilla of USVs as an affordable means of providing a capable maritime emergency response system.

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