THE MULTI-ROLE SUPPORT SHIP FOR HUMANITARIAN ASSISTANCE AND DISASTER RELIEF OPERATIONS

D Buxton, VARD Marine Inc., Canada

SUMMARY

The paper examines the contemporary multi-role platform as an increasingly sought-after national capability and discusses how this ship-type, if designed and outfitted appropriately, can provide a range of capabilities to address the constantly evolving nature of naval doctrine and maritime operations. The motivations that drive acquisition decision makers to consider this type of capability are examined, namely: operational flexibility, doctrinal relevance and affordability. An examination of the pitfalls of acquiring a multi-role platform is also presented and discussed. An overview of how modern design techniques can be applied to ensure the ship owner is provided a range of options that are easily tailored to their unique combination of requirements follows. The paper concludes by presenting a typical modern multi-role vessel within the context of a humanitarian assistance and disaster relief scenario to illustrate the utility of these vessels as an effective response capability in a non-combatant role.

NOMENCLATURE

HADR	Humanitarian Assistance and Disaster Relief
MRSS	Multi-Role Support Ship
MRV	Multi-Role Vessel

1. INTRODUCTION

What is a multi-role vessel? In the strictest sense any ship which can perform two or more functions could be identified as a multi-role vessel. Indeed, there are many diverse examples of ships that are described or labelled as being multi-role platforms. It is therefore true that the term multi-role has many connotations and can mean different things to different people. In fact, there are ships that operate at each end of the spectrum of naval operations, from logistics and combat support to high-intensity combat operations, and at many points in between, that use the moniker of *multi-role vessel*.

Looking at the Canadian example, we see at one end of the spectrum the recently announced design for the Canadian Surface Combatant program, based upon the Royal Navy's Type 26 Global Combat Ship. This ship has been described as a multi-role frigate with a centralised mission bay and that can be adapted to employ a range of weapons and sensors to allow it to execute different roles as the strategic situation requires.[1] At the opposite end of the capability spectrum there is MV Asterix, a commercial container ship converted into a multi-purpose naval support ship able to offer a range of capabilities, including: underway liquid and solid replenishment, humanitarian assistance and disaster relief, fleet medical support, helicopter maintenance, and, command and control facilities.[2]

There are many other diverse and wide-ranging examples such as the USN Independence-class littoral combat ship, HMNZS Canterbury, a multi-role vessel in service with the Royal New Zealand Navy (RNZN), the Royal Danish Navy's StanFlex frigates and, the Italian Navy's newly launched Multipurpose Amphibious vessel (LHD), to name but a few.

For the purposes of this paper, however, the notion of what constitutes a multi-role ship is deliberately more focussed. This paper will concentrate on the naval auxiliary or support ship and not ships intended for high-intensity combat operations. The *multi-role support ship* (MRSS) is defined generically as a vessel that competently performs a combination of support functions typically delivered by naval auxiliary and/or amphibious ship types. That suite of capabilities could include fleet replenishment, logistical resupply and tactical sealift, logistics over the shore, sea basing and afloat maintenance support, deployable command and control facilities and/or enhanced medical services.

The nature of a typical MRSS will allow governments to use these vessels to satisfy military, para-military and non-military (or civil) mission requirements. As such, they also serve as effective tools for foreign policy to further international relations and diplomacy in response to peace support operations in failed states, to tackle international criminal activity such as piracy and human trafficking, and to provide relief from natural disasters and address humanitarian crises.

Figure 1: The VARD 7-313 Multi-Role Support Ship presented as a case study.

2. MARITIME OPERATIONS AND THE EMERGENCE OF THE MRSS

While the context within which any given naval force operates will vary, based upon regional factors, political influences and doctrinal differences, the one constant is uncertainty. The operational context in the last 30 years has constantly evolved and perhaps remains both in a constant state of flux and as varied today as it ever has been. The uncertainty regarding what the next deployment might involve presents a challenge for procurement organizations, military planners, and operational authorities alike.

Following the cold-war era, we have seen less emphasis on traditional war-fighting force structures necessary in a bi-polar world order. The emergence of failed states and non-state actors, international terrorism and trans-border crime have produced both asymmetrical threats and humanitarian crises of significant proportions.

Natural disasters and extreme weather events, such as droughts, floods, and hurricanes, also continue to create dire situations of immense human suffering. Hurricane activity, for example, has been steadily increasing in terms of strength, intensity, frequency and duration, since the early 1980s.[3]

Accordingly, navies have had to adapt and become better equipped and trained to deal with military operations other than war. As depicted in Figure 2 below, the suite of capabilities that would be delivered by the MRSS is situated on the left-hand side of the conflict continuum, ranging from crisis response to combat support operations. While the ability to operate in contested environments can be varied for any given ship design, depending upon the addition of self-defence capabilities and off-board weapon systems, it is expected that the vessel will not normally be placed in harms way without the protection of a task group or a warship consort.

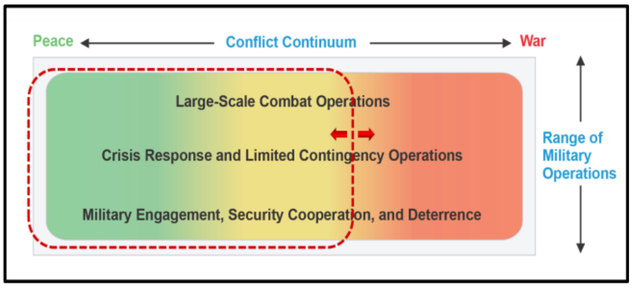

Figure 2: The Multi-Role Support Ship and Notional Operations across the Conflict Continuum.[4]

Further, military doctrine has become more collaborative where many responses to a given scenario involve multinational coalitions. Joint and combined operations involving many nations, agencies and non-governmental organizations drive the need for command and control, headquarters staff amenities, and planning and coordination facilities. Civil-military cooperation is now much more formally addressed as a requirement of contemporary military planning and the facilities to support effective interagency cooperation are vital.

A balanced fleet mix that includes combat capable vessels, ships that provide on-water support to para-military and constabulary functions, as well as other assets capable of delivering the soft-power elements needed in today's operational reality, is important. This includes the capacity to sustain a presence in an operating area, bringing substantial supplies and equipment into theatre, providing a self-contained afloat headquarters facility and getting boots on the ground to manage mass casualty situations, and provide security and safety to local populations.

Today, as we see the re-emergence of great power rivalry and a resurgence of traditional war-fighting capabilities in current force structures, the situations that have given rise to navies exploring the capability-mix inherent in the MRSS are not going away. This is the case both for the larger navies seeking to maintain a balanced force structure and for smaller navies equipping themselves to deal with regional situations and/or to contribute globally through specialization in niche capabilities. All navies need to consider how cost-effective solutions can be provided by some form of MRSS.

4. THE RATIONALE FOR THE MRSS

While the reasons for acquiring a multi-role asset are numerous, it is suggested that the rationale for any government will typically involve some combination of the following three key factors: operational flexibility, doctrinal relevance and affordability.

4.1 OPERATIONAL FLEXIBILITY

This refers to having flexibility within an operating cycle (between major dockings and depot-level maintenance periods) to respond to an urgent or emergent operational tasking. That is, having the ability to rapidly configure the vessel and mobilize for any given operation with the required mission payload, cargoes and specialist personnel embarked. When combined with an ongoing training and exercise program, this gives the government options to deploy quickly in response to any situation and allows for a high-readiness and agile posture on the part of the vessel operator. The inherent attributes of the MRSS that lend themselves to providing this operational flexibility include:

4.1(a) Ample Space and Deadweight Allowances

The MRSS is designed with large open and reconfigurable multi-use compartments and a sizeable deadweight capacity for cargo and mission payloads that lends itself to maintaining a flexible posture. The density for an embarked mission package will not vary radically whether transporting a mechanized infantry battalion or heavy equipment, vehicles and relief supplies for disaster response.

4.1(b) The Commercial Vessel Pedigree

The MRSS platform can be operated by a relatively small crew, often in a two-crew rotation system and, in many organizations, a civilian or hybrid civilian/military complement. Facilities for routine mission personnel, embarked as needed, to support capabilities such as helicopter operations and special forces, are also provided. Additionally, surge capability to provide hotel and support services for larger numbers, albeit in more austere accommodations, are also typically included.

Being based upon commercial ship designs, and being crewed and arranged in this manner, means that the operational availability that can be achieved is very high when compared with the maintenance, training and exercise time required to force generate a high-readiness complex military weapons platform.

4.1(c) Autonomy, Range and Endurance

These ships are designed with the endurance and range necessary to transport cargoes to remote and distant locations. The MRSS needs to operate autonomously in varied environments for extended periods. These vessels can also be pre-positioned within regions that are prone to natural disasters while undertaking other functions, such as training, exercise or patrol duties, and remain on station for extended periods of time. Specific mission payload items and specialist personnel can be mobilized and flown-in to a port facility and embarked en route to a specific incident to augment a standard contingency load-out when pre-positioned or forward deployed.

4.1(d) Mission Payloads

The MRSS can be designed and built with space, weight and power reservations specifically set-aside for the routine embarkation of modular mission payloads and/or force packages. A common interface specification (e.g. deck loading, securing arrangements, couplings and connections, power, data, securing arrangements) is provided to ensure maximum mission flexibility. If the payload can conform to the interface specification, then it can be embarked and operated from the ship. Mission bays, working decks, reconfigurable multi-use compartments, modular or containerized units and general-purpose spaces are included in this concept of a wholistic mission payload system. The main feature is that only minor preparation is necessary, permitting the rapid embarkation of mission payloads.

These modular items can be maintained ashore as part of the ships equipment list but only installed and set-to-work when specifically needed for a particular mission. In this way space and weight is not allocated to equipment that may only be needed occasionally.

4.2 DOCTRINAL RELEVANCE

A challenge always exists in delivering a contemporary operational capability that is timely, relevant and enduring. Arcane and lengthy government procurement processes, when set against the back-drop of the constantly evolving operational context described above, create a tension that is often very difficult to reconcile. This contributes to requirement creep that seems to impact many defence procurements, creating delays and cost overruns as new and emergent requirements are added during the latter stages of the acquisition process. Since procurement systems are traditionally slow to adapt and cannot keep pace with the prevailing operational context and technological advances, then one possible solution would be to ensure that what you procure transcends the operational doctrine of the moment. Navies need vessels that are resilient to doctrinal shifts over time and are future-proofed by design. The attributes of the MRSS that ensure continued operational relevance over the life of the asset include:

4.2(a) Scalable and Reconfigurable

What is embarked to perform a specific operation is scalable to the needs of that operation. Only the mission payload and specialist personnel need be embarked to complement the MRSS' core personnel and embedded capabilities. The MRSS can support missions ranging from lengthy patrol conducting anti-piracy operations or sanctions enforcement, to tactical sealift and amphibious landings, within a regional theatre of operations. In the first example, it may act as a mothership for maritime interdiction operations using small craft and helicopters, while in the second it would embark a mechanized infantry unit.

The MRSS is readily reconfigurable using moveable bulkheads, tracks, panels and hoistable decks. These features, often referred-to as flexible infrastructure, are easily integrated into this type of ship given their size and typical arrangement. When combined with modular furniture and fixtures, large spaces on the ship can be sub-divided for purposes such as refugee processing, triage for a mass casualty situation, stowage of segregated cargoes or used as surge accommodation for embarked personnel.

4.2(b) Adaptable

The RAND Corporation supports the argument that geopolitical uncertainty strengthens the case for adaptable ship design making it desirable to ensure adequate margins exist for ship services, namely power, cooling, personnel amenities, space, and bandwidth.[5] The MRSS design approach provides for these margins. For amphibious capability, they need to have the facilities to accommodate large cargoes and be able to embark many supernumerary or transient personnel. To provide command and control functions for an embarked incident command or forward deployed headquarters staff, the required bandwidth needs to be built-into the ship to accommodate administrative and tactical computer networks, communications systems, and data fusion needs.

The MRSS is also adaptable by re-allocating space, such as unoccupied lane-metres on the vehicle deck or space on the upper decks, to other temporary purposes. For example, additional power can be added through containerized generators and energy storage modules, potable water production capacity augmented with demountable reverse-osmosis desalination units plumbed to a fitted sea-bay, or skid-mounted air conditioning plants connected to auxiliary connections fitted on the chilled-water system.

4.2(c) Upgradeable

The notion of upgradeability is closely linked to adaptability but intends to specifically address the insertion of new technologies and/or the replacement of existing systems or equipment with the latest updates. To accomplish this the ship design employs open and flexible systems architectures, along with the integration of commercial, off-the-shelf equipment that utilize standardized interfaces. Attention to maintenance envelopes and removal routes during the design process will be important to maximize this potential.

The concept of ‘fitted for but not with’ could also apply here in that the ship could be built in anticipation of potential future missions and the downstream installation of equipment such as specialised lifting appliances, additional generators or water-making facilities.

4.3(d) Common Hull with Optional Topside Blocks

For larger navies, or potentially multi-national programs, there is the potential to consider the MRSS as a family of ships, using a common platform with a range of topside configurations. Designing and building the ship with this block philosophy also facilitates mid-life modification if required to address changes in doctrine, missions and technology.

As such, the MRSS could be retrofitted and repurposed between different primary roles. If outfit density, stack-up lengths, HVAC and electrical loads are generally consistent then the business case to undertake the work and repurpose the vessel could be examined. Presuming of course the condition of the vessel and remaining useful life of the underlying hull and main machinery provide for an adequate timeframe over which to realize a return on the investment.

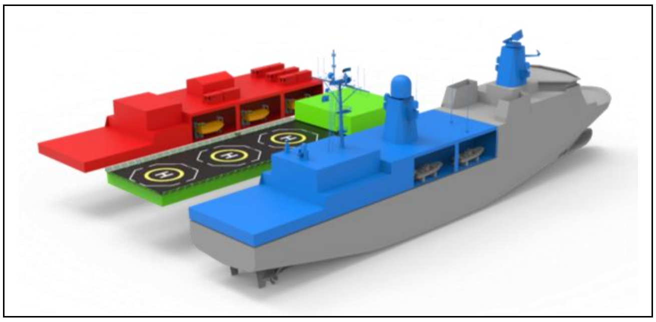

Figure 3: The retrofit of topside blocks for repurposing between primary roles

If this possibility is contemplated at the outset of the program, then the ship can be designed and built in blocks that facilitate this type of conversion in the future.

4.3 AFFORDABILITY

The best value solution is one which provides the required level of mission effectiveness for the lowest total ownership cost over the entire lifecycle of the asset. The three key themes in addressing the best-value question are:

4.3(a) The Fleet Mix – Doing More with Less

In the first instance, affordability should be assessed in terms of the overall fleet mix. Is it better to own a specialized hospital ship, a fleet replenishment vessel and a dedicated sea-lift capability or three MRSS that can cater to all those missions, albeit perhaps not to the same extent as a specialized vessel? Given commercial crewing regimes and utilization rates, could the capability resident in three specialized vessels be accomplished with just two MRSS?

Acquiring multiple MRSS also lends a measure of redundancy to a fleet operations plan knowing you have a like-asset able to backfill another in the event of unplanned downtime.

4.3(b) Reduced Capital Expenditures

Over the last four decades the inflation rates associated with naval shipbuilding has consistently exceeded twice that of normal inflation indices.[6] An MRSS designed, built and operated to commercial standards and maintained in Class will be inherently less expensive to acquire and operate than a traditional military asset.

Given the commercial pedigree of this ship type, using state-of-the-market, type-approved (i.e. non-developmental) equipment, that is commercially available off the shelf, will streamline integration, installation and set-to-work. It will also come at a lower initial price point and with a well-established support program, resulting in lower up-front integrated logistics support costs.

4.3(c) Reduced Operating Expenditures

Higher utilization rates and operational availability may allow the same number of operational sea days to be achieved with fewer assets. Additionally, if a commercial or hybrid crewing and operating model is employed, and, given the potential for achieving higher utilization rates, the cost of ownership per operational day is driven even lower. Further, owning multiple identical assets, or cooperating with other like-minded nations in a parent-navy arrangement, will allow for class management and economies of scale to be realised for training, sparing, and maintenance.

Of course, assessing the mission effectiveness of all options – that is, the how, where and when of bringing operational capabilities to bear – is an important part of the calculus in determining best value.

5. THE PITFALLS AND ACHIEVING AN OPTIMAL OUTCOME

5.1 AVOID INCOMPATIBLE MISSION SETS

The main situation to be cognisant of is ensuring that the vessel, as designed, is competent to perform the roles it is required to undertake. That is, avoiding the "jack of all trades and master of none" outcome where multi-purpose is synonymous with multi-useless. Fundamentally different types of ship have different design drivers, and this leads to great differences in configuration in the underwater hull forms, above water hull and superstructure, propulsion plant and auxiliaries, and hotel services for the persons on board. In some cases, they are also subject to differences in regulatory requirements, which can also affect design outcomes significantly.

The objective is to identify and avoid trying to combine fundamentally incompatible mission sets.

5.2 FINDING THE RIGHT BALANCE

Any multi-mission ship is a compromise between design drivers that will inevitably conflict to some extent. It will be sub-optimal in every mission, to a degree reflecting the priority given to each capability in the design. Despite this, many naval vessels today are considered multi-mission, and the disadvantages are accepted as being smaller than the costs of trying to justify a necessarily larger fleet of more specialised ships. Aiming for the gold standard in every mission requirement will drive size and cost. Walking back on current capabilities in any area will need careful consideration and a thorough analysis of operational effectiveness.

The hull must provide enough buoyancy to support the weight of the ship itself and the weight of everything it is required to carry. Bulk cargoes are dense, people are not, but containers and vehicles fall in between. Accordingly, the hull form design must provide enough buoyancy for the maximum displacement while still meeting speed and sea-kindliness requirements to be operationally effective.

Another challenge will be to arrange ballasting and subdivision to address a range of deadweight and stability conditions in different mission configurations. Considerations such as damage tolerance and vehicle loading lead to people and vehicles being carried high in the ship, increasing the stability management challenge.

Depending on the hull form, ballast and stabilization systems may be needed and pose other challenges for the hull designer. If the deadweight requirements, along with outfit and load-out densities, are relatively consistent then an optimum hull form and propulsion arrangement can be developed. Powering needs to consider a range of missions and may use hybrid solutions for maximum flexibility and capability.

Internal layouts need to consider work flows for safety and effectiveness. How the ship is arranged internally can be optimised around both the higher priority missions and an analysis of the work flows required to safely execute those missions with the desired level of effectiveness.

5.3 CREW COMPETENCY PROFILES

One of the biggest drivers of through-life costs is personnel. In an era, particularly with commercial ship operations, where an emphasis has been placed on automation and autonomy with a view towards reducing crew sizes, building a ship that has many varied and specialised functions will require many crew competencies. This would tend to drive crew sizes higher and will create a training burden that could challenge normal occupational structures and crewing models.

Maintaining a required complement of suitably trained and experienced personnel is a vital component of both readiness and mission effectiveness and cannot be divorced, or considered separately from, the asset itself. Accordingly, the crew, and the enabling competency profiles, should be considered as an integral part of the capability when requirements are initially set and then more fully considered during early stage concept design work. The competency profiles will change and evolve as those requirements are more fully defined and validated. Part of the solutions to resolving any challenges of this nature could be to consider specialist personnel as being an integral part of the mission payload or modularity concept. That is, when the mission payload is embarked the specialist personnel will also embark and augment the core crew complement.

The bottom line is that a work flow and crewing analysis should be performed early and then refreshed with each major design review milestone.

5.4 EARLY DESIGN COLLABORATION

When developing a multi-role vessel design the best contracting strategies are those that promote early-stage design collaboration. Integrated early stage collaboration between expert ship designers and expert ship operators is vitally important to ensuring realistic expectations are established and an optimum outcome is reached. In the case of HADR operations, adding expert end-users, such as non-governmental organization and aid agencies, into the discussion is also important. Those who have experienced the circumstances in which the vessel will be operated are key to developing an optimally arranged and workable solution.

Designing a multi-mission platform will be challenging and will inevitably require trade-offs. Choices will need to be made and this needs to be done within the context of mission effectiveness and a clear articulation of operational priorities. To accomplish this in a process that involves many stakeholders, likely with competing views and motives, and a long list of multi-mission requirements, the designer has two key tools in the toolbox – set-based design and scenario-driven design techniques.

5.4(a) Set-based Design

A set-based design approach, where modern ship-design tools and methodologies are applied concurrently, is ideal for the MRSS. Having the ability to leverage a family of parent vessel concepts will provide the experienced designer a viable basis around which to bound the design-space and establish a starting design-set. As opposed to point-design, this design-set allows for multiple options to be considered for as long as possible during the concept development process. These design options are simultaneously explored with sub-optimal choices eliminated progressively over time as clarity is gained and evidence-based decisions are made.

This in turn will permit a dynamic work environment to quickly and effectively respond to changing requirements as discussions with end-users ensue and their own unique combination of needs are described in detail. It enables greater flexibility and a more agile design process by committing to technical solutions only after requirements are reconciled and validated based on mission effectiveness and cost.

5.4(b) Scenario Driven Design

Scenario driven design involves the application of operational scenarios developed by ship operators and end-users to help the designer understand operational intent. This will help guide the design team towards a purpose-driven whole-ship and system-level design based upon operational imperatives, procedures and workflows. Scenarios need to be realistic and relevant to afford multiple perspectives of workflows and provide a tangible and effective way to engage end-users in early design stage discussions. This collaborative approach will allow the designer to assimilate and synthesize a great deal of information quickly by providing real time context for operations that is in turn tempered by realistic expectations regarding technical feasibility and affordability. Scenario driven design will help ensure alignment between operational intent and design intent before detailed design and engineering work commences.

6. CASE STUDY: DEPLOYING THE MRSS ON HADR OPERATIONS

6.1 THE MULTI-ROLE SUPPORT SHIP

The VARD 7-313 is a multi-purpose vessel designed as a flexible platform to aid in force projection, maritime special operations, EEZ patrol, and humanitarian assistance. Typical for vessels of this type, the vessel has significant capabilities for offloading heavy equipment, carrying cargo, transporting troops, launching boats, and supporting aviation operations.

Figure 4: The VARD 7-313 HADR Variant

The internal roll-on/roll-off facilities accommodate a variety of equipment including tanks, trucks, and ISO containers which can be efficiently loaded from a pier via ramps on the stern and vessel’s side. Two full-breadth cargo holds located beneath the vehicle deck provide extra storage capacity, while protected areas forward house expansive troop accommodations providing safe and comfortable passage for embarked personnel. Large open deck areas on each side of the vessel provide secure stowage for two 15 m landing craft and two 11 m rigid-hulled inflatable boats. Aviation facilities include a flight deck capable of landing two medium lift helicopters and a hangar accommodating a total of four.

MAIN PARTICULARS

Length overall	130.0 m	436'-4"
Length waterline	123.9 m	406'-6"
Breadth moulded	24.0 m	78'-9"
Depth main deck	9.0 m	29'-6"
Design draft	5.4 m	17'-8"

PERFORMANCE

Speed	20.0 kn max
Range	8,000 NM @ 16 kn
Endurance	30 days

CLASS

BUREAU VERITAS I✠HULL MACH RoRo Cargo Ship, AUT-UMS, AUT-CCS, AUT-IMS

Figure 5: VARD 7-313 Principal Particulars

Expansive medical facilities are readily accessible from the flight and boat decks. The substantial internal area is dedicated to configurable offices and operations areas to support various mission types. As shown in Figure 6 the VARD 7-313 offers a high degree of utility with a substantial allocation to of area and volume to cargo and both fixed and flexible mission spaces. There are 475 lane-meters or 1,330m^2 of total modular area on the vehicle deck plus another 740m^2 of reconfigurable flexible mission space.

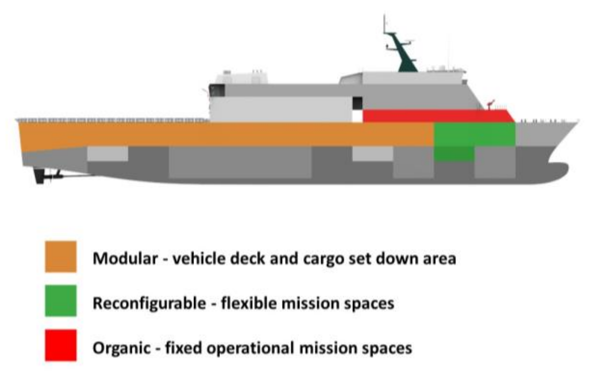

Figure 6: VARD 7-313 mission space distribution

6.2 HADR CONCEPT OF OPERATIONS

There are several different references that describe a framework for how to plan and execute a humanitarian assistance operation. Whether one examines the UK Ministry of Defence Joint Doctrine Publication 3-52[7], the ASEAN Forum Strategic Guidance for Humanitarian Assistance and Disaster Relief[8], or any number of other documents, the approaches are all very similar. For the purposes of this case study, the execution of a typical HADR operation will consist of the following five phases: Mobilization; Immediate Life Saving; Needs Assessment; Stabilization; and, Recovery.

6.3 OPERATIONAL SCENARIO

The generic scenario describes a category 5 hurricane that makes landfall on a small island nation in the Caribbean Sea with devastating results. Coastal towns and infrastructure are destroyed in high winds and tidal surges, including port and harbour facilities, and local airports and airfields have sustained heavy damage. Infrastructure, including the power grid, communications networks, and municipal water and sewer facilities have sustained significant damage and are inoperable. Many local roads are impassable. While information is sketchy and difficult to verify, media is reporting widespread loss of life, significant injuries as well accounts of many people whose whereabouts are unknown.

The vessel was pre-positioned and forward deployed conducting training exercises off the Atlantic seaboard of the United States. The ship is crewed by a core complement and is outfitted with a standard HADR contingency load-out. This includes medical and relief supplies, 5-ton transport trucks, water and fuel bowsers, heavy equipment, lighter reconnaissance vehicles and ambulances, a modular field hospital, deployable shelter systems, a mobile command post and two demountable reverse osmosis desalination plants. One light reconnaissance helicopter and two heavy-lift helicopters are embarked along with flight crews and aircraft maintenance personnel. A deployable modular raft ship-shore connector system is also embarked.

Authorities have been tracking the developing weather situation and a decision was taken early by national authorities to task the ship to prepare for a major hurricane response. Models are predicting the storm will make landfall as a category 4 or 5 hurricane within the next 48-72 hours.

6.3(a) Mobilization

Immediately upon being tasked the ship steamed directly to a Southern US port to embark additional equipment and specialist personnel flown in to meet the ship. A troop of military combat engineers, a military policy security detachment, urban search and rescue specialists and additional medical surgical and trauma teams joined the ship. Additional medical and relief supplies were also embarked along with additional temporary shelter systems and construction materials to aid in the repair of critical infrastructure. Personnel from various non-governmental organizations and aid agencies were also invited to join the ship for the voyage south. Headquarters and military planning staffs joined the ship along with several liaison officers trained in civil-military relations. A third heavy lift helicopter from an allied navy was also assigned to the ship.

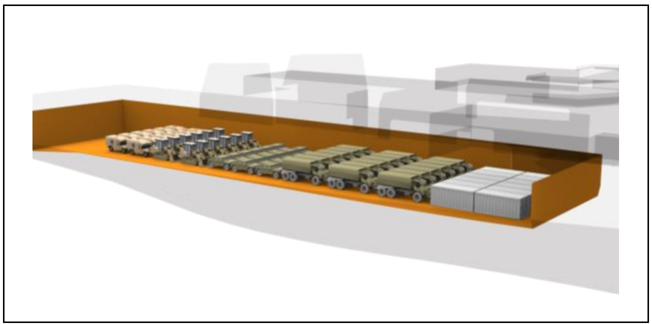

Figure 7: Typical load-out of vehicle deck for HADR operations

Once loaded, a route, avoiding the worst of any residual weather was planned, and the vessel sailed with all dispatch to the affected area.

6.3(b) Immediate Life Saving

En route to the area, the ship is tasked as a vessel of opportunity by local SAR authorities to respond to any cases resulting from the storm activity in the area.

Upon arrival on scene the focus in the first 48 hours is life saving and harm minimization. Off-board systems are immediately deployed: helicopters are dispatched to conduct aerial reconnaissance and the ship's boats are deployed to assess the situation in the ports and along the coast. Liaison officers are transported ashore to establish contact with the local emergency management authorities. Helicopters and the ships boats are tasked with search and rescue operations.

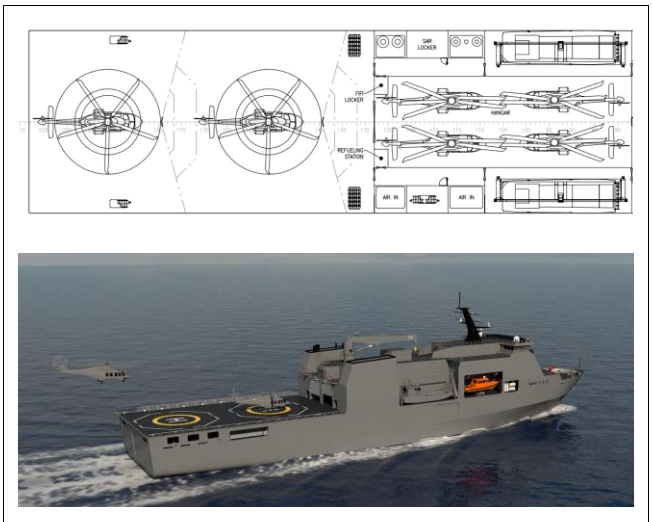

Figure 8: Aviation arrangements

The arrival of the ship brings a self-contained fully staffed and operational NATO Level II hospital facility to the scene for casualty receiving and treatment. Medivac is conducted as needed to transport urgent cases to the ship where they are received in triage and treated appropriately. Those requiring emergency surgery are treated and then cared-for in the ICU ward. Flexible mission space is configured as a recovery ward and to accommodate those patients not requiring intensive care.

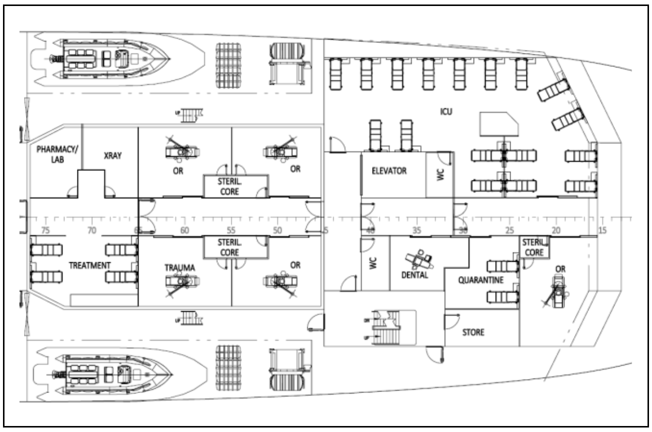

Figure 9: On-board medical facilities

Security detachments can be deployed to work in cooperation with local authorities to help maintain order in what has likely become a very chaotic situation.

6.3(c) Needs Assessment

The on-scene commander, having now established direct liaison with local authorities, and the planning staff have begun to assess the information they have received in the onboard command and control facilities. NGO and aid agency staff are working from assigned on-board office and planning spaces in a coordinated and fully integrated manner. A priority list of urgent needs is established, plans created, and resources are allocated.

A decision is made to create a suitable beach head for landing equipment and marshalling relief supplies ashore. Military engineers are deployed to scout a suitable landing beach and prepare it for landing operations. Heavy equipment and supplies are landed using the ships landing craft while the crew begins assembly of the larger modular raft ship-shore connector in preparation for larger scale landing operations.

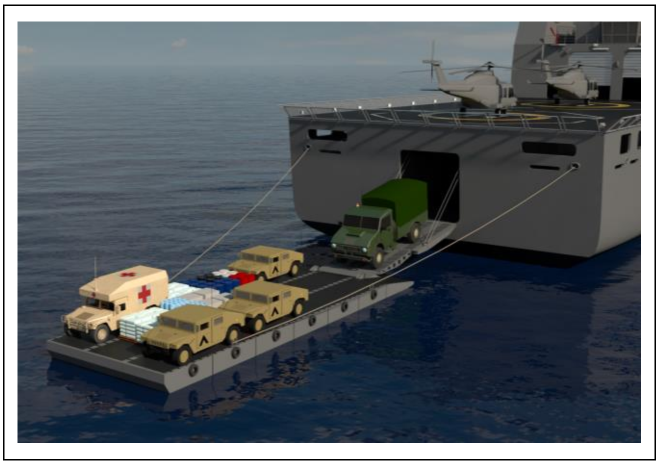

Figure 10: Ship-shore connector

A security perimeter, secondary command post, marshalling area and medical receiving facility are established immediately inland from the beach head. Critical aid supplies are prioritized and begin getting transferred ashore for distribution from the marshalling area.

6.3(d) Stabilization

Over the course of the first 5 days, having addressed the most urgent needs, stabilization efforts begin to preserve life. Aid supplies continue to get offloaded and distributed as needed. Temporary shelters are disembarked and set up to provide safe and secure accommodations for displaced persons. Medical cases are assessed ashore with urgent cases referred to the onboard medical facilities for treatment.

One of the most critical elements will be the provision of potable water. The ship can provide potable water directly from the onboard water storage tanks to bowser trucks and trailers on the vehicle deck which are then transported ashore and distributed as needed. To augment the ships production capacity demountable reverse osmosis desalination unit can be plumbed to a manifold connected to a sea-bay. These demountable units will then be transitioned ashore to support water purification needs locally where needed.

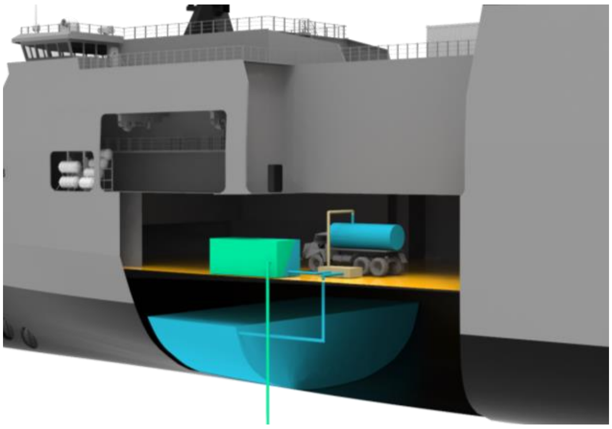

Figure 11: Provision of potable water

6.3(e) Recovery

Over the first 4 weeks the engineering teams, their equipment and building materials are utilized in the remediation of sea port and airport facilities. This will be performed on a priority basis to allow airlift and sealift operations to begin in earnest. Reconstruction of local medical facilities and restoration of utilities will ensue, and ambulatory medical cases can begin to be transferred ashore as local infrastructure and services are restored.

Once infrastructure has been restored and command post operations fully transitioned ashore the ship can then undertake resupply missions as needed. Transition of the operation to local authorities is undertaken and will occur as rehabilitation continues.

Figure 12: Resupply Operations

7. CONCLUSION

The best answer to any question is often the simplest. In that vein, perhaps the emergence of the contemporary MRSS is simply a response to the prevailing operational context within which many of today's naval forces around the world operate, where necessity becomes the parent of invention. While that might seem like a glaringly obvious statement the proliferation of the MRSS as a concept in the minds of naval planners, on the drawing boards at design houses, under construction in shipyards and alongside at naval bases around the world cannot be a coincidence.

The MRSS vessel type is particularly adaptable to ever-changing prevailing operational needs of small and large navies alike. The vessel will provide an ideal platform from which to mount a comprehensive and self-contained response to HADR operations. An optimal solution will produce the benefits of operational flexibility, doctrinal relevance and affordability. These benefits can all be realized if the procurement approach permits early design stage collaboration between expert ship operators and expert designers.

REFERENCES

1. Naval Technology, 'Type 26 Global Combat Ship (GCS) Programme', *Verdict Media Limited*, https://www.naval-technology.com/ projects/ global-combat-ship-gcs-programme/ (accessed 14 May 2019).

2. Federal Fleet Services, 'Resolve Class AOR Fact Sheet', http://federalfleet.ca/wp-content/ uploads/2016/07/Resolve-Pamphlet.pdf (accessed 14 May 2019).

3. Katharine Hayhoe et al., '20014 National Climate Assessment', *U.S. Global Change Research Program*, https://nca2014.global change.gov/highlights/overview/overview (accessed 14 May 2019).

4. Joint Publication (JP) 3-0, 'Joint Operations', *United States Joint Chiefs of Staff*, 2017.

5. John F. Schank et al., 'Designing Adaptable Ships', *RAND Corporation*, 2016.

6. Mark V. Arena et al., "A Macroscopic Examination of the Trends in U.S. Naval Ship Costs Over the Past Several Decades', *RAND Corporation*, 2006.

7. Joint Doctrine Publication (JDP) 3-52, 'Disaster Relief Operations Overseas: the Military Contribution', *UK Ministry of Defence*, 2016.

8. ASEAN, 'Strategic Guidance for Humanitarian Assistance and Disaster Relief', *ASEAN Regional Forum*, 2010.

AUTHORS BIOGRAPHY

Derek Buxton holds the current position of Director Government Programs at Vard Marine Inc. He is responsible for global business development in the government vessels market segments including offshore patrol vessels, icebreakers, military survey ships and naval auxiliary vessels. His previous experience includes a combined 32 years of service as a Marine Engineering Officer and Senior Procurement Executive with the Royal Canadian Navy and Canadian Coast Guard. In 1992 he deployed with HMCS Preserver as the Deputy Engineering Officer on Operation Deliverance in support of humanitarian efforts in Somalia.