COHORT – A NEW TYPE OF EEZ MANAGEMENT VESSEL

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UNDERSTANDING THE EEZ

Extreme Diversity

Before providing a solution to managing an Exclusive Economic Zone (EEZ), one must first understand what an EEZ is and what it means to that nation and neighbouring nations. Is this an obvious statement? As BMT Defence Services explored how to provide a solution it became apparent that many in the industry equated EEZ management to Homeland Defence Naval Operations. This viewpoint is supported by other solutions that have appeared in journals recently, where a modified naval Offshore Patrol Vessel (OPV) is offered. Each of these solutions has credibility but only for part of the requirement.

This viewpoint that EEZ management is purely or predominantly a military activity is a misconception. BMT Defence Services sought to strip away this misconception and examine the true requirements of EEZ management. For this reason this paper starts with an outline of the diversity of requirements that comprise EEZ management.

EEZ ACTIVITIES

Potential for a Nation’s Success

The EEZ concept was created by the “UN Convention on the law of the Sea, 1982”\(^1\). It allows nations to claim a geographical area of sea to use for its own advantage e.g. the ability to sell fishing licenses etc. Claiming an EEZ also places a number of obligations on the host nation with the aim of preserving and controlling the EEZ for the benefit of all.

EEZs are extremely significant Politically, Economically, Environmentally, Socially, Technically and Legally. 36% of the world’s oceans are someone’s EEZ and 97% of world trade travels by sea i.e. passes through an EEZ.

The following outlines the main EEZ activities. The source of this list is the UK Defence Export Sales Organization who put considerable effort into raising awareness of EEZ’s.

When reading the following descriptions, not only should it enlighten the reader to the diversity of activities, but demonstrate that many of them are more akin to “commercial” or “workboat” activities rather than “military” or “coastguard” duties.

It should become clear that a traditional OPV based design is unlikely to be able to conduct all EEZ activities. This leads to the requirement for a vessel that has diverse capability, which is flexible in its operation and can quickly and easily adapt to a different role. The design should be capable of carrying out “workboat” type roles, from pollution control to submarine rescue, without compromising other tasks.

Nations approach these activities from different perspectives, partly dependent on their existing infrastructure, and their approach to policing; some use military or paramilitary resources to undertake the predominant non-military “commercial workboat” activities.
Fishery Management

Fishery management is a key EEZ activity. Many nations have a system of licences and quotas to generate revenue and preserve stocks and these laws need policing and controlling. Surveillance and evidence gathering are essential to secure convictions and/or collect fines if illegal activities are being carried out.

<table>
<thead>
<tr>
<th>Surveillance and Communications</th>
<th>Vessel Tracking and Monitoring Systems</th>
<th>Licensing</th>
<th>Harbour Checks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield Assessments</td>
<td>Stock Protection and Conservation</td>
<td>Boarding Operations</td>
<td>Arrest, Prosecution and Penalty Procedures</td>
</tr>
</tbody>
</table>

Maintenance of Law and Order

For some nations, controlling smuggling is a full time job requiring high manning and equipment levels. A vessel that can conduct operations efficiently will be of benefit.

<table>
<thead>
<tr>
<th>Customs and Excise Duties</th>
<th>Suppression of Arms and Drugs Smuggling</th>
<th>Limiting Illegal Immigration</th>
<th>Operations against Terrorism and Piracy</th>
</tr>
</thead>
</table>

Safety of Navigation and Transit

Responsibility for maintaining the safety of navigation and transit often resides in different government departments, but it is still an important EEZ task. A nation may have dedicated vessels for servicing navigation marks or carrying out Search and Rescue, but an EEZ vessel that is able to fully undertake both roles would be the optimum solution.

<table>
<thead>
<tr>
<th>Traffic Monitoring and Control</th>
<th>Navigation Systems</th>
<th>Hydrographic Services</th>
<th>Search and Rescue</th>
</tr>
</thead>
</table>

Protection for the Environment

Protecting the environment is an important obligation for any nation that claims an EEZ. An EEZ vessel that can conduct these activities could provide savings on investment in environmental protection infrastructure.

<table>
<thead>
<tr>
<th>Protection of Natural Resources</th>
<th>Pollution Control</th>
<th>Crisis Management</th>
<th>Humanitarian Relief</th>
<th>Regulation of Tourism</th>
</tr>
</thead>
</table>

Additional Activities

In addition to the activities identified by DESO, BMT Defence Services propose that a vessel of this type could undertake or assist with the following. Some of these activities are supported in the commercial sector, but if a government vessel can assist then the nation has opportunity to raise additional revenue.
A New Solution

Whilst it is true that some nations conduct a selection of the above activities with their military or paramilitary organizations, there is a vast difference between a vessel that attempts to conduct these activities as supplementary roles and a vessel that is intentionally designed to conduct a broad range of these activities.

This paper describes a unique ship with versatility to address the entire spectrum of EEZ management challenges across an extensive range of scenarios for the diverse EEZ roles.

Underlying the design principles is the ability for nations of all stages of technological standing to both build and operate, whilst those looking to use future technology to enhance their EEZ management can employ its integral autonomous vehicle capability. With defence budgets under pressure, manpower resources often scarce and the high risk associated with placing personnel into precarious situations, autonomous vehicles can provide a cost effective alternative to increasing capability.

![Figure 1 - COHORT](image)

Versatility is provided in the integrated arrangement of the spacious aft working deck, garage deck and helicopter platform. Interlinking handling equipment supports embarkation and disembarkation of a wide variety of autonomous vehicles, interception craft, stores modules, navigation buoys, and even submarine rescue vehicles.
The remainder of this paper explains the scenario-based approach to developing the concept of operations for the vessel and thus how the design evolved to provide effective performance in each scenario.

It is proposed that as a result of this scenario-based approach COHORT provides the basis for a family of future-proof EEZ management vessels offering exceptional value for money through high utilisation.

STRATEGY BASED DESIGN PROCESS

Adapting a Business Model

Debunking misconceptions about EEZ management and re-enforcing understanding of the diversity and non-military nature of many of the activities, was just the first step in the design process. The COHORT design was part of BMT Defence Services “Skunk Works” programme. This programme has four main objectives as illustrated in Figure 2. Innovation is a key component and is sought in the broadest definition. For this reason the Skunk Works team is chosen afresh each time, to encourage exploration of new approaches to design, in addition to innovation in the design itself.

Figure 2 – Skunk Works Objectives

It is common practice in many nations to make use of Systems Engineering approaches to design, developing a solution that is rooted in clear requirements analysis. The use of Scenario Analysis is recognised as a valid technique to assist this process.

This Skunk Works project tested the adaptation of a business model to develop the requirements and solution together, within a framework of scenarios. The business model was intended for developing business strategy and provides a fairly rapid process to eliciting and exploring solutions that can be iterated for the required level of detail. The following paragraphs provide a high level overview of the process.

The approach was an adaptation of the JOURNEY approach developed by Eden and Ackermann. It leads the design team through a process of surfacing issues facing each stakeholder, Goals of the design team and Competences that can support those goals. Cognitive mapping was used at each stage to develop an understanding of the inter-relationships and unknowns within the picture being created. The following section provides an outline of the process. The supporting figures are intended to provide an indication of form rather than content of the outputs of this process.

The first stage was to map out the issues, refined to determine the Key Issues. The second stage was to further explore the underlying issues, using a process of “laddering up”, until the crux of the issue was identified. From this point, Goals were generated.
These goals could be the reverse of negative issues or reinforcement of positive issues (Figure 3).

Figure 3 – Key Issues and Developing Goals

In stage three these Goals were then cognitively mapped to develop a Goals System. In a similar manner these goals were explored further in order to identify the teams Core Goals.

Figure 4 – Goal System

Whilst this process was focused on the entire project (the design, project management, individual development objectives, business development objectives, etc.), this process captured the subset of Design Goals for COHORT, as set out below.
<table>
<thead>
<tr>
<th>Cost Effective</th>
<th>Inexpensive base design allowing consideration from most nations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of Manufacture</td>
<td>No need for high-tech manufacturing techniques.</td>
</tr>
<tr>
<td>Standard Chassis</td>
<td>Allowing individual customers to specify their exact needs.</td>
</tr>
<tr>
<td>Low Maintenance</td>
<td>This ship needs to represent the backbone of the continuous EEZ management task.</td>
</tr>
<tr>
<td>Proven Technology</td>
<td>The simplest way to ensure a cost effective and low maintenance design.</td>
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<tr>
<td>Everyday Use</td>
<td>The ability to carry out all tasks, whether routine or high profile.</td>
</tr>
<tr>
<td>Launch and Recovery</td>
<td>Of Supplementary Vehicles is an integral part of the design, allowing realisation of enhanced capability.</td>
</tr>
</tbody>
</table>

**Table 1 – Design Goals**

The fourth stage was a similar process of mapping out the Competencies, exploring them further and from them identifying the Distinctive Competencies of BMT Defence Services and then, more specifically, the design team. Subsequent iterations included incorporation of design ideas as Competencies that could satisfy the Goals.

The fifth stage mapped the Goal System and Distinctive Competencies together, so identifying where there was links and gaps. These gaps could be due to an unsatisfied Goal or an unused Distinctive Competency. These links highlighted the opportunities for innovation, whereas the gaps highlighted the need for innovation (Figure 5).

![Figure 5 – Mapping Distinctive Competencies to the Goal System](image-url)
The final stage in this process reviewed the issues for their impact on the Goal System and developed Strategies for achieving the goals. By this stage in the process many ideas had surfaced; some being alternatives to the same problem. These were brought together in the whole design; trading off options to provide a solution that best met the overall Goal System. This is when the scenarios that had been developed became most useful. This trade off was an optimization against the diverse range of EEZ activities, so providing a solution that in turn enables a nation to optimize control of its maritime zones.

**SCENARIO BASED APPROACH**

**Wind Tunnelling The Concept**

Scenarios were used both in parallel to the above process and then to “Wind Tunnel” the concept designs into the chosen solution – COHORT. The final solution was chosen as it had the greatest potential against the range of EEZ activities. Table 2 demonstrates how the features of the COHORT design support the main EEZ activities. The highlighted columns indicate the key features that integrate to enable the majority of these activities. This matrix clearly illustrates that the design features that make COHORT stand out from conventional OPV’s, i.e. the working deck, garage, A-frame and cargo handling, are the very non-military features that give the vessel such superior capability.

The section below outlines two of the specific roles that were identified and used during the design process. Coupled to these roles are scenarios that illustrate how COHORT would fulfil these roles. The scenarios show how COHORT’s unique design gives it a much larger capability over ‘conventional’ technology existing in today’s OPV’s. These scenarios generated are by no means exhaustive but do illustrate how uniquely capable COHORT is for many key EEZ activities.

On the first iteration the scenarios were without the COHORT design and were written in a goal based form. As the design iterations became more refined the goals were replaced with characteristics of COHORT and so the design was “wind tunnelled” for each scenario.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Containerised Stores</th>
<th>Aft Working Deck</th>
<th>Garage Deck</th>
<th>A-frame</th>
<th>Integral Cargo Handling Equipment</th>
<th>ASV</th>
<th>UAV</th>
<th>ASV</th>
<th>RIB</th>
<th>Helicopter</th>
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<tbody>
<tr>
<td>Endurance Patrol</td>
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<td>Border Dispute/Patrol Scenario</td>
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<td>Search &amp; rescue Scenario</td>
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<td>Submarine Rescue</td>
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<td>Salvage Scenario</td>
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**Table 2 – Capability Matrix**

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Fishery Management Role

COHORT will enable enforcement of a nation’s fishing rights and licences within its EEZ. This would entail patrol, detection and periodic boarding of fishing vessels for inspection. This will be a high priority activity due to the large economic benefits related to fishing rights/licences.

Scenario: Fishery Protection

Advantage to exploit: UAV’s give the speed of launch and transit, combined with the ability to loiter on-situation without consideration of human factors that cannot be achieved through more conventional hardware.

COHORT is carrying out routine fishery patrol. It is alerted to the presence of a motorised fishing vessel (MFV) that is behaving suspiciously 50 miles away (the detection of suspicious behaviour maybe via analysis of movement patterns/location on a tracking system or second hand via another vessel/aircraft). An appropriate UAV module is brought on deck from the garage and the vehicle is launched and dispatched to the vicinity of the MFV. COHORT also steams at full speed to the same vicinity.

The UAV locates the MFV and photographs some unusual activity on the stern before taking up a loitering position. COHORT arrives on scene some two hours later and boards the MFV for an inspection. There is a suspicious absence of nets onboard so the boarding party radio back to COHORT where the UAV photo/video footage has been examined. This analysis shows the MFV throwing nets overboard as COHORT appears on the horizon. This information results in the arrest and conviction of the MFV crew.

This compares to a scenario where the mother vessel would have to react to the intelligence. At maximum speed, the transit time to the location would allow the MFV to dispose of vital evidence. The capture of evidence in such situations is described as critical by the EEZ Protection team within the Defence Export Services Organisation (DESO).

Anti-Terrorism Role

Although anti-terrorism is not a core role of the EEZ vessel it is still absolutely necessary that the ability exist to call on and host special forces as required. To this end a scenario has been envisaged where a special forces team can occupy the vessel and integrate with its resources and modular capability.

Scenario: Harbour Protection

Advantage to exploit: On the most fundamental level, USVs allow operations in an arena that would otherwise be of risk to Naval personnel.

The threat level at Sunny Bay oil terminal has increased due to intelligence from central government. It is decided that the threat level justifies the use of an EEZ vessel with an embarked military force of Special Forces personnel. COHORT is the only vessel in the vicinity, carrying out routine fishery patrol duties and nearing the limit of its endurance. COHORT docks in a convenient fishing port where container trucks, a partial new crew and the Special Forces team are waiting for her.

COHORT remains in the fishing port for 12 hours where she is re-fuelled by a commercial provider, has a partial crew change and has three twenty foot containers lowered into her, two into the garage and one into the foredeck hatch. One of the containers contains extra USV’s for the forthcoming operation, one has Special Forces equipment and the last has
general stores for the ship. The crew sorts these supplies when the vessel is underway.

COHORT is then deployed to the area of Sunny Bay and takes up a central position. Four USV’s are launched to patrol close to the terminal and berthed vessels. The USV’s are programmed to complete a pre determined patrol route, contouring the terminal and vessels. Each USV streams real time video (plus the possibility of underwater profiling with towed side scan sonar) back to shore or directly to COHORT where it is monitored.

Something unusual is then spotted by one of the operators from the camera of USV 1; the USV is then taken into direct control from COHORT to return to the location of interest.

When USV 1 returns to have a closer look, its IR camera spots a small vessel launching an inflatable. The alarm is raised and a small Special Forces team sets out from COHORT in RIB’s to assess and control the situation. USV 1 returns to its pre-programmed patrol.

This compares to having a stand-by EEZ vessel that cannot be re-stored quickly. Patrol at Sunny Bay is then carried out with RIB’s crewed by at least four people per boat (as opposed to the minimal reaction team needed in the above example). These people would have to be armed to protect themselves – whereas USV does not and video from four USV’s can be monitored by one/two people. Also, when the alarm is raised the team that is dispatched is fresh, as they have not spent three freezing hours on patrol.

**COHORT – THE CONCEPT**

**What is in a name?**

The reader will have grasped that EEZ management covers extremely diverse activities. These are activities that require a vessel that is highly adaptable and flexible in the uses it can be put to. Some of these activities also require integration with other organizations. In addition to satisfying the Design Goals presented in Table 1 and performing well in the Scenario Based “Wind Tunnel” as demonstrated in Table 2, the COHORT concept has the following three attributes that are depicted in the definition of it’s name:

**COHORT**

A **tenth part of a Roman Legion** – The EEZ management vessel is part of the wider national defence

A **band of warriors** – There can be many EEZ management vessels

A **group of individuals** – The EEZ management vessel is itself a group of individuals – itself, the unmanned vehicles (USV, UAV, UUV), and the RIBs.

This concept is the result of a challenging review of the requirements of managing a nation’s EEZ, combined with a fresh and dynamic approach to the design process. It has satisfied BMT Defence Service’s objectives for Skunk Works on many levels (Figure 2).

The design is **Market Orientated**, stripping away preconceptions and taking a fresh review of the true requirements of effective EEZ management. It has **Innovation** in both the design and design process. It has spanned the **Multiple Disciplines** of both whole ship design and the array of activities required in an EEZ. And in so doing it has **Stretched the Capability** of EEZ management vessels, providing for an affordable, efficient, high utility vessel that implicitly incorporates future unmanned vehicle technology.
UNIQUE CHARACTERISTICS

COHORT has broken from the traditional approach often employed in EEZ vessel development. COHORT provides this with a unique versatility of ship layout and functionality encapsulated in a common platform that maximises cost effective proven technology. The family of ships can be tailored to any customer’s specification whilst maintaining flexibility within the chosen design. The following section looks at COHORT’s four key integrated features that give COHORT its high level of adaptability.

Aft working deck

COHORT boasts a 30-metre, open working deck capable of being utilised for a wide variety of tasks. This working deck links up with other key features, namely the travelling A-frame and Garage Deck. The deck allows for the transportation of large pieces of equipment, transport and deployment of specialist stores such as pollution control or research equipment, for use in a work boat role e.g. for carrying a load of navigational marks to be laid and for the launch and recovery of UAV’s.

Garage Deck & Internal Cargo Handling Equipment

The garage deck allows for stowage of a range of items as well as an area where work can be carried out in shelter such as servicing/re-fuelling of vehicles. The garage is serviced by a container/stores handling system comprising two independent gantries. These gantries, coupled with the deck hatch above, give the garage area complete flexibility to load, unload and move items as required. Items that may not be needed until later in a mission can then be stored out of the way and then brought to the front when required. This is a considerable advantage over a purely stowage area where, once stores are loaded onboard by dockside crane, they have to remain where they are until the vessel returns to port.
Stern A-Frame

The stern A-frame transforms the working deck and garage into a linked, versatile system that can move/launch/store a wide variety of items. A-frames are used extensively in the offshore industry for launching equipment in a wide range of sea-states. Travelling A-frames are not common but are fundamentally based on existing technology. COHORT's A-Frame can be used for tasks from the launch and recovery of USV's/RIB's/submarine rescue vehicles through to lifting buoys or salvaging items from the seabed.

A NEW APPROACH – A NEW TYPE OF VESSEL

Transparent and Versatile

This brief paper outlines a new approach to understanding requirements and developing a demonstrable solution. This approach draws together all issues associated with the problem, not just technical issues. It provides this in a manner that does not need the designer to have knowledge of specific requirements management tools. Further its visual and collective approach provides a more vibrant discussion between designers and facilitates the generation of innovative options.

The COHORT design illustrates the potential of this new approach. This paper outlines the wider issues that impact on the requirements of an EEZ management vessel and has sought to broaden the reader’s perspective of this type of vessel. COHORT provides an adaptable level of capability, based on a single platform design, which is suited to meet the wide spectrum of technological readiness levels of nations around the world.

REFERENCES

1 UN Convention on the law of the Sea, 1982

