# "The Queen of Wessex"

## Team Wessex

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The Royal Institution of Naval Architects

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Institute of Marine Engineering, Science & Technology – IMAREST

**Western Joint Branch Design Challenge 2017**

## PRINCIPAL PARTICULARS:

| | |
|---|---|
| **Waterline Length** | 65m |
| **Beam** | 14m |
| **Draught** | 3.5m |
| **Depth** | 6m |
| **Displacement** | 1560 tonnes |
| **Cb** | 0.40 |
| **Max speed** | 22 knots |
| **Range** | 1200Nm (out and back with 14 days loiter) |
| **Endurance** | 14 days |
| **Propulsion** | |
| **Type** | Twin Podded propulsions, diesel electric: Azipod® CO1400 |
| **Propeller diameter** | 1.5m |
| **Total Power Load** | 7720kW |
| **Engines** | 2 x 9L26 Wartsila engine<br>1 x 8L20 Wartsila engine |
| **Capacities** | |
| **Rescuees** | 1000 |
| **Crew** | |
| **Water production** | 60 tonnes/day |
| **Water storage** | 50 tonnes |
| **Fuel Oil** | 150 tonnes |
| **Capabilities** | |
| **Fast response** | 2 x 8.5m RIBs |
| **Well deck** | Up to 14m RIB vessels |
| **Reconnaissance** | Tethered and remote UAVs |
| **Embarkation** | 2x drop down ramps |

## CONOPS:

**Expected Operations:**

The vessel is expected to sail from a number of ports in the Mediterranean to the North African coast to conduct 14 days maximum rescue missions, to rescue up to a 1000 people who are attempting to cross the sea in unsafe vessels.

**Scenarios:**

Three scenarios are envisaged and designed for:

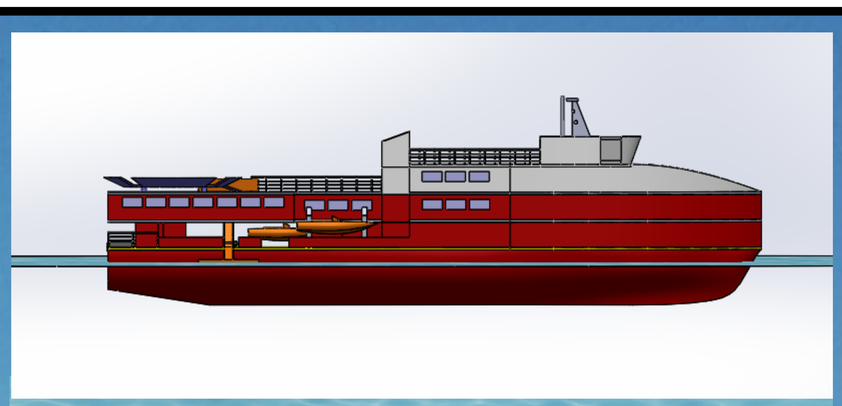
1. Overboard (people in the sea after vessel capsize / sinking).
2. Overcrowded Rib (bounding case 15m inflatable, 150 people).
3. Overcrowded large fishing vessel (bounding case 500 people).

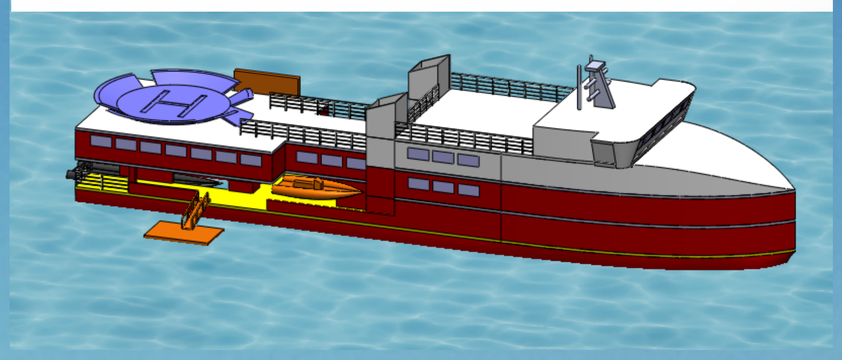
**Rescue Methods:**

The vessel is able to rescue people in each scenario by using a range of rescue methods detailed in *EMBARKATION*. Operations will be controlled from the bridge, aided by live aerial footage from UAVs encircling above the vessel to identify people in distress.

**Rescuee Processing:**

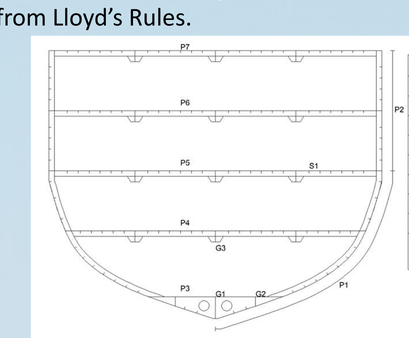
The vessel is able to provide medical services and shelter for up to a 1000 people, with facilities for evacuation by helicopter for severely injured people. The vessel will also have facilities for processing and seating, ascertaining their nationality and other details, and providing necessary service until return to safe port (duration 48 hours approx).






## MIDSHIP STRUCTURES:

- The design pressure for the worst case (midship bottom) was calculated using Lloyd's Rules as being 118 kN/m$^2$.
- Steel was selected as a material for construction due to strength and low cost. The beams were sized according to the inertia, modulus and web area calculations from Lloyd's Rules.
- The number of sections selected has been limited to three to ensure ease of construction.

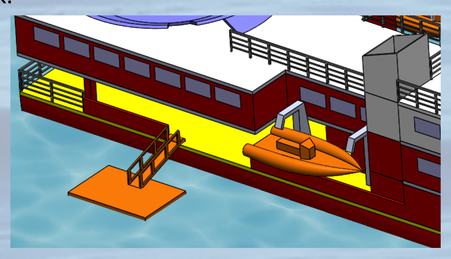



| Specification | |
|---|---|
| Section | Details |
| P1 | Bottom Shell 8mm Steel |
| P2 | Side Shell 6mm Steel |
| P3 - 6 | Tween (Internal) Deck 6mm Steel |
| P7 | Weather Deck 6mm Steel |
| G1 | Center Girder 1m height |
| G2 | Side Girders 430mm height |
| G3 | Deck Girders 500m height |
| S1 | Secondary Longiudinals; 100mm height, bulbs, 593mm spacing |

## EMBARKATION:

**Ribs:**

The vessel is fitted with two 8m ribs, manned by 3 crew each. The ribs are stowed on each side of the vessel and can be lowered to the water by crane. During rescue operations, the ribs will go to any boats in distress and provide lifejackets as a first protection. Then they will guide the rescued boats to the Well Deck.



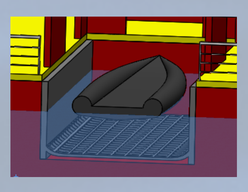
A simple Solidworks model showing the lowered platform and a rib in its docked position.

**Platforms:**

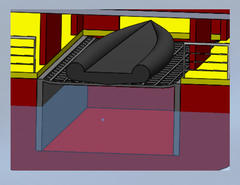
Two inflatable platforms at the end of a gangway can be lowered to the water from a vertical position, as shown above. These can then provide a stable platform for rescuees in the sea to access the vessel, or a floating dock for rescuees to be unloaded from the ribs.

**Well Deck:**

At the stern of the vessel there is a 15m long, 6m wide well deck. A hard mesh platform will then rise from the bottom of the well deck with hydraulic power and lift any inflatable vessel present. It is capable of lifting a bounding case of a 14m rib with 150 people on board, or the returning rescue ribs. Once the rescued boat is secured, rescuees can simply walk onto the main deck level.



Mesh lowered – boat in well deck.



Mesh and boat raised.

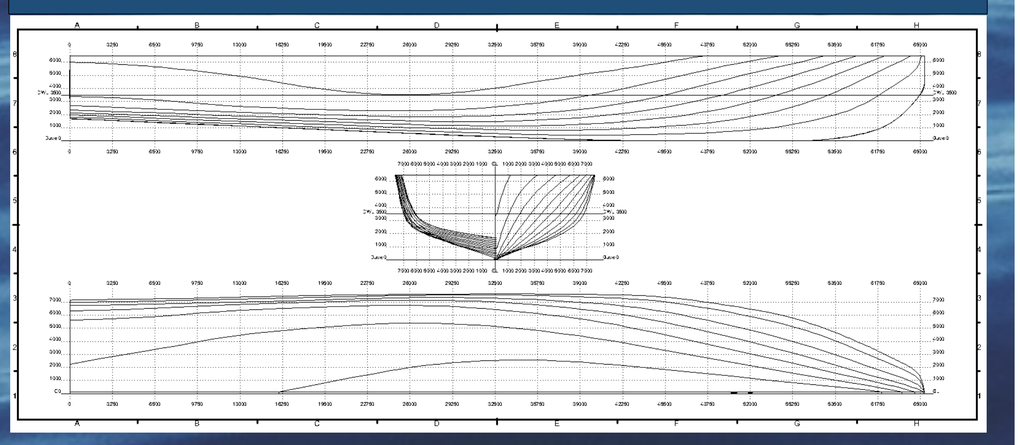
## MARINE ENGINEERING:

- The total power load was selected based on a regression of basis vessels
- A diesel electric system was chosen due to the varying demands from propulsion and hotel load
- Ultimately three engines were selected for efficiency; one small engine for normal loitering, and two powerful to enable a sprinting speed with low fuel consumption. This enables fast rescue operations.
- Water generator installed to optimise the amount of fresh water produced to the number of passengers on the vessel, which will vary in each trip.

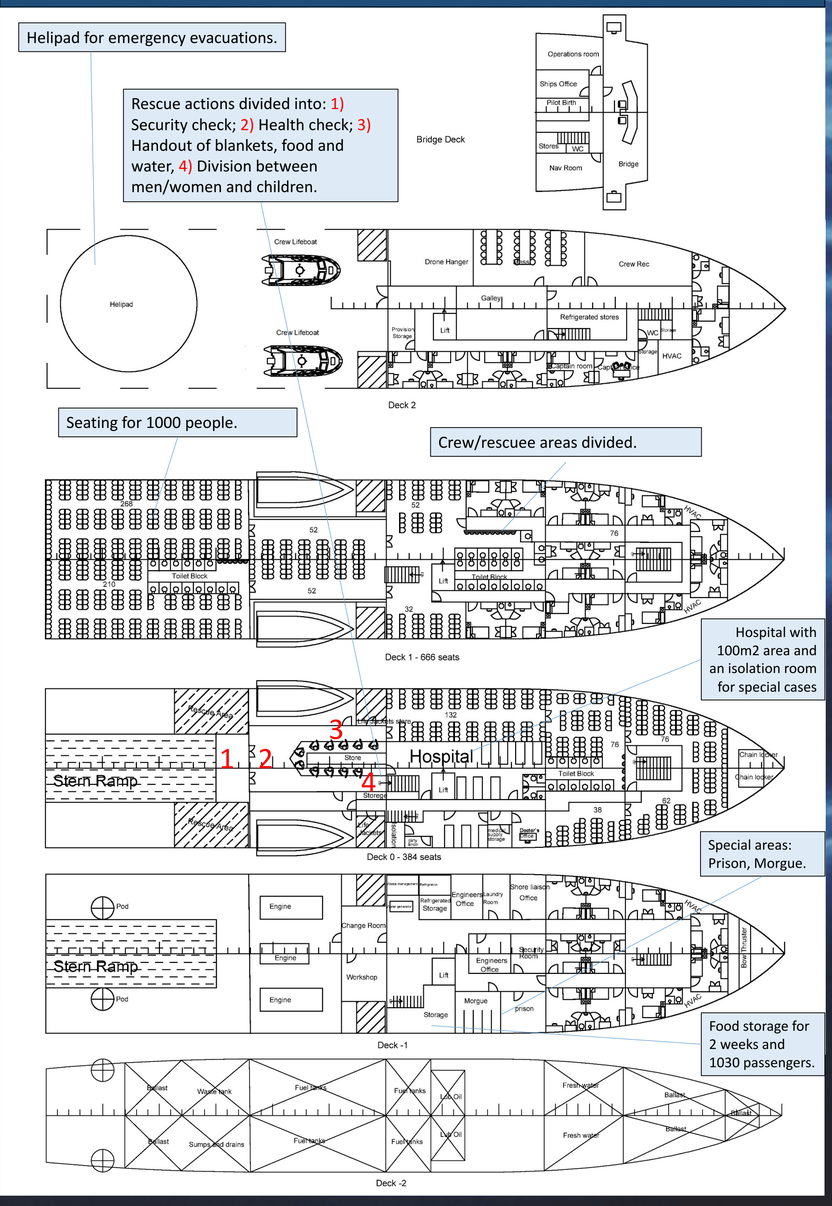
## LAUNCH & RECOVERY:

- The vessel will have base in various European ports across the Mediterranean, as not all ports can easily accommodate for 1000 rescuees.
- The possible ports that the vessel could launch from are shown on the map, and are in Italy, Greece, Spain, Turkey and Cyprus. The exact port will depend on political and operating conditions.
- Agreements should be in place with certain ports stating that rescue hubs with medical/ immigration/ accommodation facilities are available.

## LINES PLAN:



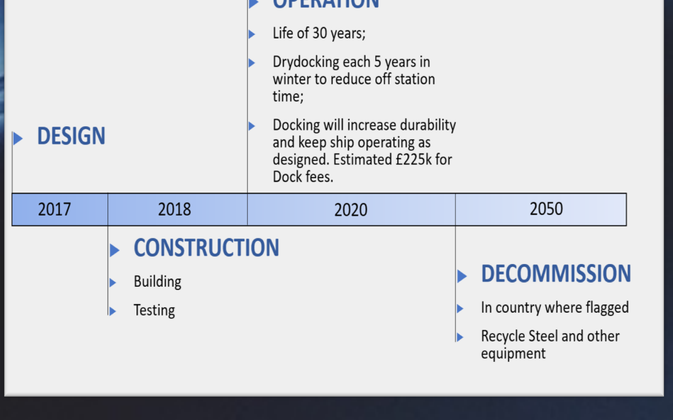
## GENERAL ARRANGEMENT:




## STABILITY:

- Initial stability was checked by calculating GMt using Morrish's formula.
- This was verified using data from Delft Ship Software, and this gave a transverse metacentric height of 9.383m
- The centre of gravity was estimated in a weights and moments spreadsheet giving a vertical centre of gravity of approximately 3.9m, although this may increase as outfit mass is uncertain.
- The resulting GMt was significant at 5.5m giving confidence in stability.
- An initial GZ curve for small angles of heel showed a good positive initial angle.

## LIFECYCLE:




## BUILDING & OPERATING COSTS:

| Building Cost | |
|---|---|
| **Item** | Cost |
| **Materials** | |
| **Steel** | £5,887,500.00 |
| **Outfitting** | £1,500,000.00 |
| **Machinery** | £1,500,000.00 |
| **Labour** | |
| **Ship yard** | £2,500,000.00 |
| **Total** | £11,387,500.00 |

| Operating Cost | |
|---|---|
| **Item** | Annual Cost |
| **Crew cost** | £331,500.00 |
| **travel cost** | £1,165,850.00 |
| **Insurance cost** | £1,138,750.00 |
| **Docking cost** | £45,000.00 |
| **Repairs** | £50,000.00 |
| **Total** | £2,731,100.00 |

## ACKNOWLEDGEMENTS:

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