Lifeboat Design Challenge

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Introduction

• Background
• Design Drivers
• CONOPS
• Design Solution
  • The Fleet
  • Manning
  • Calculations
  • Maintenance & Disposal
  • Environment & Durability
  • Cost
• Conclusion
Situation report of the migrant crisis in the Mediterranean to show the need for a solution;

- Most severe loss of life can be seen in the central Mediterranean Sea
- Peak arrival in summer months when weather gets better
- 300,000 people crossed the med in 2016, approximately 4,000 of these died.
- Over 3,000 people have died in 2017 so far trying to reach Europe, with over 33,000 dead since 2000
Background
Migrant Crisis

- Large amounts of people being transported in vessels of varying seaworthiness and numbers.
Current Solution

- Current solutions undertaken by NATO/NGO’s.
Design Drivers

- **Modularity** so that multiple scenarios can be catered for
- **Safety** of the migrants and personnel on board
- **Rapid** response to get migrants out of the water
- **Recuperation** of mental/physical state of migrants
- **Meet Design Objectives**
Design Solution

The Fleet

**Mothership**
- Host ship

**Alpha**
- Recovers migrants
- Transports migrants

**Beta**
- Collects migrant from water
- Deals with emergency cases

**EC225 Helicopter**
- Speed: 171 mph
- Deploys 12 x 100 man liferafts
- Deploys medic divers
- Retrieves urgent cases
- Carry load: 5754 kg

**Scan Eagle**
- UAV
- Speed: 92 mph
- Endurance 24 hours
- Thermal imaging
- Reconnaissance

**100 man liferaft**
- Weight: 340kg
- Chemical heat supply
Design Solution

Alpha

Design features

- Maximum Passenger capacity
- Ship remote controlled from bridge of Alpha
- Foldable bridge used to board people
- Navigation space
- Advanced motion control
- Bow thruster
- Adaptable awning optional
- Collapsible antenna for comms

Statistics:

- Speed: 30 knots
- Power: 1000hp
- Crew: 5
- Passengers: 200
- Endurance: 24 hours

inboard impeller
Design Solution

Beta

Design Features

- Advantages of using a RIB are;
  - Flexibility of the hulls will cause less injury to people being rescued;
  - Flexibility of the hulls will make the boat more hardwearing against impacts to the Mothership’s ramp;
  - High speed capable;
  - Tried and tested;
  - Large amount of buoyancy;
- Capable of recovering people from water using:
  - Scramble nets
  - Removable RIB tube sections;

Statistics

- Size: 12m
- Speed: 55 knots
- Power: 600hp outboard impeller
- Crew: 3
- Passengers: 25
- Endurance: 4 hours
Design Solution
Mothership

- Hosts over 1000 migrants
- Hosts 3 Alpha’s & 4 Beta’s
- Wide bridge with overhang for visibility
- Wave piercing bow, designed for speed
- Helipad
- Tailored traffic flow to control boarding migrants
- Separation of men and women & children
- Can taken 7 x 40ft ISO containers for modularity
- Immediate physical/mental recuperation services
- Specialist security measures;
  - Cameras / Facial recognition
  - Evidence lock up
  - Holding area
- Ship to ship transfer via bridge with fire fighting capabilities

Statistics
- Size: 98m
- Speed: 60 knots
- Power: 2 x 25MW GT
- Range: 600 miles
- Crew: Max. 113
- Passengers: 1000
Design Solution
Mothership
Design Solution

Manning

Standard crew for USN ~100m cat

- Officers: 1 CO, 1 XO, Navigator, Engineer, Operation specialist, Medical, Logistics
- 5 Weapons
- 2 Boat handlers
- 6 Operators
- 2 Cooks
- 10 Engineers
- 9 Hands

Crew Alterations

- Weapons - 5
- Cooks + 5
- Medical staff + 30
- Beta crew + 12 (3 crew / boat)
- Alpha crew +15 (5 crew / boat)
- Maintenance crew + 1
- Crane driver and ramp operator + 1
- Security staff + 15
- General + 15
Calculations (Structures)

- Analysis of one of the main bridge support arms:
  - Hinged at the deck level and free where crane wire attaches to end of bridge.
  - Simulation shows 1 support arm can carry half the load.
  - Load distributed between 4 support arms.
Calculations (Stability)

- 950 tonnes displacement
- Form stable
- Increased freeboard of catamaran means:
  - Raising DEI angle
  - Stability improved at large angles of heel
- Size of ballast tank to support bridge:
  - \( 8 \times (10+14) = 13 \times X \)
  - \( X = 14.8 \) tonnes
  - \( X = 14.43 \) m\(^3\) assuming density of 1.025 t / m\(^3\)
Maintenance & Disposal

• Maintenance:
  • Regular maintenance by on board crew to reduce down time. Ship is capable of responding to events with part of it propulsion system inactive.

• Disposal:
  • Aluminium construction recyclable and can be dismantled. Large open spaces will assist this.
  • Diesel engines can have their life extended to be resold.
  • Gas turbines can be returned to GE for recycling or refurbishment.
Environment & Durability

• Environment:
  • Capability of receiving shore services
  • Recover and recycle used life rafts and migrant crafts if possible
  • Flexibility on fuel types for gas turbines
  • No underwater exhaust
  • Solar Panels

• Durability:
  • Wave piercing hull to reduce slamming loads and increase longevity of hull
  • Strong ramp to sustain repeated impact
Cost

• New build cost for all boats: £100 million
• Fuel Cost: £5,500 / hour
• Consumables Cost: £70,000. Average £70 a head
• Manning: High
• High cost maintenance equipment:
  • Gas Turbines
  • Water Jets
  • Technology
Design Criteria

• Rescue a large amount of people from an unsafe vessel
  -

• Rescue a large amount of people from the sea
  -

• Provide medical attention to the rescued people
  -

• Transport the rescued people to a safe location
  -
Thanks for listening
Any Questions?
Design Solution
Mothership

Diagram:
- Water Jets
- Gearbox
- Gas Turbine
- Electric Motors
- Back Up Battery
- Diesel Generators