PATROL VESSEL
BIS- PV 43
### Main characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length overall</td>
<td>43.16 m</td>
</tr>
<tr>
<td>Breadth, max.</td>
<td>8.00 m</td>
</tr>
<tr>
<td>Draught</td>
<td>2.80 m</td>
</tr>
<tr>
<td>Max. speed (100% MCR)</td>
<td>&gt;27.9 kn</td>
</tr>
<tr>
<td>Complement</td>
<td>14+3</td>
</tr>
<tr>
<td>Main engines power</td>
<td>2 x 2525 kW</td>
</tr>
<tr>
<td>Propulsor type</td>
<td>CPP</td>
</tr>
<tr>
<td>Electric Plant</td>
<td>2x118 kWe, 1x51 kWe</td>
</tr>
<tr>
<td>Cruising range</td>
<td>1000 NM/15 kn</td>
</tr>
<tr>
<td>Autonomy</td>
<td>10 days</td>
</tr>
<tr>
<td>Seakeeping</td>
<td>Active stabilization system with 2 fins</td>
</tr>
<tr>
<td></td>
<td>NATO seakeeping criteria (STANAG 4154)</td>
</tr>
<tr>
<td></td>
<td>Full operability at sea state up to 5 WMO</td>
</tr>
<tr>
<td>Damage stability</td>
<td>Two adjacent compartments flooding</td>
</tr>
<tr>
<td>Hull material</td>
<td>AH36 - High tensile steel</td>
</tr>
<tr>
<td>Superstructure material</td>
<td>Aluminum alloy AlMg4.5Mn</td>
</tr>
<tr>
<td>Weapon system</td>
<td>1x30 mm gun, 2x12.7 mm machine guns, EOS</td>
</tr>
<tr>
<td>Fast intervention/rescue boat</td>
<td>1xRHIB</td>
</tr>
<tr>
<td>Nuclear, Biological and Chemical (NBC) Protection</td>
<td>Hermetically closed spaces</td>
</tr>
</tbody>
</table>
Main noncombat mission:

- Patrol with the purpose of surveillance and protection of interests in territorial and open sea (continental shelf)

- Prevention:
  - terrorism and international organized crime specially smuggling,
  - maritime border violation and illegal migration,
  - illegal exploitation of marine natural resources and marine cultural heritage stealing,
  - marine environment pollution and other kinds of damage,
  - pirate activities on the sea.

- Search and rescue on the sea and other forms of support

- Evacuation and rescue in the state of natural disasters
Main combat mission:

- Artillery protection of territorial and coastal sea from lightly armed enemy vessels
- Air defense with light portable air defense rockets
- Combat (using arms) and strategic support for assault and other navy activities
- Transportation of smaller special forces group (up to 6)
- Interception of non-armed and lightly armed intruders at sea
Meeting NATO criteria for seakeeping (STANAG 4154)

10 days autonomy with full operability at sea states up to 5 (WMO) including embarkment of intervention group at sea state up to 3 (WMO)

Limited operability up to sea state 6 (WMO)

Full power navigation up to sea state 5 (WMO)
PV 43 is based on the technologies, methods and experiences of the proven designs used by Croatian and former Yugoslavia Navy for past decades.

- It represents a cost-effective patrol vessel optimally suited for its main tasks, incorporating a certain level of design reserve, which, with a combat system with open architecture, both provide possibilities for and simplified further upgrades during the life time of the vessel.

- Fulfills given tactical-technical requirements and requirements for long patrol tasks.
Design main characteristics

- Fulfills international, NATO and CRS standards
- Minimized ship resistance and fuel consumption
- Full NBC crew protection ensured
- Construction reliability and survivability - ship can survive flooding of any 2 neighboring waterproof compartments
- High standard for living spaces
- Excellent maneuverability and seakeeping performance
Design main characteristics

All design phases are made in Croatian company (tactical study, feasibility study, initial design, model testing, basic design and workshop design).

Builder: **Brodosplit d.d. , Split, Croatia**
Design company: **Marine and Energy Solutions DIV, Zagreb, Croatia**

Equipment: Croatia, Europe, USA and Japan
General Arrangement

Main Deck

OFFICER AND NCO COMMON SALOONS
General Arrangement

Main Deck

OFFICER AND NCO COMMON SALOONS
GUEST CABIN AND TOILETS
Main Deck

- Officer and NCO Common Saloons
- Guest Cabin and Toilets
- Galley and Food Storage
Main Deck

- Officer and NCO Common Saloons
- Guest Cabin and Toilets
- Galley and Food Storage
- Radio Cabin
Main Deck

- Officer and NCO common saloons
- Guest cabin and toilets
- Galley and food storage
- Radio cabin
- Decontamination station
General Arrangement

Main Deck

- OFFICER AND NCO COMMON SALOONS
- INFIRMARY
- GUEST CABIN AND TOILETS
- GALLEY AND FOOD STORAGE
- RADIO CABIN
- DECONTAMINATION STATION
General Arrangement

Lower Deck

CABINS
General Arrangement

Lower Deck

- CABINS
- GUESTS CABIN
General Arrangement

Lower Deck

- CABINS
- GUESTS CABIN
- AMMUNITION CHAMBER
- AUXILIARY ENGINE ROOMS, ENGINE ROOM, ENGINE CONTROL ROOM
Engine room
Measures for technical safety and combat endurance

Nuclear, Biological and Chemical (NBC) Protection - Hermetically closed spaces

NBC protection of the crew using ship decontamination station and so called citadel protection systems (spaces in the superstructure and hull from FR 23 to FR 50 can be hermetically closed and fitted with filtrated NBC ventilation system). In order to protect outer superstructure and hull plates from contamination, ship is fitted with sprinkling system. When NBC protection is activated all inlets and outlets are closed automatically using gas proof dampers.
Hermetically closed spaces – NBC protection
Measures for technical safety and combat endurance

- Crew protection from noise (floating floors, acoustically isolated rooms)

- Vessel can survive flooding of any 2 neighboring waterproof compartments including engine room (ship is divided in 9 waterproof compartments).

- Vessel have all of the life-saving equipment required by international conventions about saving human life at sea for all passengers and crew.
Special equipment

- Ship waves motion stabilization system with active fin stabilization system
- Rigid hull inflatable boat (RHIB) and diesel engine with waterjet propulsion which enables speed up to 40 kn with 6 crew onboard and range of 60 NM
- Possibility of RHIB fast launch/recover up to sea state 3 and ship speed up to 5 kn
- Stern platform with movable ladder for divers or other people in the sea
- Firefighting system with a 50 m range of fire fighting gun (monitor type)
RHIB Launch and Recovery system

Rigid hull inflatable boat (RHIB) and inboard diesel engine with waterjet propulsion which enables speed up to 40 kn with 6 crew onboard with heavy machine gun mounting possibility and range of 60 NM is located on stern platform for launch/recovery.
RHIB Launch and Recovery system

- RHIB Launch and Recovery system has been developed for fast launching and recovering up to sea state 3 (WMO).
- With this development the Navy aimed to react to the increasing demand for coast guarding and the demand for being operational in heavier types of weather and higher sea states.
- Catching and releasing procedures are executed very quick without any dangerous situations for the crew.
- The system requires only a small amount of maintenance.
WEAPON AND FIRE CONTROL SYSTEM

- Automatic bow gun (30 mm), gyro-stabilized gunpoint line remotely controlled from the wheelhouse, linked to EOS – electric optimal system for fire control
- Two machine guns of 12.7 mm caliber
- Electric-optical system (EOS) for observation, search and recognition of targets at sea and in air and weapons control
WEAPON SYSTEM ARRANGEMENT
NAVIGATION SYSTEM

- X band navigation radar 25 kW
- S band navigation radar 30 kW
- Electronic Chart Display & Information System (ECDIS)
- Centralised navigation data display (CONNING)
- Electric-optical system for daily and night observation with observation recorder (EOS)
- Main magnetic compass
- Gyro-compass
- Automatic Identification System (AIS)
- GPS
- Echo sounder (ultrawave sounder, speed and temperature gauge)
- Sound reception system (SRS)
- Bridge navigational watch alert system (BNWAS)
- Voyage data recorder (VDR)
- Meteo system
- Radio direction finding (RDF)
Monitoring and control system (MCS) from control cabin, wheelhouse and open bridge using purpose-designed software for monitoring and control all ship’s services and installations (propulsion, electricity, fuel oil system, fresh and grey water, exhaust, bilge, ballast, sprinkling, fire protection, ammunition chamber protection, heating, ventilation, air condition, filter ventilation, water penetration).

Date are collected from sensor system; 133 sensors and alarms installed.

CONTENTS

- Block scheme and description
- Alarm and monitoring system
- Power management system
- Control system
- Mimic diagrams
MONITORING AND CONTROL SYSTEM

**MCS** provides autonomous PMS and Safety (ESD) systems, which are independent but also networked with AMS and Control systems thus forming fully integrated automation system.

**SELF-DIAGNOSTICS AND AVAILABILITY**
In case of failure of particular device, system triggers alarm and performs automatic actions in order to ensure next best possible availability of process data.
Ring shaped ethernet network provides fast data acquisition cycles and increased availability of system in case of failure.

**INHIBITION AND SAFETY**
Start inhibition of main engines with combination of control group control aspect, reduces the risk of accidental human error.
MONITORING AND CONTROL SYSTEM
ALARM & MONITORING SYSTEM (AMS) delivers real time accurate data and alarm indications to each operating station on board by means of utilizing modern data acquisition equipment and fast ethernet based communication protocols.

- High availability and reliability
- Media redundancy
- CPU redundancy
- Real time data with fast acquisition times
  - Short/Long term alarm list
- Available history and data logging
- Exporting of alarms and other data
- Duty management
- Tailor made mimic diagrams
- Alarm repeaters and optional DMA
- Self diagnostics Trends
- Printing
MONITORING AND CONTROL SYSTEM

POWER MANAGEMENT SYSTEM (PMS)

- Load depending start / stop
- Heavy consumer support
- Automatic start of next genset upon blackout
- Load sharing
- Load shedding
- Short parallel to shore - no need for blackout when preparing for sail
- Generator protections active ALL THE TIME (even in emergency manual mode)
- Integration with IAS, control and management from operator stations
CONTROL SYSTEM (CS)
CS offers intuitive and simple control management of main and auxiliary ship services.

- Single acting valve control
- Double acting valve control
- Remote starter control
- Standby/Auto starter control
- PMS breaker control
- Ventilation and HVAC control
- ME starting/stopping
- AE starting/stopping
- Pump control
# Maneuverability Trials Results

## Crash Stop Test

<table>
<thead>
<tr>
<th>Condition</th>
<th>Stopping Inertia Trial</th>
<th>Accelerating Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crash stop @ 15 kn</td>
<td>$S_F / L = 2.5$</td>
<td>$T_F = 24$ s</td>
</tr>
<tr>
<td>Crash stop @ Vmax</td>
<td>$S_F / L = 6.2$</td>
<td>$T_F = 40$ s</td>
</tr>
<tr>
<td>Crash stop @ 15 kn</td>
<td>$T_F = 24$ s</td>
<td></td>
</tr>
</tbody>
</table>

## Stopping Inertia Trial

- Stopping at 27,8 kn: $S_F = 318$ m
- Stopping at 15,5 kn: $S_F = 203$ m

## Accelerating Trial

- Acceleration 0-5 kn: 23 m / 15 s
- Acceleration 0-15 kn: 96 m / 24 s
- Acceleration 0-28 kn: 1170 m / 104 s

## Williamson Turn Trial

- Williamson turn @15 kn: 118 s
- Williamson turn @15 kn distance: $S_F = 504$ m

## Course-Keeping

- Course keeping < 1°
# Maneuverability Trials Results

<table>
<thead>
<tr>
<th>Turning Circles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>With rudder</strong></td>
</tr>
<tr>
<td>180° turn @ 5 kn</td>
</tr>
<tr>
<td>360° turn @ 5 kn</td>
</tr>
<tr>
<td>Tactical diameter @ 5 kn</td>
</tr>
<tr>
<td>180° turn @ 15 kn</td>
</tr>
<tr>
<td>360° turn @ 15 kn</td>
</tr>
<tr>
<td>Tactical diameter @ 15 kn</td>
</tr>
</tbody>
</table>

& **Main propulsors**  
180° turn @ 15 kn                     | t = 45 s          |
360° turn @ 15 kn                     | t = 203 s         |
Tactical diameter @ 15 kn             | 2.7               |

& **Bow thruster**  
180° turn @ 5 kn                      | t = 108 s         |
360° turn @ 5 kn                      | t = 211 s         |
Tactical diameter @ 5 kn              | 3.8               |
SEAKEEPING TRIAL RESULTS
WITHOUT STABILIZATION SYSTEM

### RMS and MSI at sea state 5

<table>
<thead>
<tr>
<th>10 kn</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RMS roll angle - 45° = 6.27</td>
<td>MSI = 0</td>
</tr>
<tr>
<td>RMS pitch angle - 45° = 2.19</td>
<td>MSI = 0</td>
</tr>
<tr>
<td>RMS roll angle - 90° = 6.16</td>
<td>MSI = 0</td>
</tr>
<tr>
<td>RMS pitch angle - 90° = 1.74</td>
<td>MSI = 0</td>
</tr>
<tr>
<td>RMS roll angle -135° = 4.83</td>
<td>MSI = 0</td>
</tr>
<tr>
<td>RMS pitch angle -135° = 1.43</td>
<td>MSI = 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>15 kn</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RMS roll angle - 45° = 5.61</td>
<td>MSI = 6.25</td>
</tr>
<tr>
<td>RMS pitch angle - 45° = 2.25</td>
<td>MSI = 6.25</td>
</tr>
<tr>
<td>RMS roll angle - 90° = 5.88</td>
<td>MSI = 13.5</td>
</tr>
<tr>
<td>RMS pitch angle - 90° = 1.81</td>
<td>MSI = 13.5</td>
</tr>
<tr>
<td>RMS roll angle -135° = 5.24</td>
<td>MSI = 18.75</td>
</tr>
<tr>
<td>RMS pitch angle -135° = 1.65</td>
<td>MSI = 18.75</td>
</tr>
</tbody>
</table>

### RMS and MSI at sea state 3-4

<table>
<thead>
<tr>
<th>24 kn</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RMS roll angle - 0° = 1.33</td>
<td>MSI = 0</td>
</tr>
<tr>
<td>RMS pitch angle - 0° = 2.54</td>
<td>MSI = 0</td>
</tr>
<tr>
<td>RMS roll angle - 180° = 2.73</td>
<td>MSI = 0</td>
</tr>
<tr>
<td>RMS pitch angle - 180° = 1.72</td>
<td>MSI = 0</td>
</tr>
</tbody>
</table>

For MSI (Motion Sickness Incidence) the NATO seakeeping standard, STANAG recommends a limit value of 20% after 4 hours for naval vessels.