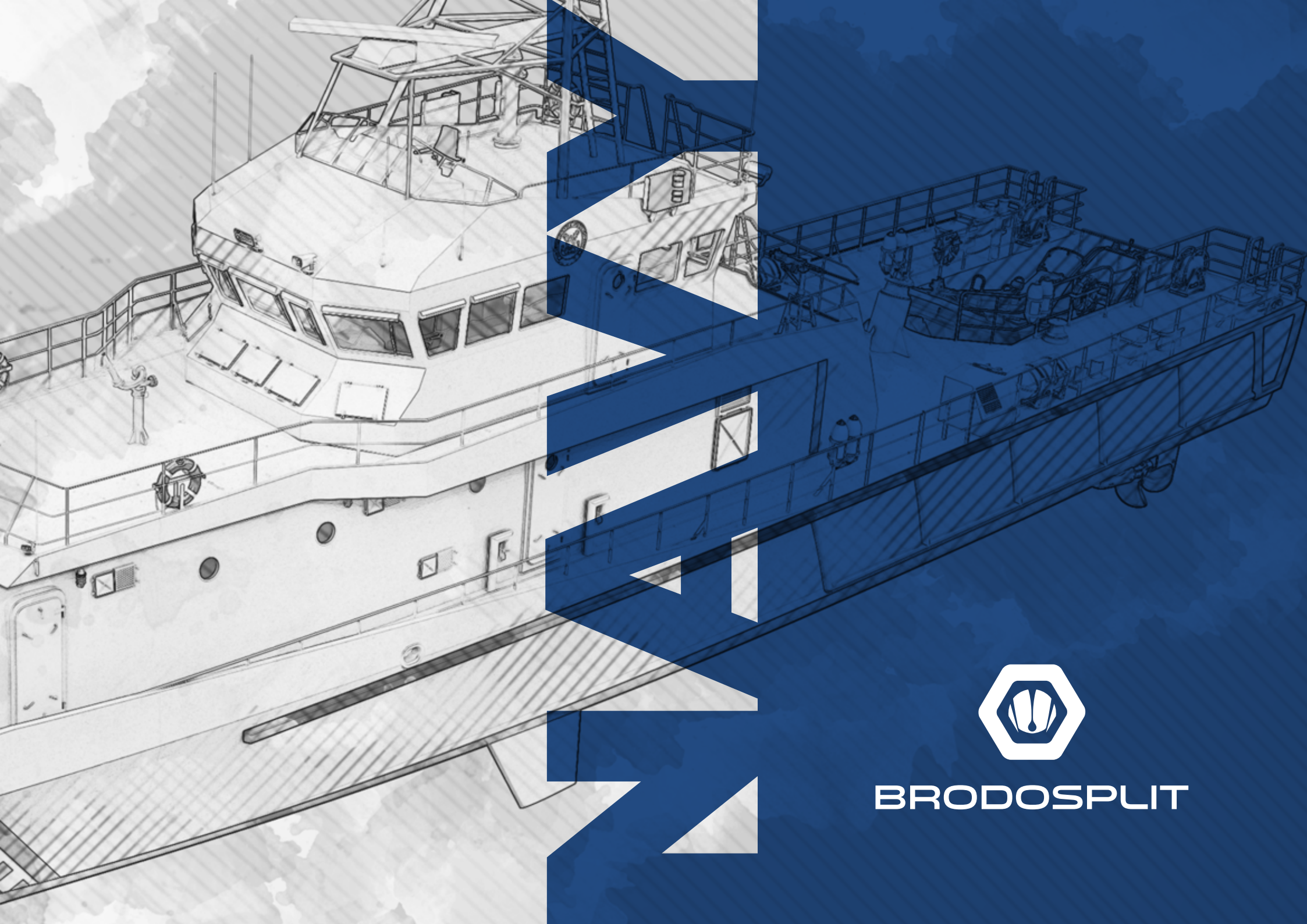


BRODOSPLIT

CONTENTS

NAVAL PROGRAM

Naval program has been a highlight of Brodosplit's business ever since the first submarines that were built and have left from our slipways in 1960's. The most relevant submarines that were built in Brodosplit were from the class Hero and Sava after which a series of 6 midget 100-ton submarines of Una class came along.

Wide usage of the new technologies and knowledges ensures speed, preciseness and optimal production as well as fully arranged manufacturing lines for cutting and welding of plates.

- Automated robotic stations
- Ultrasound devices for testing the welding joints
- Large capacity transporters (up to 600 t)
- Halls equipped for sandblasting and painting

SUBMARINE CONSTRUCION PROJECTS FACTSHEET

Started off in the 60-ies of the past century.

1968 - 1970
Heroj, Junak and **Uskok**

1978 - 1982
Sava and **Drava**

1981 - 1989
Series of **6 midget 100-ton submarines** of Una class, among which was the only Croatian upgraded submarine **VELEBIT**.

Brodosplit workshops and slipways spread over the surface of 599.569 m^2 with total of 110.000 m^2 of covered objects. 1250 m long fitting quay has 5 cranes with lifting capacity from 7 to 80 t and one floating crane with lifting capacity of 100 tons.

Slipways can be used for building of ships with characteristics, as follows:

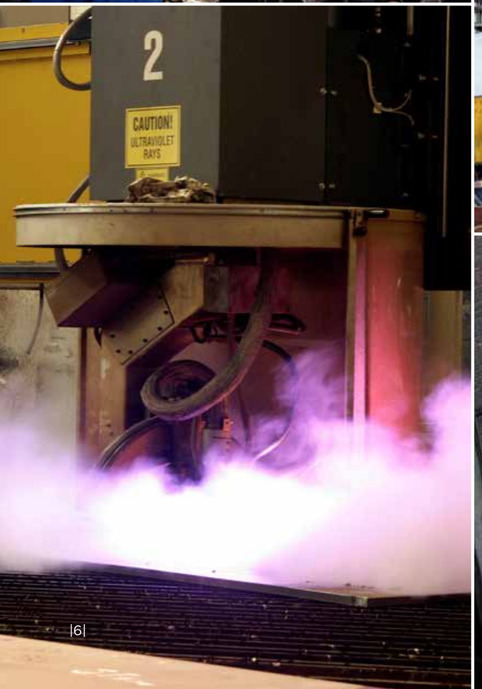
SURFACE VESSELS

- FRIGATES UP TO 2500 t IN CAPACITY
- PATROL VESSELS
- LOGISTIC SUPPORT VESSELS
- LANDING SHIP | MINELAYERS | 100 t
- PAINTING WORKSHOPS

UNDERWATER VESSELS

- CONVENTIONAL TORPEDO SUBMARINES
- DIVER'S SUBMERSIBLE
- HYPERBARIC CHAMBERS
- MIDGET SUBMARINES

LIFTING CAPACITY	MAX. SHIP DIMENSIONS	L*B (m)
Slipway No. 1	170.000 dwt	282*50.0
Slipway No. 2	120.000 dwt	250*42.0
Slipway No. 3	30.000 dwt	185*25.0
Closed slipway	1.000 dwt	60.0*12.0
Horizontal slipway	800 dwt	30.0*17.0



Equipment, which is the utterly important part of work, is mainly coming from Croatian companies. It relates to propulsion 40 ton electric motors, generators, valves, electric equipment, diving cylinders, shafts, propellers, fibreglass and other parts of equipment.

SPLIT SHIPYARD HAS BUILT:

- **4** AUXILIARY MULTIPURPOSE SUMBERSIBLES
- **4** AUXILIARY MULTIPUSPOSE TRANSPORTER SHIPS
- **4** FUEL BARGES FOR THE FORMER STATE
- **2** FRIGATES
- **8** SUBMARINES
- **12** PAINTING SHIP STATIONS FOR FOREIGN BUYERS
- **18** DIVERSIONARY SUBMERSIBLES

The most prominent torpedo submarines in Sava class were pennant numbers P-831 and P-832.

55.90 m long
5.5 m wide
300 m diving depth
32 days of underwater autonomy

A class of midget submarines were named Una:

18.80 m long
2.7 m wide
88 t underwater displacement
120 m diving depth
4 days of underwater autonomy
6 submarines built

SUBMARINES
P-911 Tisa, P-912 Una, P-913 Soča,
P-914 Zeta, P-915 Vardar, P-916 Kupa

Thanks to its capacities, professional and highly educated personnel and scientific institutions In Croatia, Brodosplit was able to design and build the most contemporary war submarine subject to Buyer ensuring supply of electronic equipment and armament.
The design documentation of improved versions of midget submarines of Una class with diesel generator and diversionary submersibles of R-1 and R-2 type are preserved.

3.72 m long
520 mm in diameter

4.9 m long
1.22 m in diameter

R-1 and R-2 submersibles are made for autonomus diving, with space for one diversionary mine of Pearl type or two mines of Coral type is in the front part of submersible. Control, navigation and hydroacoustic devices are located inside alight bow. Retractable hydroplanes, located next to the control panel, are used for navigation in depths. Their intention is underwater protection of ports, anchorages and own mine fields, and for implementation of distance diversions against ships at anchor or land forces with the assistance of submarine transport to staring position of the planned mission.

COASTAL PATROL VESSEL

The 43.50 long vessel will be fitted with the basic weapon of all coastal guards today, 30 mm automatic gun and two manually operated 12.7 mm machine guns. The vessel can reach the speed of 28 knots at 90% MCR-a and is very capable of pursuit. It has a large navigational range and can stay at sea for ten days with 14 crew members. The vessel is certified in accordance with Croatian Register of Shipping Rules (CRS) member of IACS.

It is a project of five vessels for the needs of Croatian Coast Guard. The basic purpose of the vessel is surveillance and protection of Croatian interests at sea. They will be used as support to island population and in search and rescue sea operations.

Length | overall
43.50 m

Length | on water line
39.11 m

Breadth | max
8.00 m

Breadth | hull
7.50 m

Depth
3.89 m

Draft
2.70 m

Speed | 90% MCR
28 knots

Cruising range
The cruising range at cruising speed of 15 knots is **1000 NM**

Complement
14 + 3 crew members
Number of crew members may be considered to Customers' preference until 20 crew members

Rated output
2 x **2525 kW**

Logistic support during service life
- Technical monitoring (Safety and Maintenance Management System)
- Maintenance time schedule normative with maintenance in domestic shipyards
- Instruction manuals with maintaining procedures
- Spare parts delivery for 20 years

Education
- Crew teaching
- Crew training
- Technical experts teaching and training

Weapon system

One **remotely operated stabilized 30 mm naval gun system**, installed on the main deck forward at the centerline, ensuring a wide field of gun action.

Such configurations incorporate advanced features as remote operation, built-in electro-optic sensor system for autonomous operation, day and night operation, stabilized turret, automatic target tracking (detect, track and fire on the move) and ballistic computation. Stabilized turret enables the line-of-sight of the gun to be aimed at the target at all times. Due to the stabilization feature, the system can perform precise firings against stationary or moving targets while the platform is on-the-move.

Two **360° pedestals for 12.7 mm machinegun** (of M2HB type, e.g.), situated starboard and portside on the superstructure, ensuring a wide field of gun action with same level of protection assured by open bridge wing structure.

EOS - Electric-optical Surveillance (EOS) system for observation, search and recognition of targets at sea and in air, and weapons control. It contains next sensors: Thermal Camera (3-5 μm cooled thermal imager, resolution: 640x480 pixels), Day Camera (minimum 20x optical zoom, resolution: 640x480 pixels) and Laser Range Finder (range: 100-20000m, accuracy ± 5 metres, divergence: < 1 mrad).

Weapon system options

- Man-Portable Air Defense missile system (SAM) with four (4) missiles that are located in the boxes.
- Lightweight remote-controlled missile launcher with a short-range ship-to-air or ship-to-ship misseles

Other configurations (20 mm, 27 mm or 40 mm) and producers may be considered to Customers' preference.

Optional oil spill recovery equipment
Free floating skimmer, oil spill temporary tank, deck crane, oil containment booms, air compressor and dispersant systems

360°

Visibility
Wheelhouse windows provide a good visibility on cruising, navigation and berthing.
There is a 360º unobstructed visibility

Smaller patrol ships are known to be **more efficient** than the large ones.

Estimated **world need** for this type of ship is 2000

General Arrangement

MAIN DECK

FAST INTERVENTION BOAT RHIB

INFIRMARY

DECONTAMINATION STATION

GALLEY AND FOOD STORAGE

RADIO CABIN

OFFICER AND NCO COMMON SALOONS

RECEPTION CABIN

GUEST CABIN AND TOILETS

HVAC UNIT SPACE

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 especially 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

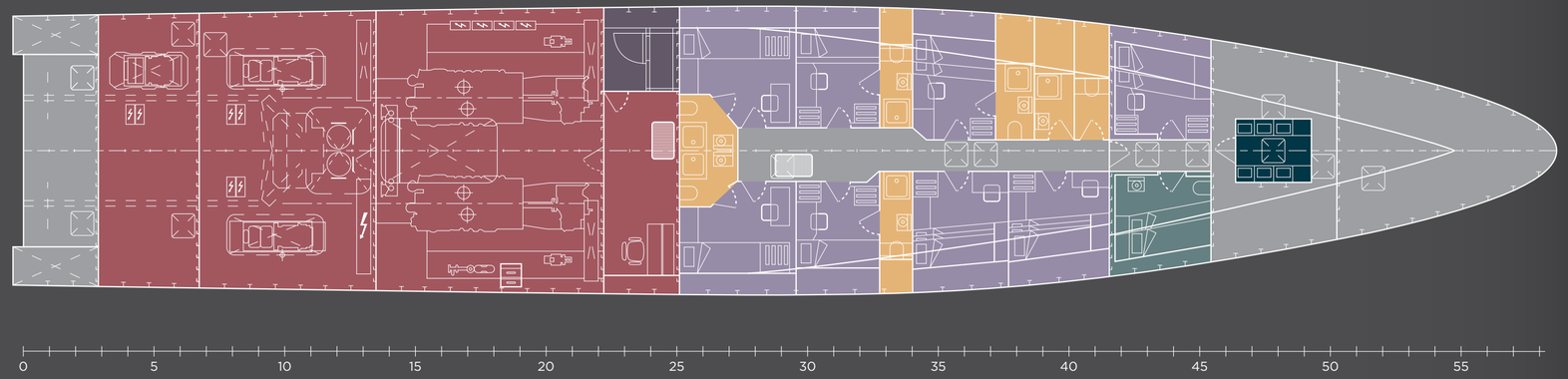
Combat
(using arms) and strategic support for assault and other navy activities

Transportation
of smaller special forces group (up to 10 soldiers)

Interception
of non-armed and lightly armed intruders at sea

General Arrangement

LOWER DECK



CABINS

GUESTS CABIN

AMMUNITION CHAMBER

AUXILLIARY ENGINE ROOMS, ENGINE ROOM, ENGINE CONTROL ROOM

DESIGN MAIN CHARACTERISTICS

CPV is based on the technologies, methods and experiences of the proven designs used by Croatian and former Yugoslavia Navy for past decades.

Cost-effective patrol vessel
optimally suited for its main tasks

Possibility to upgrade
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 patrols

Good behavior of the ship **on waves** ensured even at low patrol speed with stabilization system with fins

Fulfills international, NATO and CRS **standards**

Full NCB (Nuclear Chemical Biological) crew **protection** ensured

Construction reliability and survivability
- ship can survive flooding of any 2 neighboring waterproof compartments including engine room (ship is divided in 9 waterproof compartments)

High standard for living spaces

Minimized ship resistance and fuel consumption is provided by:

- optimization of hull lines
- optimization of ship structure
- use of lightweight materials for the ship's structure:
Hull | AH36 - High tensile steel
Superstructure | aluminum alloy AlMg4.5Mn
- weight optimization of the equipment

MEASURES FOR TECHNICAL SAFETY AND COMBAT ENDURANCE

NCB 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 NCB ventilation system). In order to protect outer superstructure and hull plates from contamination, ship is fitted with sprinkling system. When NCB protection is activated all inlets and outlets are closed automatically using gas proof dampers.

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

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 fins stabilization system

Fast intervention RHIB boat is equipped with:

- inboard diesel engine with waterjet propulsion (Cummins + Hamilton) which enables speed up to 40 kn with 6 crew onboard and range of 60 NM.
- LOA: 7,7 m
- Aluminium hull
- Jockey seats for 6 crew member
- Light machine gun mounting possibility
- Navigational lights and equipment according COLREG 72

Possibility of **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 monitor

NAVIGATION SYSTEM

Navigation radar
X band navigation radar - with 96 NM range
S band navigation radar - with 96 NM range

Electric-optical system for daily and night observation with observation recorder

Compass
Main magnetic compass
Gyro-compass

Electric map display

AIS - automatic identification system
DGPS

Echo sounder
ultrawave sounder, speed and temperature gauge

SHIP SYSTEMS AND PROPULSION - CONTROL AND SUPERVISION

Supervision from control cabin, wheelhouse and open bridge using purpose designed control panels (fuel oil system, fresh and grey water, exhaust, bilge, ballast, sprinkling, fire protection, ammunition chamber protection, heating, ventilation, air condition, filter ventilation, water penetration)

Automatic sensor system
133 sensors and alarms installed

PROGRAM FOR TRAINING, EDUCATION AND SPECIALIZATION OF THE SHIPYARD EMPLOYEES

TECHNOLOGY TRANSFER

INTEREST GROUPS
Engineers, Workers,
Shipyard Project Managers,

FIELD OF WORK
Welding and assembling, Naval Architecture, Electrical Engineering, Mechanical Engineering, Welding Engineering, Process Management

EDUCATION FOR ENGINEERS

Education in design offices:

- Introduction of the organizational structure and methodology
- Vessel concept design
- Vessel model testing
- Class documentation production
- Workshop technical documentation
- Preparation of proposals, tenders, contracts, contract and as-built/as-fitted technical documentation
- Technical documentation and archiving
- Shipyard process organization
- Sea trials - programs, measurements and reports
- Delivery procedure

Specialization practice for Engineers at the Shipyard:

- Introduction to the supervision for the projects
- Introduction to the tools, structure of manpower and organization of work
- Introduction to the process of procurement of equipment and devices
- Introduction of the quality control procedure

STUDY IN CROATIA

- Naval Architecture
- Mechanical Engineering
- Electrical Engineering
- Welding technology
- Naval Architecture and Mechanical Engineering design, materials, new technologies, new manufacturing processes and engineering, maintenance, transport systems, offshore engineering
- Projects in the fields of applied physics and mathematics, electrical engineering and computing
- Professional levels in welding technology and related areas (IWE Engineer)

EDUCATION AND TRAINING FOR WORKERS

- Welders' Training
- Fitters' training
- Pipefitters' training
- Grinders' training
- Scaffolders' training
- Machinists' training
- Crane operators' training
- Electricians' training
- Carpenters' training

PROJECT MANAGER EDUCATION
Education will last 2 months and will cover the following:

- Project planning
- Project organization
- Project leadership
- Project controlling
- Risk Management
- Shipbuilding Contract issues

MIDGET SUBMARINE 88 T

This submarine is capable of carrying out commando-type missions as well as laying of acoustic-induction sea-bottom mines. It is also used for patrol and surveillance missions, clandestine transport of personnel and material, for training of submarines and combat divers. Four single-seat submersibles of R-1 type are accommodated under the light superstructure. Instead of submersible, four sea-bottom mines can be carried.

Length | overall
18.80 m

Pressure | hull length
13.30 m

Pressure | hull breadth
2.70 m

Displacement | underwater
88 t

Operating diving depth
105 m

Submerged speed | max
8 knots

Speed | cruising | underwater
4 knots

CONSTRUCTION

The submarine is of single-hull construction. The pressure hull is built of steel and light superstructure of reinforced polyester.

NAVIGATION EQUIPMENT

The communication system includes: HF transceiver, radiotelephone, underwater telephone and sound-powered telephone for the submarine internal communication. The navigation equipment consists of: gyro compass, electromagnetic log, echo sounder, active sonar, passive sonar and periscope.

Cruising range
The cruising range at cruising speed is **200 NM**.

Complement
Depending on tactical mission, crew is composed of **6 persons**, or **4 persons** plus **6 combat divers**.

Propulsion system
The submarine is driven by two DC electric motors. Electric energy is supplied by two groups of storage batteries, **128 links** each. The batteries are charged from shore by **200 kW** generating set.

MIDGET SUBMARINE 99 T

P-01 VELEBIT

Submarine is divided into **three parts**: bow (control) compartment, exit chamber and stern (propulsion) compartment. Commanding-control panel of the submarine is in the bow part. Upper part has **4 berths** and is envisaged for accomodation of diversion forces and their equipment. Propulsion is located in the aft, stern part where there is another back-up commanding place. Built-in electric motors generate low noise level which is crucial combat characteristic for a submarine.

Length | overall
21.09 m

Pressure | hull length
15.37 m

Pressure | hull breadth
2.70 m

Draught | mean
2.40 m

Displacement | surface
88.04 m

Displacement | underwater
98.75 m

Operating diving depth
105 m

Limited submerged depth
120 m

Submerged speed | max
7.4 knots

Speed | cruising | underwater
4 knots

Speed | cruising | surface
5.9 knots

Underwater autonomy with ten persons is 96 hours with 24 hours back-up. The submarine is driven by two electric motors, 18 kW power each. Electric energy is supplied by two batteries, each consisting of 128 cells. Diesel generator, 105 kw, serves as replenishment of batteries while the submarine is sailing on the surface.

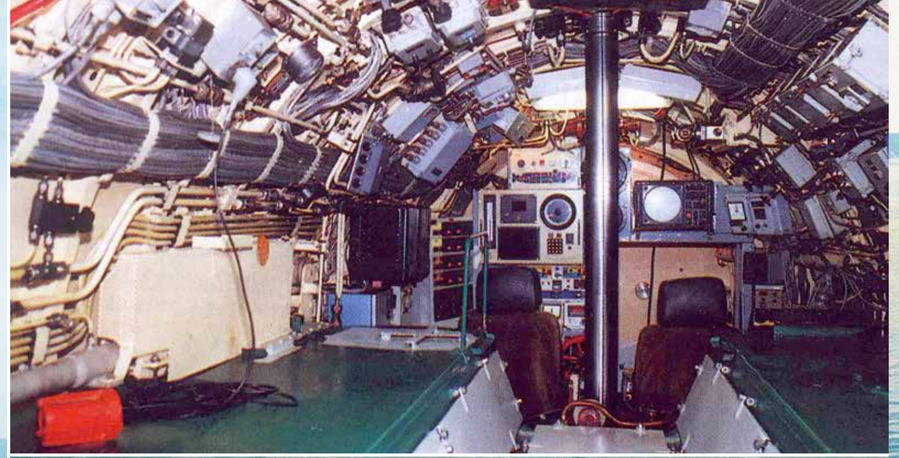
CONSTRUCTION

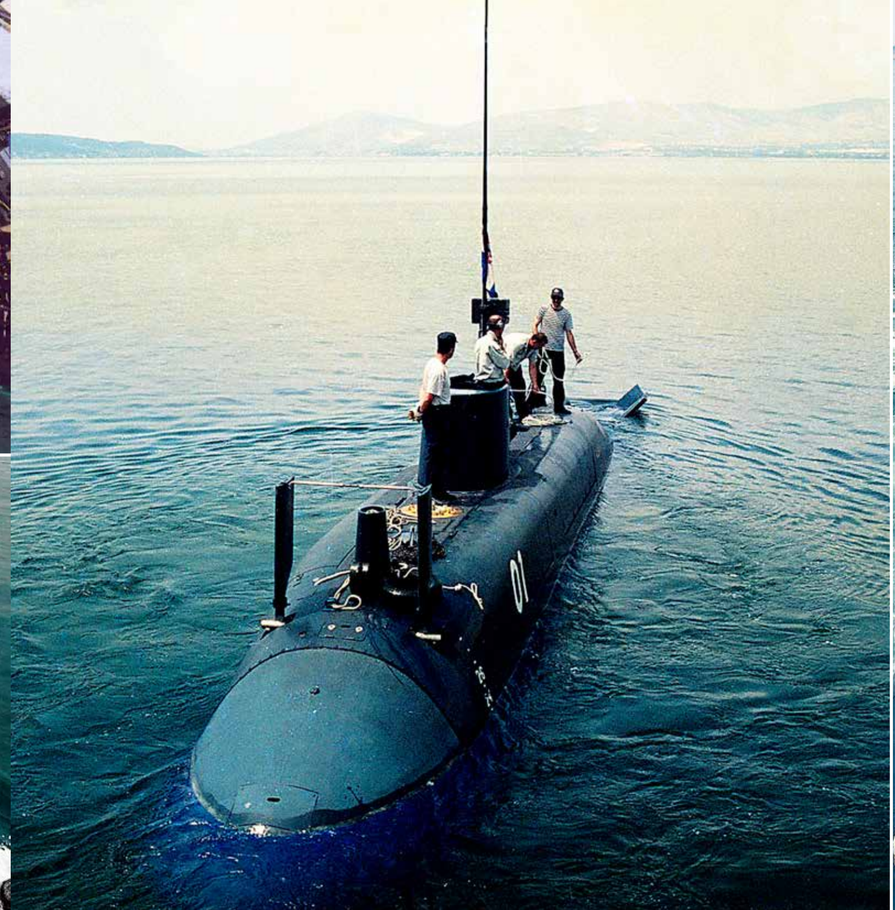
The submarine is of single-hull construction. The pressure hull is built of steed and light superstructure of reinforced polyester.

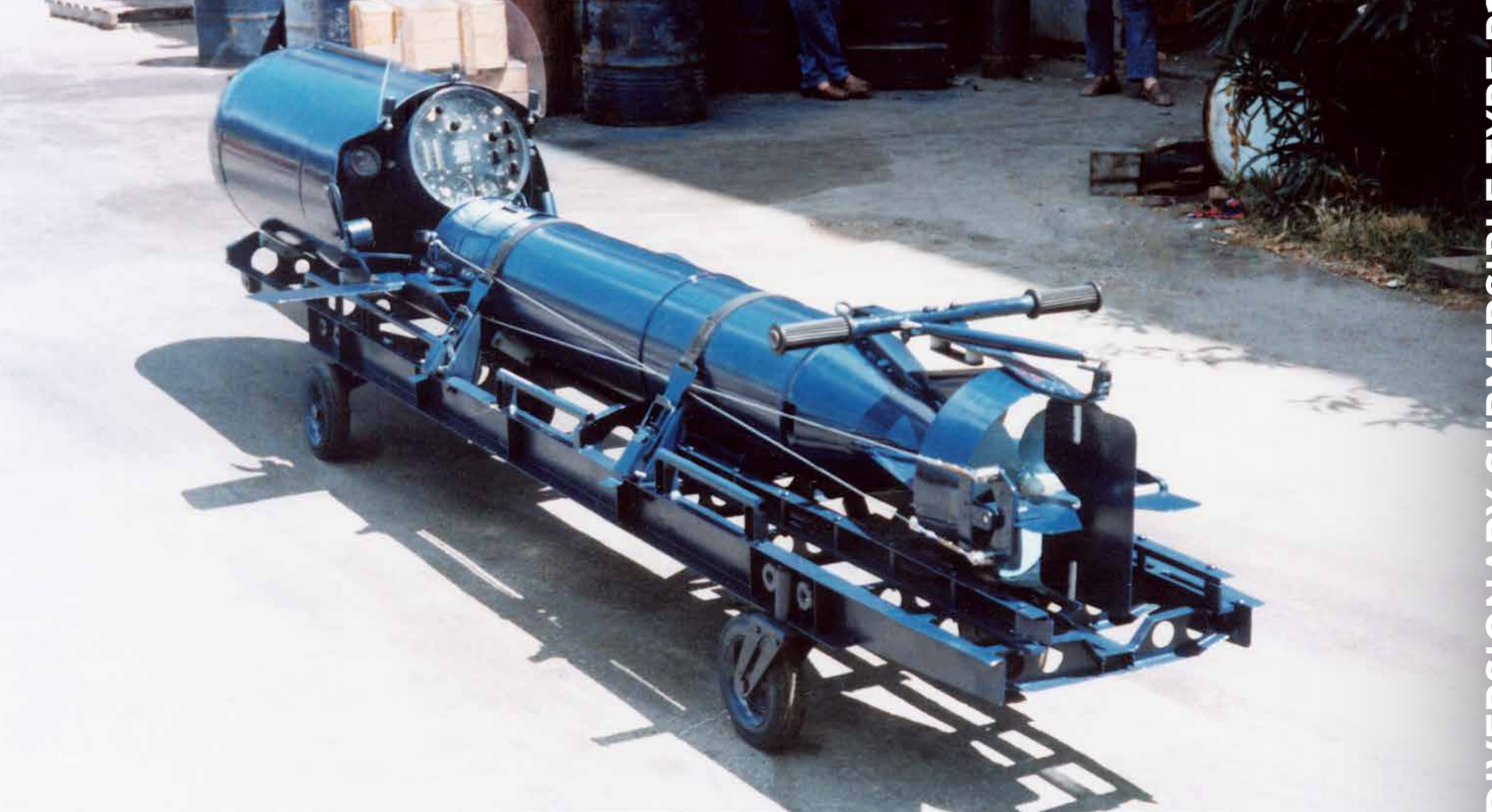
Cruising range
In underwater navigation with 7.3 knots, cruising range is **80 NM**, and **192 NM** with 4 knots. In sufrace navigation with 5.9 knots, cruising range is **90 NM**.

Complement
Depending on tactical mission, crew is composed of **6 persons**, or **4 persons** plus **6 combat divers**.

Propulsion system
The submarine is driven by two DC electric motors, **18 Kw** each. Electric energy is supplied by two groups of storage batteries, **128 links** each. The batteries are charged by **105 kW** diesel-generator.







DIVERSIONARY SUBMERSIBLE TYPE R1

YARD 528

Owner: SWEDISH NAVY

The submersible type R-1 is a single-seat underwater vehicle for one frogman. It is used for underwater reconnaissance, protection of harbours and moorings, and surveillance of enemy minefields.

Length | overall
3.72 m

Breadth | max
1.05 m

Height | max
0.76 m

Height | of hull
0.53 m

Diameter | of light bow
0.52 m

Mass | without load
145 kg

Diving depth | operating
60 m

Diving depth | max
100 m

Speed | max
3 knots

Speed | cruising
2.5 knots

CONSTRUCTION

The submersible R1 is monohull construction with the light bow and stern that can be flooded. The structure is made of aluminium alloy. It can be transported in submarine torpedo tube and used both in fresh water and sea of specific grafity of 1.000-1030 t/m3 without reserve updrift.

NAVIGATION EQUIPMENT

The navigation instruments are accommodated in water light cylindrical and consist of: gyro magnetic compass, sonar, echo-sounder, electric clock and other masuring instruments.

Cruising range
The cruising range at max. speed is **6 NM** whereas at cruising speed the range is **8 NM**

Propulsion system
DC electric motor of **1 kW**

Storage silver-zinc battery **24V DC**

DIVERSIONARY SUBMERSIBLE TYPE R2

YARD 529

Owner: SWEDISH NAVY

The diversionary submersible type R-2 is assigned for transport of two frogmen, underwater mines, diversionary equipment and underwater reconnaissance. It can be effectively used for antidiversionary protection of harbours and moorings, minefields and for detection and surveillance of enemy minefields.

Length | overall
4.90 m

Mass | equipped submarine
1400 kg

Speed | cruising
3.7 knots

Diving depth | max
100 m

CONSTRUCTION

The hull is made of aluminium alloy resistant to sea water corrosion. Front upper part of the submersible is made of plexiglass.

NAVIGATION EQUIPMENT

Gyro magnetic compass of aircraft type, magnetic compass, echo-sounder, sonar, two searchlights, etc.

Cruising range
The cruising range at cruising speed is **23 NM**

Propulsion system
DC electric motor of **4.5 kW**

Storage battery **24V 192 Ah**

Mine armament
Two underwater **mines of 50 kg** each.

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