

BULGARIAN ACADEMY OF SCIENCES
BULGARIAN SHIP HYDRODYNAMICS CENTRE **BSHC**





Bulgarian Ship Hydrodynamics Centre (BSHC) – Varna has been established in 1976 with the financial and expert support of the United Nations Development Programme (UNDP) and of the International Maritime Organization (IMO) as a scientific research and experimental center in the field of hydrodynamics of ships, floating structures and marine-based facilities. Since 2010, by decision of the BAS General Assembly, BSHC has been transformed as a detached research unit with preserved scope of activities within the frames of the Institute of Metal Science, Equipment and Technologies "Acad. A. Balevsky" at Bulgarian Academy of Science.



MISSION



EXPERTISE

BSHC performs wide spectrum of fundamental and applied research in the fields of ship hydrodynamics, aerodynamics, water transport and energy saving, ocean engineering, sea and river crises and disasters, marine ecology and coastal protection, facilities for fisheries and aquacultures, marine renewable energy sources, technology transfer, national security and defense. In cooperation with National High Schools and Universities, the Centre performs also training of students, cadets, PhD students, post-graduate students and trainees in the fields of its competence.

Scientific and applied research services offered by BSHC are highly recognized and frequently demanded by maritime stakeholders all over the world. The Centre operates in the cherished environment of broad national and international cooperation and represents the Republic of Bulgaria in a number of international organizations and projects relevant to its scope of activities.

- Ship hydrodynamics
- Ship powering
- Manoeuvrability
- Ship propellers and cavitation
- Aerodynamics
- Seakeeping
- Ocean engineering
- Renewable marine energy sources
- Coastal hydraulics

The Centre is an active member of ITTC, IMAM and other professional organizations, international as well as nationwide. Since 2005 BSHC is a member of the European Council for Maritime Applied R&D (ECMAR). BSHC has a representative in the working group of the WATERBORNE Technology Platform with the Directorate General "Researches" of EC. It collaborates and maintains close contacts with recognized R&D institutions and businesses worldwide. BSHC participates in a number of cooperative research projects under EU frame programs and NATO.

BSHC operates under the terms of ISO 9001:2008 conformed Quality Management System certified by SGS Company. Standard ITTC recommended procedures are fully adopted and followed.



BSHC partnership in several NATO research working groups has been highly estimated by authorities.

Customers and partners

BSHC develops and works in the nourishing environment of broad, intensive and extremely beneficial national and international cooperation. Since its establishments, BSHC had contracted over 400 research and applied projects, including design and manufacture of precise models of ships, propellers, nozzles, yachts, floating platforms, etc. and their thorough testing in various conditions, often in parallel with detailed numerical assessment. Throughout the years BSHC executed wide range of activities employing highly skilled and experienced personnel and applying customer-oriented approach to meet the expectations of over 160 clients from 25 countries (including Bulgaria).

BSHC is developing and strengthening steady partnerships with other research and development organizations, academia and the private sector all over the world, aiming to promote new research and scientific applications.



Distribution of Export Services for BSHC Key Customers over the 2004-2014



International Recognition



William Morgan,
"David Taylor Naval Ship
Research & Development Center",
USA

...The international well-known ship hydrodynamics laboratories have as first-class experimental facilities as well as highly qualified research staff. The Bulgarian Ship Hydrodynamics Centre is blessed to have both of them and could be proud with its achievements ...

Bruce L. Hutchison,
Glosten Associates Incorporated,
USA

...The experimental facilities available at the Bulgarian Ship Hydrodynamics Centre put it amongst the elite ship model investigations centres in the world. The BSHC Shallow Water Towing Tank and Seakeeping-Manoeuvring Basin are amongst the biggest in the world and possess wide possibilities. ...BSHC represents an achievement of world scale with which Bulgaria can be proud ...



- USA**
 - Office of Naval Research
 - The Glosten Associates
 - Exmar Offshore Company
 - IIHR - University of Iowa
 - Maybank Industries, LLC
 - Marinette Marine Corp.
- Germany**
 - Becker Marine Systems GmbH & Co.KG
 - P & S Project GmbH, Rostock
 - Technical University, Rostock
- Turkey**
 - RMK Marine
 - Delta Marine
 - Istanbul Technical University
 - AKAR GROUP
 - Bayraktar Shipping Group of Companies
 - Ulstein Es-Cad as
 - CICEK Shipyard
 - Sedef Shipyard
 - DESAN Shipyard
- Denmark**
 - Danish Maritime Institute (DMI)
 - FORCE Tehnology
- Singapore**
 - Keppel FELS
- Belgium**
 - Flanders Hydraulics Research
- Republic of Korea**
 - Hyundai Mipo Dockyard Co., Ltd.
- P.R. China**
 - China Shipbuilding Industry Corporation
 - China Ship Scientific Research Centre
- Russia (former Soviet Union)**
 - Krylov Shipbuilding Research Institute
 - Central Maritime Research Institute
- Hungary**
 - MAHART
- Bulgaria**
 - Navigation Maritime Bulgare
 - Rousse Shipyard J.S.C.
 - Passat Bulgaria JSC
 - Ministry of Education and Science
 - Naval Academy – Varna
 - BULYARD
 - MTG DOLPHIN
- United Kingdom**
 - Burness Corlett
 - Newcastle University
- France**
 - S-te GENIMAR - E.U.R.L. TECIMAR
 - DCNS Lorient
 - ENSIETA
 - Compagnie Nationale du Rhone
- Norway**
 - Omega Technology AS
 - SINTEF
- Spain**
 - KER Associated Lmt
 - VICUS td
- Sweden**
 - Rolls – Royce AB
- Canada**
 - DH20 SEPARATORS INC
- Finland**
 - VTT Technical Research Centre of Finland
- Israel**
 - Israel Shipyard Ltd

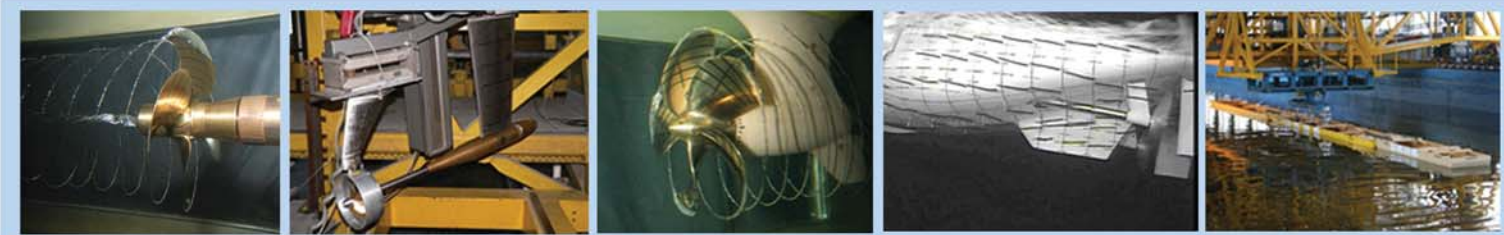


Propellers & Cavitation

- Open water tests of propellers in axial & oblique flow
- Propeller/rudder behind hull condition tests
- Cavitation observation
- Cavitation erosion investigation
- Pods and Z-drives tests
- Hull and rudder pressure distribution measurements
- Assessment of 6DoF loads on propellers and rudders

Inland Water Transport Effectiveness

- Hydrodynamics of barges, tug boats, river ships and push trains for inland navigation
- Restricted water effects
- Development of intermodal transport schemes along inland waterways
- Investigations of the sea/river transport effectiveness



Resistance & Propulsion

- Resistance tests on vessels and floating bodies
- Self-propulsion tests
- Flow visualization
- CFD computations of the flow around ship's hull by the *nu-Shallow* potential code
- Wakefield measurements
- Model tests of energy saving devices
- Ship trim optimization tests
- Non-conventional propulsion, incl. water jets

Design and Production of Testing Appliances and Instrumentation

- Ship model autopilot systems
- Ultrasonic model tracking system
- Wave profile probes
- Unified data acquisition system and DSP modules based on NI LabView software
- Specialized model test equipment according client's specification



Coastal Engineering

- Physical modeling of hydrodynamics, beach profile dynamics and sediment transport in coastal zones in support of environmental protection structure's design
- Computational applications based on *SWAN* (modeling of sea waves in the coastal zone), *MIKE 21* (simulation of waves, currents and sediment transport in rivers, river entrances, bays), *MIKE FLOOD* (simulation of floods for flood mapping and risk assessment)

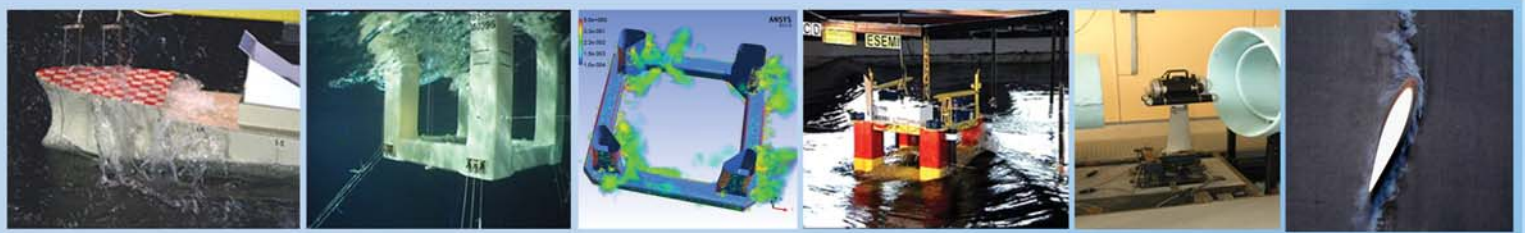


Seakeeping & Ocean Engineering

- Theoretical & experimental prediction of ship behavior in waves
- Model tests on offshore structures
- Offshore structures motion analysis
- VIM analysis
- Offshore structures mooring analysis
- Modeling of aquaculture and fish farm floating systems
- Model tests of renewable energy devices
- Prediction of ship stability, including damaged stability
- Development of ship emergency response systems
- Development of on-board stability, motion and loading control systems
- Analysis of accidents at sea
- Computational applications based on HECSALV (stability, strength, emergencies, salvage), MORA (dynamics of floating structures), ROMEO and ORCA FLEX (mooring analysis), ANSYS FLUENT (VIM, VIV, fluid loads of structures, etc.), in-house software

Aerodynamics

- Aerodynamic design and optimization of waterborn vehicles, rudders, fins, skegs, etc.
- Aerodynamic model investigations and design of wind energy utilization devices
- Calibration of standard instrumentation for measuring of fluid flow parameters
- Computational applications based on ANSYS FLUENT



Maneuvering

- Free running model tests of mono- and multi-hull vessels
- Large amplitude Planar Motion Mechanism tests on surface ships, push-trains and submerged bodies
- Restricted water 4-quadrants maneuvering, including shallow water, channels, locks etc.
- Maneuvering and course keeping in waves
- Assessment of vessel's maneuverability compliance with IMO standards
- Vessel's maneuverability investigation on ship maneuvering training simulator
- Computational applications based on MathLab and Simulink



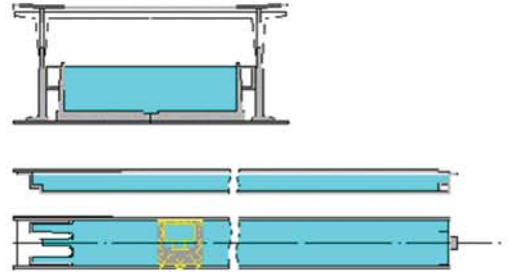
CAD/CAM Design

- Hull lines and ship physical model design by *Rhinoceros*, *Rhino Marine* and *NAPA* design tools
- Propeller, duct, rudder and appendages design by *VISI* software
- Hull model fabrication by a CNC milling machine
- Propeller, duct, rudder and appendages manufacturing by a CNC machining center



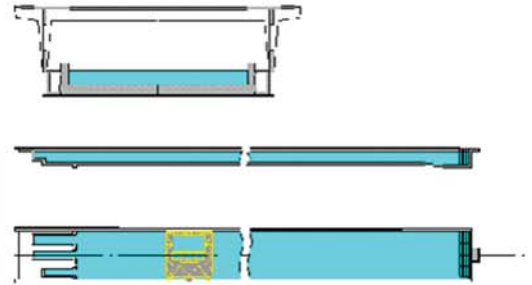


DEEP WATER TOWING TANK



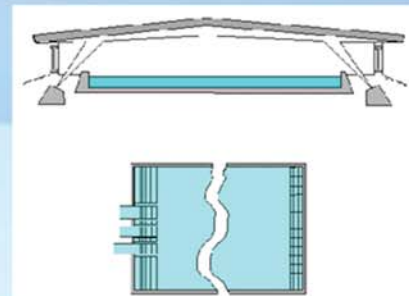
Dimensions, m			Other parameters		
Length	Breadth	Depth	Max. carriage speed		6 m/s
200	16	6.5	Wave-maker regular and irregular waves	Wave length	1-12 m
				Wave height	0.1-0.4 m
			Ship models	Wave steepness	1/20
				Max. length	12 m
				Max. weight	12 t

SHALLOW WATER TOWING TANK



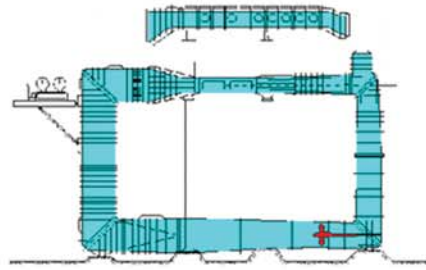
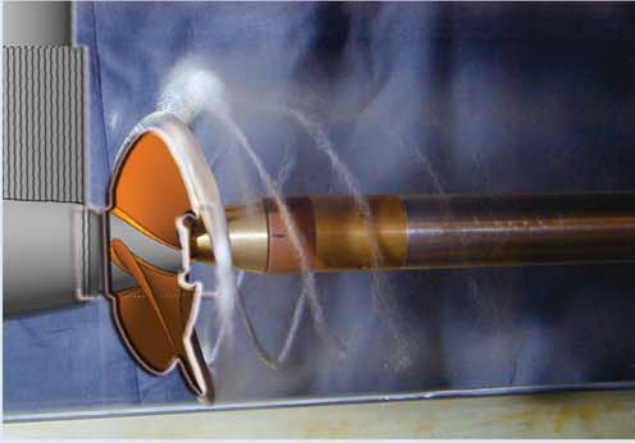
Dimensions, m			Other parameters		
Length	Breadth	Depth	Max. carriage speed		6 m/s
200	16	0-1.5	Ship models	Max. length	12 m
				Max. weight	12 t
			Modeling of arbitrary channel configuration		

MANOEUVRING & SEAKEEPING BASIN



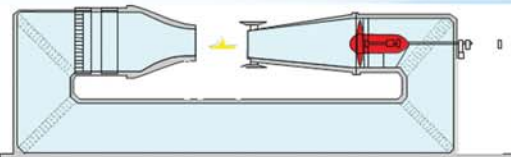
Dimensions, m			Other parameters		
Length	Breadth	Depth	Wave-maker regular and irregular waves	Wave length	1-12 m
64	40	2.5		Wave height	0.02-0.4 m
				Spectrum	optional
			Ship models, self-propelled ratio-controlled	Max. length	4.5 m

CAVITATION TUNNEL



Measuring section	Dimensions, m			Other parameters	
	Length	Breadth	Depth		
Section No.1	2.6	0.6	0.6	Min. cavitation number Max. flow velocity	0.2 14 m/s
Section No.2	6.0	1.4	0.7	Max. flow velocity Max. model length	4.5 m/s 5m

WIND TUNNEL



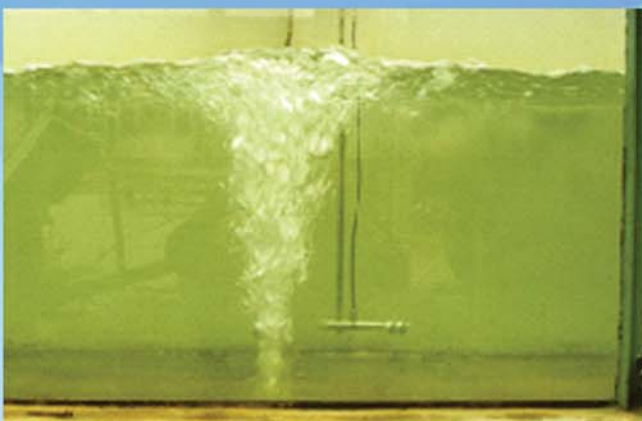
Dimensions, m			Other parameters	
Length	Breadth	Depth		
9.5	0.8	0.46	Max. flow velocity	66 m/s
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OPEN WATER AREA

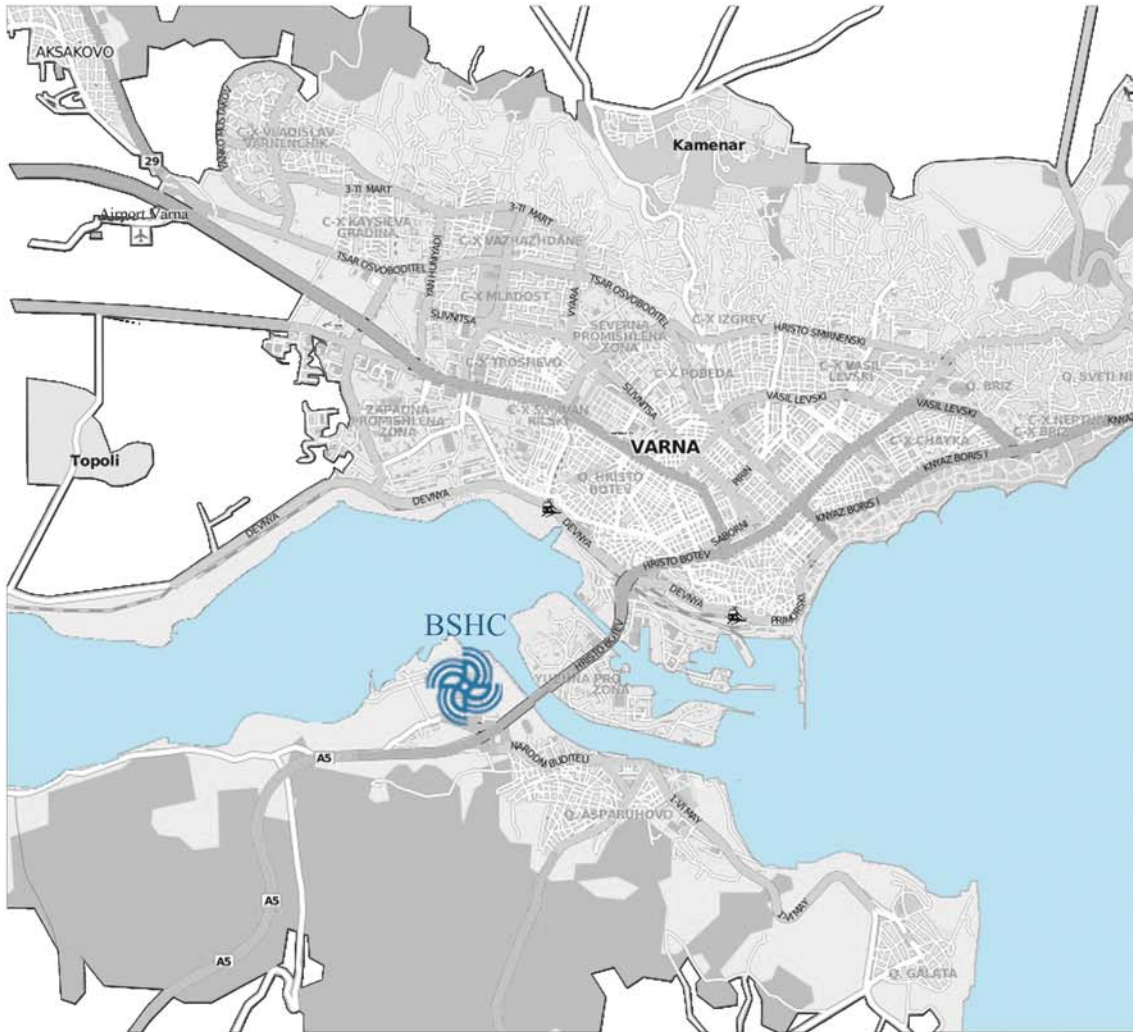


Length - 170 m
Breadth - 160 m
Depth - 3 m

WAVE CHANNEL



Dimensions, m			Other parameters	
Length	Width	Depth		
30	0.8	0.9	Wave height	up to 0.2 m
				0.6 - 2.5 sec
			Solitary wave height	
			Max. current speed	



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