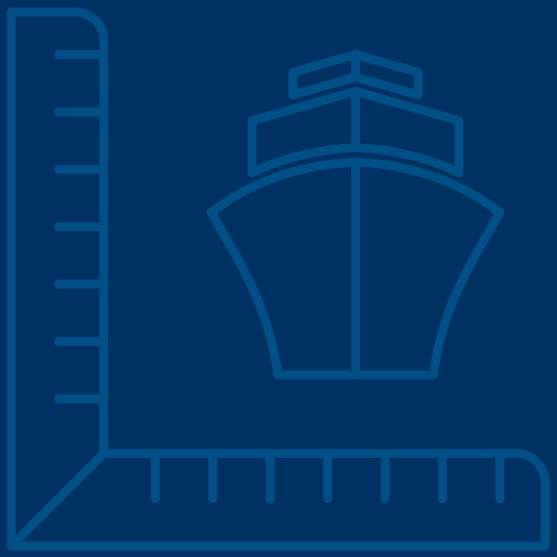
MARITIME RESEARCH AND DEVELOPMENT CENTRE

Maritime Research and Development Centre

Maritime University of Szczecin

Poland


MRDC

Maritime Research and Development Centre

The Maritime Research and Development Centre (MRDC) is the largest university development project in the West Pomerania region in years becoming a meeting ground for research and business in the maritime industry.

The Centre includes a dozen of ultra-modern equipped laboratories with permanent access to waterways. The facilities provide our top-level academic staff with the opportunity to research, develop and test innovative maritime technological solutions.

The MRDC will enable the implementation of modern solutions and methods used worldwide in scientific research. This will create conditions conducive to:

- better aligning research offerings with the needs of entrepreneurs;
- introducing innovations in the production process through the use of new technologies and the development of proprietary modern solutions;
- improving the quality of research processes by utilizing or creating state-of-the-art equipment;
- directing research to meet employer expectations and developing new solutions and technologies through the creative process of identifying employer needs.

Laboratories

IT Laboratory

Research objectives:

- engineering simulation for structural, fluid dynamics and thermal analysis;
- navigational risk analysis of both ships and maritime infrastructure;
- logistics processes simulation;
- advanced design and prototyping projects;
- AI powered data mining.

Commercial objectives:

- modeling interactions between components of complex navigational environment of XXI century shipping;
- new offshore projects risk analysis;
- end-to-end maritime supply chain simulation and analysis.

Laboratory for Land and Offshore Survey Data Processing

Research objectives:

- automation of data processing methods using machine learning.

Commercial objectives:

- processing hydrographic and geophysical spatial data in cloud and raster formats from oceanic, marine, and inland seabed areas, along with their existing technical infrastructure;
- utilizing raster and cloud data to create 3D/4D maps.

Laboratory for the Positioning of Underwater Constructions and Robots

Research objectives:

- use of raster data for seabed classification, e.g., backscatter;
- utilizing water column data to identify objects within the water column.

Commercial objectives:

- bathymetric and sonar studies, including depth analyses, seabed topography, stratification of the seabed, assessment of hydrotechnical structures, verification and search for objects on the seabed, physico-chemical water analysis, archaeological research, and support for dredging and installation works;
- studying the accuracy of underwater positioning.

Laboratory for the Positioning of Floating Objects in Motion

Research objectives:

- research on data fusion algorithms from navigation sensors;
- application of Machine Learning to integrate and filter navigation data.

Commercial objectives:

- moving object tracking algorithms using Forward Looking Sonar (FLS);
- application of SLAM methods in autonomous hydrographic measurements.

Laboratory of Navigation Technologies and Satellite Techniques

Research objectives:

- multi-system static and kinematic measurements (GPS, Glonass, Galileo, Beidou, SBAS) high-precision RTK (static 0.5 cm RMSE, kinematic 1.5 cm RMSE) in navigation, geodetic, geoinformatic research in the field of positioning and dimensioning objects using the ASG Eupos network or own reference station;
- construction of data fusion, integration and filtration methods, design of geoinformatic systems such as PNS, PNDS, ECDIS and Refsys data;
- development of methods for assessing the reliability and integrity of satellite position and situational data in order to optimize the safety criteria of navigation and offshore works;
- simulation modelling of GNSS, hydroacoustic, laser and radar measurements; commercialization within FSA and FMEA analyzes for industrial partners.

Commercial objectives:

- navigational, hydrographic and geoinformatic research in the field of measurement and positioning of floating objects with a dual-antenna DGNSS PPP/RTK GNSS marine receiver with accuracies of: 5cm RMSE of horizontal position, 0.1° RMSE of course. High precision SBAS, RTK, PPP kinematic measurements in 3 to 5 degrees of freedom;
- conducting simulation tests of GNSS, RTK GNSS equipment and vessel control systems using a broadband, multi-constellation GPS L1, L2, L5 signal simulator; GLONASS G1, G2, G3; Galileo E1, E5a/b, E6; BeiDou B1, B2, B3; QZSS L1, L2; IRNSS L5;
- research and commercialization of autonomous technologies based on GNSS data.

Cartographic and GIS Laboratory

Research objectives:

- testing of geodetic and photogrammetric methods for dimensioning floating objects (including unmanned ships);
- development of computational algorithms for point cloud integration;
- using machine learning to automate the processing of measurement data for offshore purposes;
- testing the accuracy of LiDAR data obtained from unmanned ships;
- support for the MRDC laboratories in the field of precise geodetic and photogrammetric measurements, geospatial analyses and visualization of research results.

Commercial objectives:

- dimensioning of floating objects using precise geodetic and photogrammetric measurements;
- photogrammetric training in the use of unmanned aerial vehicles (UAV – Unmanned Aerial Vehicle);
- measurement of the volume of earth masses using LiDAR data and short-range photogrammetry;
- development of orthophotomaps and three-dimensional digital models with very high resolution (VHR);
- development of environmental analyzes using geospatial data.

Laboratory of Large Scale Models Control

Research objectives:

- testing of the remote control system by an operator using remote control consoles;
- tests of autonomous mooring systems;
- research on the use of AI in the autonomous control process.

Commercial objectives:

- the possibility of testing innovative technical solutions created in the industry for the operation of autonomous ships on models.

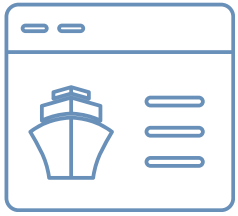
Laboratory of Inland Vessels Stability and Operation

Research objectives:

- identification, analysis and assessment of risks on inland and maritime waterways;
- identification of safe maneuvering areas in inland navigation;
- analysis and assessment of the safe operation of ships in terms of their stability and unsinkability;
- creation and visualization (2D and 3D) of innovative technical and technological solutions;
- configuring, modeling and simulating simple river models;
- hydrological modeling within the designated area.

Commercial objectives:

- design and modeling of objects (2D and 3D) superstructure and inland water transport infrastructure;
- creating and modifying three-dimensional geometry of object models, intelligent dimensioning of models for parametric studies;
- performing analyzes in the field of calculations of hydrostatic properties and ship stability (damage stability and intact stability);
- performing analyzes in the field of risk assessment of maneuvering ships, estimating the frequency of vessel collisions and groundings on a given waterway for various types of waterways.



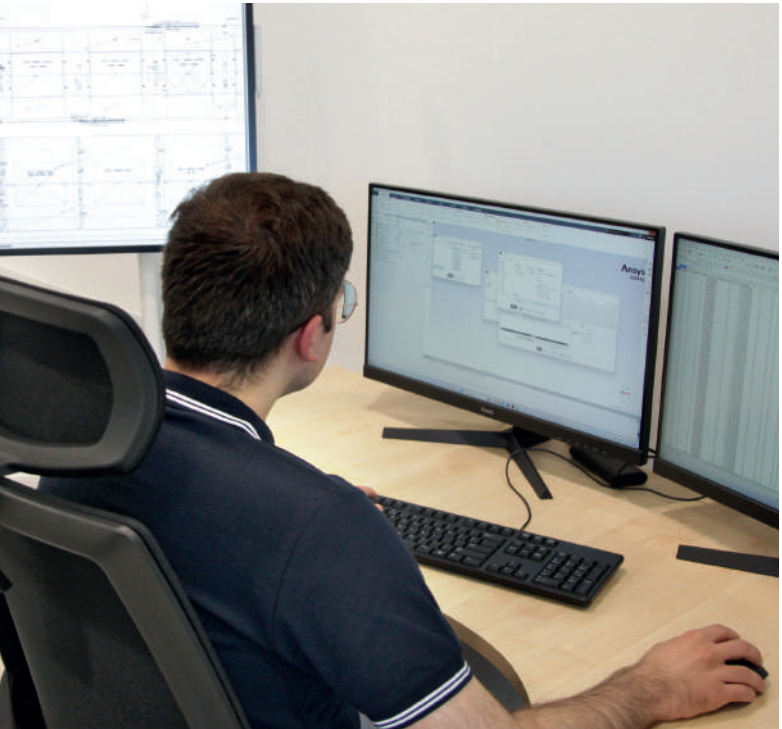
Laboratory for Modelling the Consequences of the Floating Objects Failures

Research objectives:

- probabilistic risk models for manoeuvring a floating object in confined waterways and sea areas with hydro-technical structures which pose a risk to navigation.

Commercial objectives:

- development of mathematical models for estimating the risk of vessel manoeuvring in open waters in terms of vessel collision;
- simulation method covering hydrotechnical equipment, including off-shore and underwater infrastructure;
- optimization of hydrotechnical port facilities;
- monitoring analysis while checking with the bottom and hydrotechnical infrastructure.



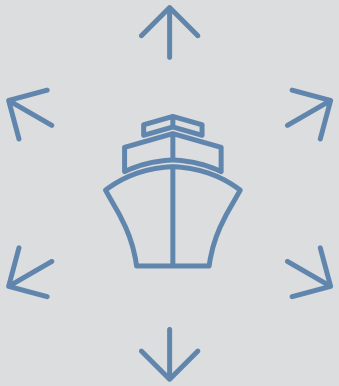
Laboratory for Modelling of Waterways and Infrastructure

Research objectives:

- systemic diagnosis of actual production and operation processes of floating objects;
- building 3D models of technical objects, transportation systems and production environments;
- testing the processability of products and the efficiency of transport systems;
- setting up technological databases equipped with artificial intelligence tools for classifying and searching information.

Commercial objectives:

- testing the processability of products and the efficiency of transport systems;
- creating technological databases equipped with artificial intelligence tools for classifying and searching information;
- simulation of production processes and logistics operations, assessment of their effectiveness, system optimization, model visualization, also in the VR environment;
- designing and creating software supporting decision-making processes in the area of production and logistics management in the maritime industry.



Laboratory of Automatic Tracking of Moving Objects

Research objectives:

- real-time analysis of the movement of vessels in the waters of the ports of Szczecin, Świnoujście, Kołobrzeg and adjacent ports;
- real-time analysis of navigation markings (Aids to Navigation – ATON) operating in the AIS system;
- analysis of the operation of AIS-PL system base stations and neighbouring countries within range or providing information;
- using data on the movement of conventionally crewed units to plan and monitor the route of autonomous units;
- economic analyzes (e.g. waiting time at the roadstead and in ports for ships of particular types, speeds maintained);
- risk assessment on approaches to ports and in Polish and foreign ports;
- processing and analysis of historical AIS data of other countries available online.

Commercial objectives:

- risk assessment on Polish fairways, approach lanes to ports, coastal and open waters;
- risk assessment in fairways, port approach lanes, coastal and open waters using historical AIS data available online (free or with purchase) access);
- analysis of unit movement for statistical purposes;
- monitoring the movement of competitive units.

Scale models

Scale model of the bulk carrier mv „TATRY" (PŻM) - scale 1:40

Scale model of the Triple E container ship „MAJESTIC MAERSK", 18,340 TEU - scale 1:70

Scale models are used to:

- automate of autonomous ships in the field of remote control;
- risk analysis of the operation of autonomous ships;
- build mathematical models and algorithms for autonomous control of unmanned ships;
- development of technology for communication between the on-shore service centre and the deck of an unmanned ship.

Maritime Research and Development Centre
Maritime University of Szczecin
Poland

ul. Dębogórska 12
71-717 Szczecin
Poland

ceop@pm.szczecin.pl

+48 91 48 09 509
+48 602 789 066

ceop.pm.szczecin.pl/en/