CTO S.A.

CENTRUM TECHNIKI OKRĘTOWEJ S.A.

our research-design programmes






modern research laboratories

export of high technologies

About the company

Research and design support programmes

The Ship Design and Research Centre (CTO S.A.) is a unique combination of research institute and design office. The main scope of the company's operation includes provision of R&D services for different industries. The company provides services in Poland and abroad presenting results of applied research and design works constituting the basis for implementing innovative technical and engineering solutions. CTO S.A. cooperates with numerous research units utilising its research potential in domestic and international research projects. The company's offer also includes the transfer of knowledge and high technologies, particularly in the field of designing and manufacturing research facilities and equipment.

During over 40 years of its operation, CTO S.A. has evolved from an industry centre closely connected mainly with the domestic shipbuilding industry into a cutting-edge company respected all over the world and involved in varied research activities. Over the years, the Company's activity has contributed to maintaining competitiveness and high level of innovation of ships built in Poland. Presently, its scope of operation is significantly diversified. Most of all, CTO S.A. is famous for its ship towing tanks and for being a manufacturer of high-quality research equipment. The modern fire and acoustic testing laboratories created in 2009-2011 are used to carry out tests including fire resistance, smoke-tightness and acoustic insulating power of ship and construction structures. Both laboratories are accredited by the Polish Centre for Accreditation. In 2011, CTO S.A. established the Product Certification Centre for its Clients.

The CTO S.A. scope of operation consists of three main areas including the following, thematically uniform, research-design programmes:

1. Services, research and designing activities connected with marine technology:
   - ship programme
   - yacht programme
   - off-shore programme
2. Services, research and designing activities including utilisation of research facilities, measuring equipment, computer programs and professional expertise during projects implemented for marine and land-based industries:
   - environmental engineering programme
   - renewable energy sources programme
   - medical engineering programme
3. Designing, manufacturing and commissioning research facilities and equipment and measuring instrumentation:
   - research equipment programme.

This folder is to present the above-mentioned research-design programmes.










Customer satisfaction resulting from using with CTO S.A. services and products is guaranteed by long-lasting experience and recognition confirmed with numerous domestic and international awards and distinctions. Our company's main assets include:

- specialised personnel,
- diversified and unique (in Poland), research base with cutting-edge laboratories and workshops,
- long-lasting continuity of research, development and design activities,
- substantial base of research results, in particular the model-full scale correlation in the ship model testing,
- capability of undertaking multidisciplinary research-design tasks while developing own products or fulfilling customers' orders,
- high position on the domestic and international markets resulting from the quality and scope of research and design services provided,
- capability of diversifying our activity resulting from our personnel's qualifications and experience,
- ability to perceive different application possibilities in relation to our competences and research equipment,
- good financial standing and systematically implemented investment and modernisation projects.

CTO S.A. always strives to fulfil all its tasks on the highest possible level, according to its Clients' expectations and, thanks to its ability to independently implement the research results, the company's products belonging to the high-tech category are recognised on domestic and international markets.

Presently, CTO S.A. has been involved in a broad scope of activities including the ship and yacht industry, off-shore, power engineering based on renewable energy sources, environmental engineering, production of specialist research equipment or even medical engineering and product certification. Our Clients may come to us with even most difficult problems and we do our utmost to solve them.

See below for our offer and cooperation opportunities:

- www.cto.gda.pl
- www.yachtresearch.eu
- www.laboratoria-badawcze.pl

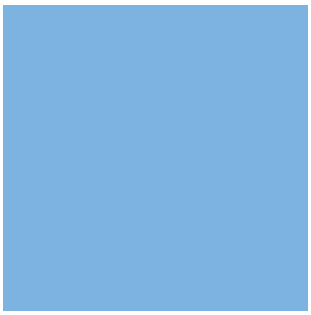
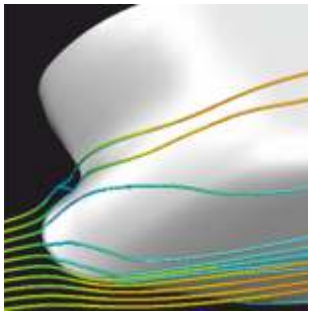
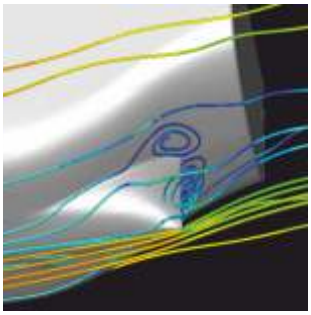
Ship programme

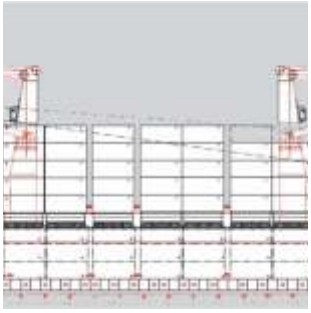
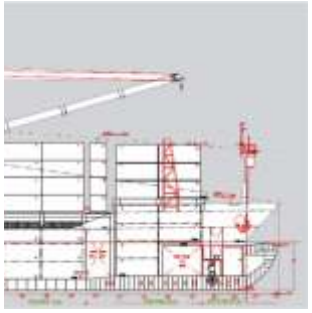
- designing, experimental model testing, computational analyses for ships
- prediction of power performance, seakeeping and manoeuvring properties of a ship
- sea trials, other on-board tests

Our research facilities and equipment, laboratory instrumentation, computer programs as well as personnel's competences and expertise determine the CTO S.A. basic scope of operation, i.e. the market of research, design, construction and modernisation of different vessels.
The services provided within the framework of this programme take into account global trends in naval architecture consisting in implementation of solutions aimed at reducing fuel consumption and greenhouse gas emissions, enhancing operational safety and introducing new materials and technologies which decrease the costs of manufacturing, utilising and scraping vessels.

Our ship programme includes:

- predicting operating characteristics of actual vessels on the basis of experimental model tests and numerical computations taking into account changeable weather conditions (currents, wave motion, wind, depth and sea area limits),
- experimental model tests regarding hydrodynamics and aerodynamics,
- numerical analyses of water flow around a vessel's hull, propeller and above-water body,
- numerical analyses of structural strength, vibrations and noise propagation in relation to vessels,
- designing vessel equipment elements, ship systems or complete vessels,
- measurements and analyses carried out on actual vessels in operating conditions, e.g. during acceptance tests on the sea.

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The main directions of the research work performed within the programme are connected with:

- improving designs of cutting-edge and economical marine power plants, steering and steering-power units,
- development of methods of modelling, effectiveness forecasting and designing dynamic vessel positioning systems,
- improving computer programs for virtual modelling of vessel hull and propellers,
- numerical modelling of the flow around a vessel hull and screw propeller, taking into special account the problems connected with the free surface, actual physical properties of water and interactions among the vessel hull, propeller and rudder,
- improving technologies of taking measurements, processing data and presenting results in ship model tests,
- development of measurement methods on ships during sea trials, in particular measurements and location of vibration and noise sources,
- development of the forecasting methods for ship environmental impact indicators: EEDI (Energy Efficiency Design Index) and EEOI (Energy Efficiency Operational Indicator).

Within the framework of our ship programme, we cooperate with:

- shipyards and design offices,
- ship-owners and fleet operators,
- ship equipment manufacturers,
- classification associations,
- universities and research centres.

- catalogue sheets
- a reference list and
- implementation examples

are available at:
www.cto.gda.pl
www.laboratoria-badawcze.pl

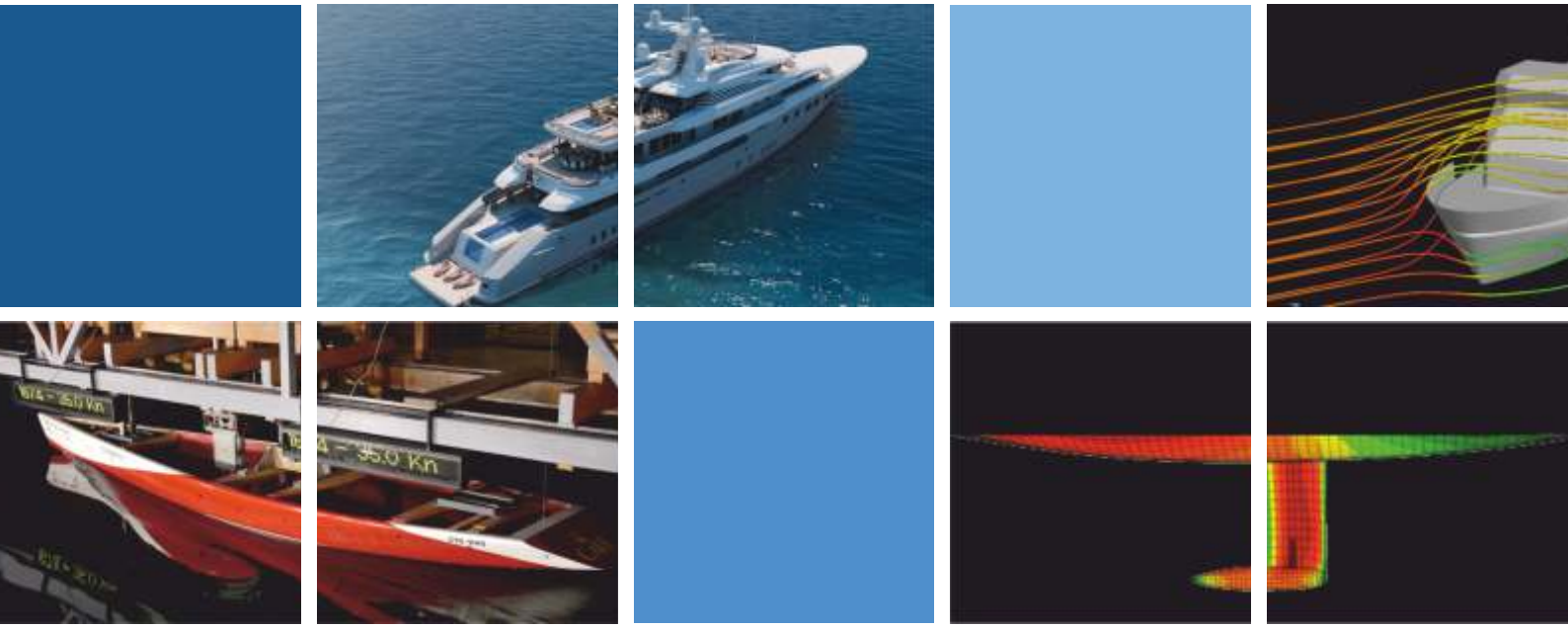
Yacht programme

- support for design activities
- model hydro- and aerodynamic tests and numerical analyses of motor and sailing yachts and other recreational vessels

CTO S.A. is a recognised research centre on the international yacht market. The company develops numerical and experimental methodologies for model hydrodynamic and aerodynamic tests, particularly for large motor and sailing yachts. The scope of the programme is systematically complemented with new elements responding to the needs of designers, manufacturers and users of these vessels.

The programme includes:

- hull geometry modelling,
- numerical analyses of the flow around the vessel hull and her above-water body,
- experimental model tests,
- elaborating the resistance-propulsion predictions,
- designing marine properties,
- defining manoeuvring properties,
- aerodynamic tests.



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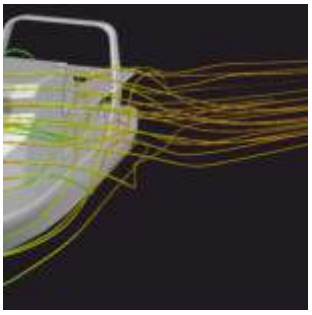
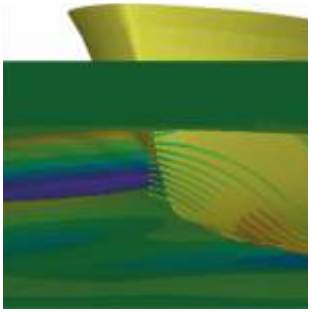
The main directions of the research work performed within the programme are connected with:

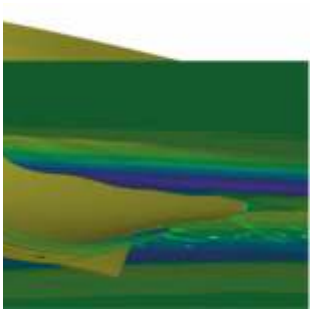
- utilisation of the computational fluid dynamics tools to determine the flow around underwater and above-water hull sections in marine properties predictions,
- research connected with structure mechanics,
- testing light, durable and corrosion resistant materials and technologies of hybrid structure matarials,
- environmental protection and recycling issues resulting from operation of a large number of vessels within relatively small sea areas.

Within the framework of our yacht programme, we cooperate with:

- yacht shipyards,
- design offices,
- ship-owners operating charter vessels,
- manufacturers of yacht equipment and water leisure equipment.







- detailed description of services
- implementation examples

are available at:
www.yachtresearch.eu

Off-shore programme

- model hydro- and aerodynamic tests, numerical analyses and operating tests of off-shore facilities
- analyses of foundation methods, anchoring systems and dynamic positioning of off-shore vessels and facilities
- structure modelling

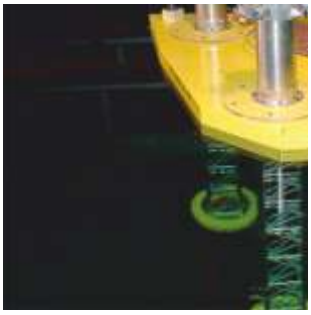
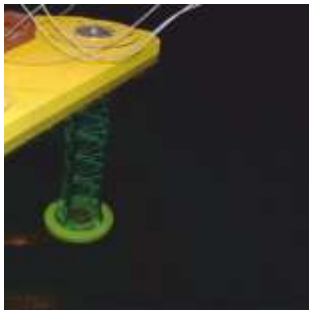
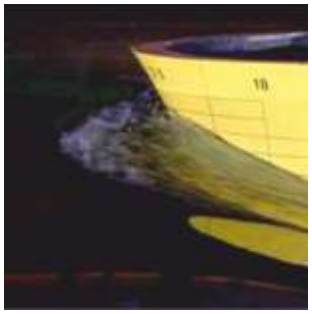
Over numerous years, CTO S.A. has been involved in R&D activities connected with vessels used in off-shore facilities operation. The company has been systematically developing its competences within this scope including state-of-the-art laboratories for testing off-shore facilities, necessary methodology for calculating environmental loads and structure response and methods of forecasting actual properties of off-shore facilities on the basis of calculation analyses and model tests.

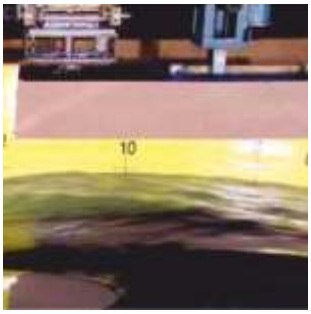
The off-shore mining sector including semi-submersible facilities, lifting islands, Floating Production Storage and Offloading facilities (FPSO), TLP platforms, SPAR platforms and other deep-submersible facilities and the power engineering sector including structures aimed at energy recovery from renewable sources have certain established innovation requirements. A state-of-the-art and specialised off-shore laboratory facilitates development of research activities as regards hydrodynamic and aerodynamic testing, which enables domestic off-shore facilities manufacturers and their operators to fulfil the assumed research needs within a broad scope.

The programme includes:

- experimental model tests and numerical analyses constituting the basis for predicting the power demand and properties of marine vessels and off-shore units,
- designing equipment and mechanisms used as on-board equipment of units servicing oil rigs including designs of anchoring and mooring systems,
- designing auxiliary equipment used in drilling systems operation,
- testing actual off-shore facilities,
- FEM numerical analyses for durability and resistance to vibration of sea vessels and off-shore facilities.





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The main directions of the research work performed within the programme are connected with:

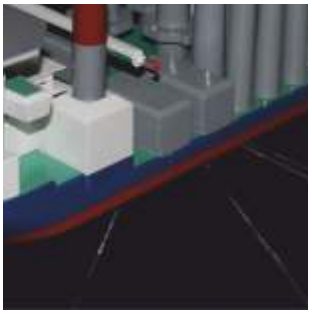
- designing and testing special propulsors and dynamic positioning systems,
- forecasting seakeeping and manoeuvring properties on the basis of experimental model tests and numerical simulations,
- development of associated numerical simulation methods including determination of the flow around objects, loading their structures against wave, current and wind impact and response of structures to forecasted loads,
- development of the hybrid research methodology combining model experiments and numerical analyses in relation to anchored off-shore facilities,
- using innovative sandwich-structure materials.

Within the framework of our off-shore programme, we cooperate with:

- entities operating in the marine mining industry including equipment manufacturers,
- design offices and shipyards,
- off-shore facilities owners and operators,
- classification societies,
- universities and research centres.








- catalogue sheets
- detailed description of services

are available at:
www.cto.gda.pl
www.laboratoria-badawcze.pl

Renewable energy sources programme

- support for designing works
- model hydro- and aerodynamic tests as well as numerical analyses and operating tests for renewable energy sources equipment

Over numerous years, CTO S.A. has been fulfilling orders of domestic and international Clients regarding model tests and calculation analyses for renewable energy sources equipment utilising wave, water current and wind power in marine and land environments.

Utilisation of renewable energy sources has positive impact both on the environment and economy stability exerted through enhancing power supply security. Development of the domestic renewable power engineering industry facilitates export of modern technologies. The increase in renewable energy sources utilisation is compliant with the domestic energy security policy.

CTO S.A. belongs to MORCEKO (Marine Centre for Renewable Energy and Ecosystems) including research units located on the Polish coast having complementary competences as regards comprehensive research connected with designing and operating marine wind farms.

The Company's main goal is to ensure safe energy generation through designing new technical solutions making it possible to utilise the renewable energy sources available on the Baltic Sea and the Polish coast.







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The main directions of the research work performed within the programme are connected with:

- methods of verifying the equipment operation in the environment,
- testing models and prototypes of various equipment used to convert the power obtained from seas, rivers and the atmosphere,
- methods of the economy of scale effect evaluation in experimental model tests,
- numerical flow analyses,
- tests of stability on waves and safety of operating power engineering equipment supporting structures, analyses of structure strength and vibrations,
- field tests for small wind power plants within a special measuring station.

Within the framework of our renewable power engineering programme, we cooperate with:

- entities operating in the renewable power engineering sector, in particular marine wind towers manufacturers,
- equipment operators,
- universities and research centres.

- implementation examples
- description of services

are available at:
www.cto.gda.pl

Research equipment programme

- designing, manufacturing and implementing equipment and research facilities including necessary training within this scope
- export of expertise and high-tech

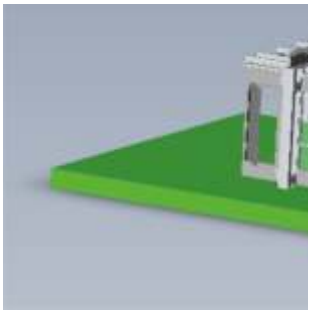
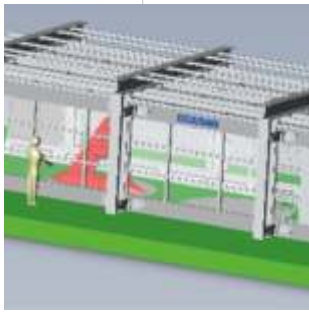
CTO S.A. has long-standing experience in the field of operating own research equipment. Since 1973, the company has been a member of the International Towing Tank Conference (ITTC). Conducting necessary research enables us to look at the process of designing research and measuring equipment from the user's point of view, better understand our Clients' needs and properly select technical and operational characteristics of the designed equipment.

We offer comprehensive solutions including Client's needs analysis, feasibility and profitability studies, initial and conceptual designs, research laboratory organisation, technical and detailed designs, manufacturing and functional testing of research equipment, training based on the research conducted within our own research facilities, comparative inter-laboratory tests of benchmark models, elaborating research procedures and supervision over project implementation until the stage of full equipment commissioning and implementation.

The programme includes:

- designing, manufacturing, delivering and commissioning of facilities and equipment for conducting applied research connected with the marine technology, particularly model tests of vessels (towing tanks equipment, cavitation tunnels, circulating water channels, subsonic and transonic wind tunnels),
- designing and manufacturing measuring equipment used in the experimental fluids and solids mechanics including dynamometers and equipment measuring physical fields,
- modernisation of research equipment including towing tanks and cavitation tunnels and their equipment,



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- training connected with designing, calculation methods for ship structure mechanics and conducting model tests,
- training connected with operating the delivered research equipment (theoretical bases and practical exercises using standard models),
- experimental inter-institutional comparative research,
- manufacturing models of ship hulls and propellers.

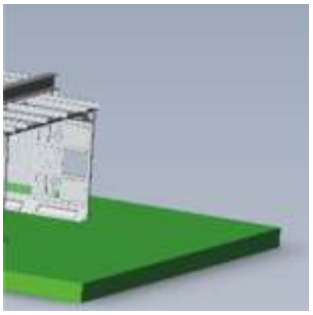
The main directions of the research work performed within the programme are connected with:

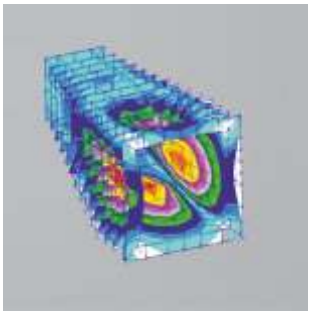
- development of measuring equipment, e.g. dynamometers for aerodynamic and hydrodynamic tests,
- new methods of performing measurements and processing the data obtained,
- methods of research equipment designing (cavitation and wind tunnels, water circulation channels, facilities for hydroacoustic tests, towing tank carriages, etc.),
- calculation methods connected with flows and structure durability,
- taking into account the specificity of the flow equipment used as research facilities in the experimental hydromechanics.

We are at your disposal as far as the selection and manufacturing of equipment customised to certain research and technological needs is concerned.

Within the framework of our renewable power engineering programme, we cooperate with:

- entities operating in the R&D sector,
- university centres,
- industrial entities operating in the marine and land sector.





- implementation examples
- description of services and products

are available at:
www.cto.gda.pl

Environmental engineering programme

- examining the influence of extreme environmental impact on means of transport, building structures and other facilities
- expertise in ship and land-based structures enhancement to meet the environmental requirements

CTO S.A. conducts research connected with the environmental impact exerted on marine and land-based structures including materials used for their erection. This research is conducted in new laboratories being one of the most modern facilities of this type in Poland and Europe. The company has long-standing experience in conducting seismic research for auxiliary equipment used in nuclear power stations.

The programme includes:

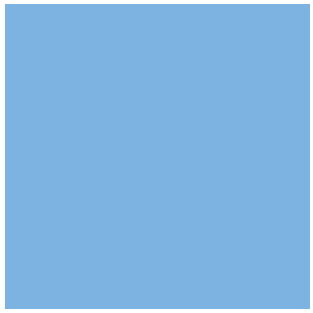
- acoustic tests regarding acoustic insulation, acoustic absorption and acoustic power,
- in-situ measurements of acoustic insulation for buildings and vessels and noise measurements in facilities, workplaces and the environment,
- elaborating technical solutions protecting against noise emissions on ships and in building structures,
- fire tests including fire resistance, smoke-tightness and combustion properties of materials and products,
- tests of structure resistance to vibrations,
- tests of metals and plastics properties.

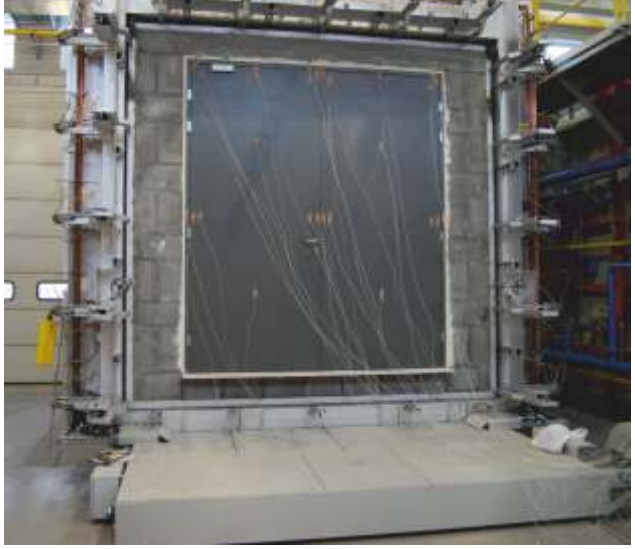










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Within the framework of our environmental engineering programme, we cooperate with:

- system providers and manufacturers of wood joinery products,
- ship equipment manufacturers,
- public (road and rail) means of transport manufacturers,
- entities operating in the following sectors: environmental protection and testing the environmental impact exerted on facilities and equipment, in particular evaluation of noise attenuation effectiveness and fire safety of structures,
- entities operating in the nuclear power engineering sector as regards modelling and assessing the environmental impact exerted on the equipment used in nuclear power stations, in particular their efficiency, reliability and operational safety.

PCA Polskie Centrum Akredytacji BADANIA AB 014

PCA Polskie Centrum Akredytacji BADANIA AB 1241

Tests are accredited according to the scope of accreditation.

- catalogue sheets
- certificates and the scope of accreditation
- detailed description of services
- environmental laboratory characteristics and
- news

are available at:
www.laboratoria-badawcze.pl
www.cto.gda.pl

Medical engineering programme

- designing, model in vitro tests and numerical analyses of structures and equipment used in medicine

The medical engineering is one of the latest interdisciplinary specialisation of CTO S.A. It requires combining numerous fast-developing areas of basic, technical and medical sciences. The results of our research and design activity include implementation of technical devices in certain conditions of contact with a living body for diagnostic and therapeutical purposes as well as to support and replace organs.

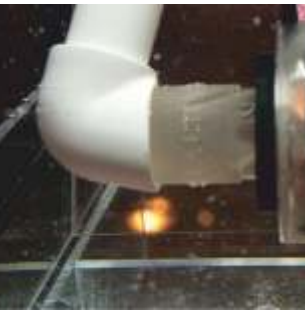
CTO S.A. fulfils the research tasks of the national long-term strategic programme called “Polish Artificial Heart” which include implementation of implantable pumps supporting a human heart. The CTO S.A. activity within this scope includes designing, numerical flow simulation, manufacturing and experimental in vitro research on miniature implantable axial pumps supporting a human heart. CTO S.A. also participates in the research programme connected with bioprostheses heart valves.

The programme includes:

- computer simulations and experimental model in vitro tests of supporting equipment and prostheses used to cure heart and circulatory system diseases,
- numerical modelling of blood flow in interaction with vessels, valves and their prostheses,
- modelling of metal nanotube structures used in bone prosthodontics,
- testing titanium alloys physical and chemical properties.





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Medical Engineering Division
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The main directions of the research work performed within the programme are connected with:

- methodology of calculating the flows of non-Newtonian viscous fluids,
- contactless magnetic bearings and magnetic drives,
- methods of controlling heart support devices,
- design and construction of precision test stations for experimental in vitro research on heart support devices,
- numerical analyses and experimental in vitro tests of biological aortic valve prostheses,
- equipment used for rehabilitation of disabled persons.

Within the framework of our medical engineering programme, we cooperate with:

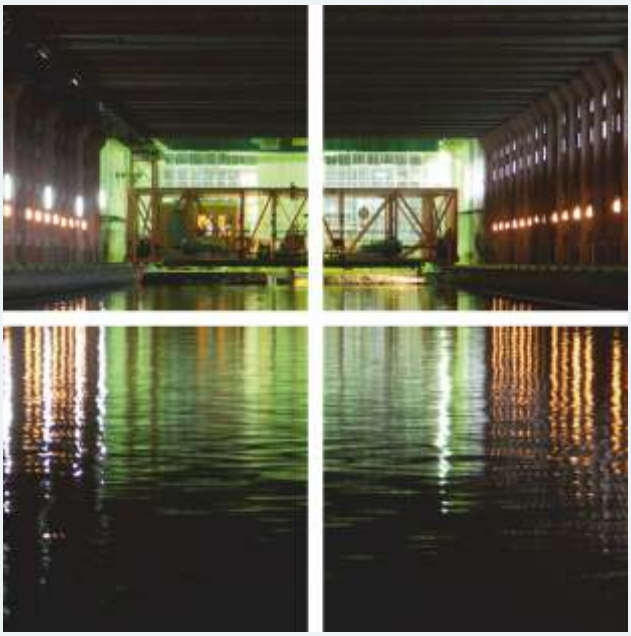
- entities operating in the medical technology sector, in particular the area of utilising flow devices in medicine,
- universities and research centres,
- university medical research centres.

- implementation examples
- description of services

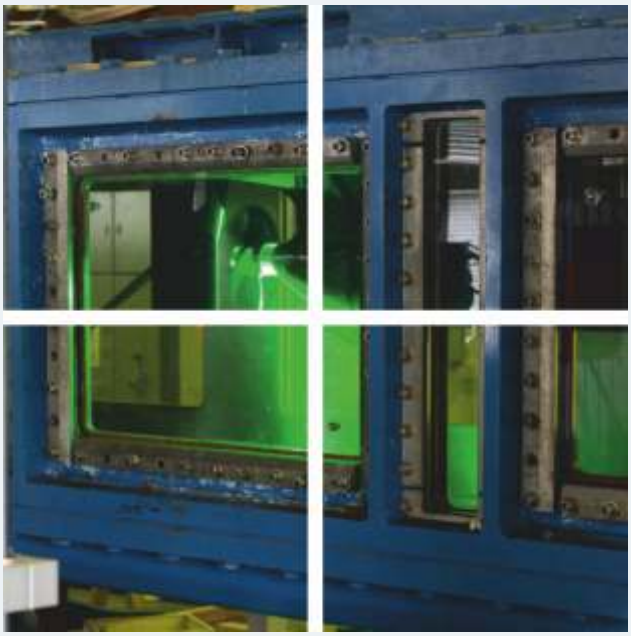
are available at:
www.cto.gda.pl

Our research facilities

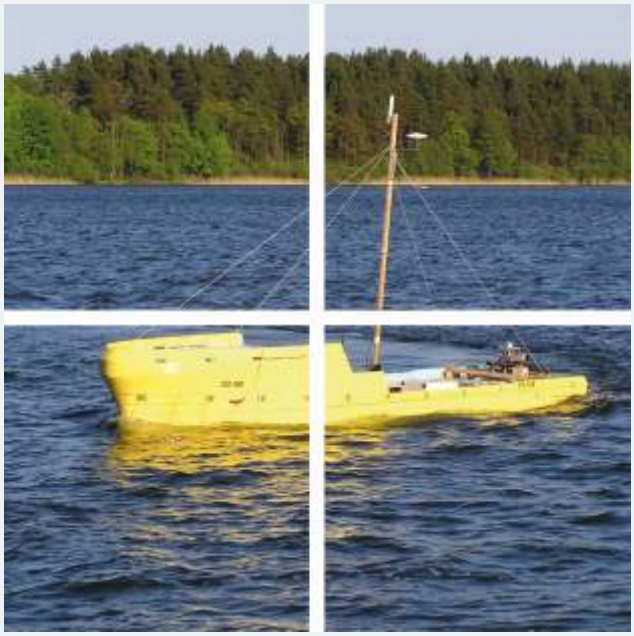
DEEPWATER TOWING TANK
dimensions 270.0 x 12.0 x 6.0 m,
max. velocity of towing carriage 12.0 m/s



AUXILIARY TOWING TANK
dimensions 60.0 x 7.0 x adjustable depth 0.0-3.0 m,
max. velocity of towing carriage 4.0 m/s



CAVITATION TUNNEL
dimensions of test section 3.0 x 0.8 x 0.8 m,
max. flow velocity 20.0 m/s



SHORE STATION FOR MANOEUVRABILITY
MODEL TESTS
at lake

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WIND TUNNEL
dimensions of test section 1.42.0 x 0.95 x 4.0 m,
max. flow velocity 52.0 m/s

ACOUSTIC LABORATORY
stand area up to 10.0 m^2

FIRE TESTING LABORATORY
stand for fire resistance testing
(vertical 3.2 x 3.4 m and horizontal 4.0 x 3.4 m)

FIRE TESTING LABORATORY
stand for testing smoke-proof properties
(3.0 x 3.0 x 1.5 m)








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