— FINNISH SOLUTIONS

FOR THE ENTIRE ICEBREAKING VALUE CHAIN

Photo by Tim Bird

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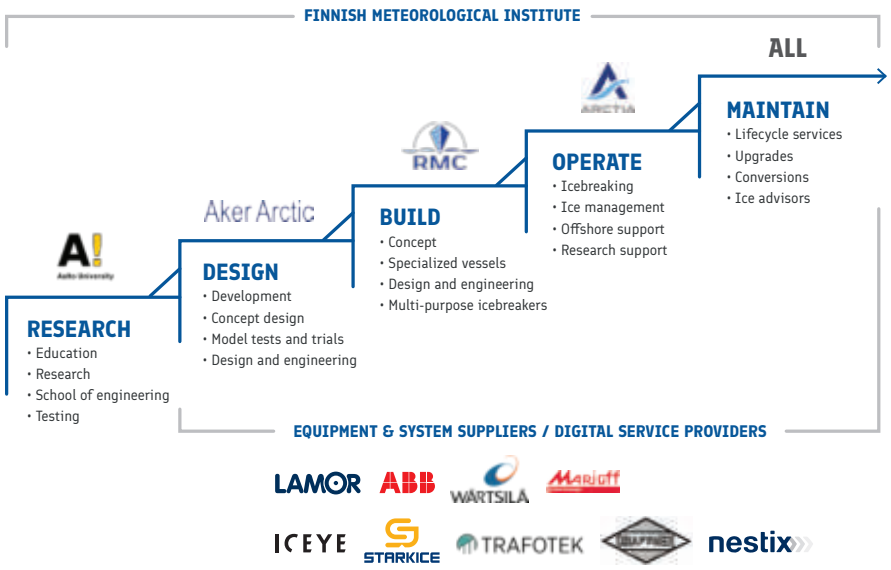
FINNISH SOLUTIONS FOR THE ENTIRE ICEBREAKING VALUE CHAIN

FINLAND IS A GLOBAL LEADER IN ICEBREAKER DESIGN, POLAR SHIPBUILDING, ICE TECHNOLOGY AND FLEET OPERATION

Finnish companies have designed about 80 percent of the world's icebreakers, and about 60 percent of them have been built by Finnish shipyards. We have a creative and agile polar maritime network that is known for delivering on schedule and on budget. We are also known for delivering sustainable, innovative and effective solutions for demanding tasks in Arctic conditions.

Finland is the only nation in the world that offers ice-proven products and services created through a solid, cost-effective value chain. This value chain covers R&D, education, ship design, engineering, building, operation, program management and life cycle support services. Globally recognized Finnish companies and shipyards offer icebreaking solutions that can be considered as a complete package or configured as individual options to suit specific needs. Partnering with Finland for icebreaker projects means you will benefit from the latest research and technological advances.

The key players in the innovation platform for Finland's shipbuilding and marine industry are companies, research organizations, internationally recognized universities, the Finnish Funding Agency for Innovation and the Finnish Meteorological Institute.



THE POLAR MARITIME NETWORK IN FINLAND

FINNISH SOLUTIONS MAXIMIZE EFFICIENCY AND SUSTAINABILITY

Finland is known for designing vessels that meet performance requirements while still being economical to build, maintain and operate in both open water and ice-covered seas. Finland has the capacity to develop, build, deliver and commission several icebreaking ships every year. The latest Finnish icebreaker, Polaris, delivered in 2016, is the most recent example of our cost-efficient advanced technology.

Finnish icebreaker innovations are used worldwide. The world's first environmentally friendly LNG-powered icebreaker was built in Finland. Additionally, the oblique icebreaker (which maximizes icebreaking efficiency and operational capability), the azimuth propulsion system, the air bubbling system and the multipurpose icebreaker concept are also Finnish innovations.

Finland is a pioneer in intelligent ships and digital solutions. For example, our technologies are used for:

- optimizing ice-management and operations
- autonomous operation
- fleet and asset management
- IT-technologies for emergency and rescue
- integration of scientific functionalities and operational capabilities

FINLAND IS A FORERUNNER IN INTERNATIONAL COLLABORATION

Finland is a forerunner in bilateral partnerships as well as public-private arrangements for icebreaking services. It can procure icebreaking services from both public and private partners and currently has three icebreaking agreements with neighboring countries.

In Finland, icebreaking services are financed through a market-driven system based on fairway dues. During the Arctic summer when the fleet is not required in the Baltic Sea, Finnish icebreakers are available for charter missions in polar areas. An icebreaker charter is a cost-effective way to experience the latest technologies and operating procedures, to conduct technology benchmarking and to train future crews before making final decisions on operational requirements for your own icebreaker investment.

Previous international icebreaker projects have benefitted from Finnish cooperation. For example, Finnish companies have provided ship designs, extensive equipment deliveries, execution of the projects and commissioning for icebreakers around the polar regions.

Finnish multi-purpose icebreakers have operated in Arctic waters and transited through both the Northwest Passage and the Northern Sea Route.

PARTNERSHIPS INCREASE ICEBREAKING OPTIONS

Finland and Sweden also have plans for renewing their fleet of icebreakers. The timing of the renewal programs offers a unique window of opportunity to share icebreaker assets, leading to affordable options for strengthening icebreaking capacity and the cost-efficient deployment of new icebreakers.

In the following pages, leading Finnish companies Aker Arctic, Rauma Marine Constructions, Arctia, ABB, Wärtsilä, Lamor, Nestix, Trafotek, Marioff, Craftmer, Starkice, Iceye as well as Aalto University describe their solutions.

Photo by Tim Bird

RESEARCH

AALTO UNIVERSITY
Cutting edge research, testing knowledge and facilities.

Aalto University's research group on Arctic and Marine Technology is studying the behavior of ships and structures both in open water and in areas covered by sea ice. The work is linked with the design and operations of passenger vessels, icebreaking ships and Arctic marine structures. It focuses on ice loads on ships and structures, ship performance, ship safety and ice mechanics. Furthermore, the research on open water ships includes work on advanced structures, hydrodynamics as well as risk and safety.

Currently, the group consists of eight professors, including two Finland Distinguished Professors (FiDiPro), lecturers, post-docs, and doctoral students. The group has an excellent national and international support network, including CEARCTIC, a Joint Research Center of Excellence for Arctic Shipping and Operations funded by Lloyd's Register Foundation in London and led by Aalto, and SAMCoT, a Center for Research-based Innovation on Sustainable Arctic Marine and Coastal Technology led by NTNU in Norway and funded by the Norwegian Research Council and international industry. Members of the research group have organized several international scientific conferences at Aalto and are active on the editorial boards of international scientific journals.

AALTO ICE TANK IS THE LARGEST TESTING FACILITY IN THE WORLD

Aalto Ice Tank is a 40m × 40m × 2.8m basin equipped to produce sea ice at model scale. Typical tests include ship resistance in different ice conditions and ice failure against marine structures. The facility is open to visitors through the Hydralab+ network funded by the EU, or through other arrangements.

DESIGN

Aker Arctic

AKER ARCTIC
The world's leading designer of icebreaking vessels

Established in 2005 as a spin-off of Aker Yards (the former Wärtsilä Helsinki Shipyard), Aker Arctic has the accumulated icebreaker design and construction knowledge that the shipyard and its design department have gathered since the 1950s. Aker Arctic's past references, both as the shipyard's Arctic technology research unit and as an independent engineering company, include more than half of the icebreakers built worldwide. Today the company is involved in most of the high ice class projects that are on order or under development around the world.

ICEBREAKER INNOVATIONS

Aker Arctic prides itself on being a forerunner in icebreaking technology and can claim a number of "firsts" in the world of icebreakers. In the 1950s, the company established a new standard for Baltic escort icebreakers with two bow propellers and developed the first large diesel-electric polar icebreakers. The construction of one successful icebreaker class after another for both domestic and foreign customers led to the perfection of the various design features and systems that are typical of ice going vessels today, such as the AC/AC diesel-electric propulsion system. By the late 1980s, Aker Arctic was responsible for constructing the only nuclear-powered icebreakers built outside the Soviet Union and Russia. More recently, Aker Arctic developed several state-of-the-art icebreakers for their clients, including the concept for the world's first LNG powered icebreaker for the Finnish government.

Aker Arctic developed the electric podded propulsion unit nowadays known as Azipod. And as a result of this work, found new ways of operating ships in heavy ice conditions. For example, Aker Arctic also invented the sideways-going oblique icebreaker to take full advantage of the azimuth propulsion units. Recently, the company demonstrated the unique capabilities of the first such vessel in extensive full scale trials in the Arctic. Aker Arctic's latest vessel concepts such as the new Finnish icebreaker have been widely regarded as the world's most advanced icebreakers and in full-scale ice trials, Aker Arctic's icebreaking innovations continue to outperform other designs.

MORE THAN A DESIGN OFFICE

One key to Aker Arctic's success has been its in-house ice model testing laboratory and the close relationship between model testing and design. The company has carried out over 500 ice model test series since the first model basin was opened in 1969, and today operates its third generation testing facility in Helsinki, Finland.

Aker Arctic also has one of the world's largest reference databases of full scale ice trials. This guarantees that its icebreaking performance predictions are accurate and help to achieve maximum icebreaking capability with the least possible propulsion power. The goal is to design vessels that not only meet performance requirements, but are also cost-effective to build, maintain and operate in both open water and ice-covered seas.

Aker Arctic offers a range of proven icebreaking ship designs for different operational needs. Ship types include:

- icebreakers
- ice-going vessels such as cargo ships and tankers
- vessels intended for arctic offshore operations like AHS and OSV
- antarctic research vessels
- arctic cruise and expedition cruise vessels

They offer services related to:

- feasibility studies, ship specifications and tender designs, basic designs
- designs which can be customized for operational requirements, e.g. the standard Aker ARC series
- offshore structures, designing for ice loads and structural design
- design criteria based on environmental conditions and operating profile
- winterization specifications and solutions
- hull optimization for open water and/or ice conditions
- ship performance and power predictions
- icebreaking capability in a variety of conditions
- structural dimensioning, global and local forces
- ship propulsion systems in ice, loads and dimensioning, complete designs.

AKER ARCTIC'S IN-HOUSE ICE MODEL TESTING LABORATORY

BUILD

RAUMA MARINE CONSTRUCTIONS
A specialist in
ice-going vessels

Rauma Marine Constructions Ltd. (RMC) was founded in 2014 to continue the shipbuilding traditions in Rauma. This new beginning marks the culmination of centuries of shipbuilding experience at the Rauma shipyard which, under various owners, has built up a vast amount of knowledge in naval architecture and technological innovation. Specifically, this knowledge comes from building, upgrading and overhauling specialized vessels, including all Finnish multi-purpose icebreakers, large border guard patrol vessels, and all Finnish Navy surface combatants since 1991.

With its own steel structure manufacturing facilities, Rauma Marine Constructions can manufacture up to 18,000 tons of steel per year and has a building capacity for vessels of up to 80,000 GT. In addition, the facilities include a ground stone supported dry-dock that can incorporate vessels of up to 260 meters in length. Furthermore, the shipyard's two outfitting quays ensure efficient production as three large ships can be outfitted at the same time and a fourth can be assembled in the drydock simultaneously.

RMC's product portfolio includes:

- ICEBREAKERS
- NAVAL VESSELS
- COAST GUARD VESSELS
- CAR & PASSENGER FERRIES
- RESEARCH VESSELS

PARTNERING WITH RMC

In cooperation with its network partners for engineering, model testing, construction and performance verification, RMC specializes in the design, construction and maintenance part of the value chain. Pre- and post-delivery activities, as well as operations-related assistance can be provided, with a special focus on costs and optimizing the delivery schedule while managing production and risks. For each new commission, a specialized project team is created to guarantee adequate flexibility and the best combination of experts. Concepts are developed internally utilizing in-house knowledge. RMC's goal is to offer customers specialized vessels and customized solutions through collaboration with their partner network.

SHIPS CONSTRUCTED IN RAUMA AND THE STATUS OF RMC'S FOCUS PROJECTS

A wide range of ships have been built at the shipyard in Rauma, including car & passenger ferries, research vessels, icebreakers and naval surface combatants. Rauma Shipyard has built the Finnish multipurpose icebreakers Fennica (1993) and Nordica (1994), all Finnish Navy surface combatants since 1991, the ice-going Polar Research and Supply Vessel S. A. Agulhas II for South Africa (2012), and the Finnish Border Guard Patrol vessel Turva (2014).

RMC´s focus is currently on the design of the Finnish Navy´s ice-going Squadron 2020 corvettes. The renewal of Finland's entire icebreaker fleet is also starting soon, and the Finnish government expects this project to be completed by 2029. Additionally RMC focuses on Polar research and supply vessels for harsh conditions with Arctic navigation capability. To remain at the forefront of Arctic shipbuilding, RMC cooperates with Finnish universities, several design companies and experts.

THE RAUMA SHIPYARD HAS BUILT ALL FINNISH NAVY SURFACE COMBATANTS SINCE 1991

OPERATE

ARCTIA
A world-leading polar maritime service partner

Arctia Ltd. deploys one of the strongest icebreaker fleets in the world. This specialized shipping company currently has eight icebreakers in its fleet, including two heavy multipurpose and research icebreakers. The company has extensive international experience in providing icebreaking and ice management services, as well as specialized multipurpose vessel services in all polar and sub-polar areas.

Arctia has operational experience in the Northern Sea Route and the Northwest Passage, as well as offshore operations in Alaska, Greenland and elsewhere in the Arctic. Arctia's customer base includes international energy companies, research institutions and other organizations that are active in polar areas. The company's offshore services include, but are not restricted to, fairway icebreaking, ice management, pipe and cable laying, towing, service work for production platforms, and the installation and maintenance of underwater structures.

Arctia's current fleet includes three conventional icebreakers: Voima (commissioned in 1954, major refits 1979 and 2016), Urho (1975) and Sisu (1976). It also includes the converted polar icebreaker Otso (1986), the oil recovery icebreaker Kontio (1987), the multipurpose icebreakers Fennica (1993) and Nordica (1994), and the world's first LNG-powered icebreaker Polaris (2016). From 2010 to 2016, IB Kontio was in a continuous state of readiness for oil spill response operations in the northern Baltic Sea as mandated by the EMSA (European Maritime Safety Agency).

Arctia has more than 150 crewmembers IMO-trained for oil spill preparedness and response operations. The company works in close cooperation with national and regional rescue authorities. Arctia also develops oil recovery from ice with Lamor in the IMOR (Ice Management in Oil Recovery) programme.

In September 2016, the icebreaker Polaris joined Arctia's fleet. IB Polaris is unique in many ways. It is the first icebreaker in the world capable of running on both liquefied natural gas (LNG) and ultra-low-sulphur diesel. Its total output of about 22 MW also makes it Finland's most powerful icebreaker and it is the most environmentally friendly diesel-electric icebreaker in the world. The vessel is equipped with three Azipod propulsion units which rotate 360 degrees to enable excellent maneuvering qualities. The icebreaking capacity of IB Polaris is 1.2 meters at a speed of 6 knots. The Finnish company Lamor Corporation Ab delivered the built-in oil recovery system, which enables Polaris to collect 1015 square meters of oil at a rate of 200 m^3/h in harsh weather and ice conditions.

SHARING ICEBREAKER ASSETS IN THE ARCTIC

Icebreakers in the Baltic Sea are only used 30 to 40 percent of the year, mainly just during the harshest winter months. Sharing icebreaker assets with international partners would maximize operational use time and bring affordable strategic icebreaking options to all.

Finland is a forerunner in international collaboration as well as public-private arrangements for icebreaking services. Arctia's icebreakers are available for international charter missions in polar areas. Arctia's multipurpose icebreakers Nordica and Fennica, as well as IB Otso which has been recently converted to handle open-water conditions better, have been used for various maritime services in the Arctic.

POLARIS, THE WORLD'S FIRST LNG-POWERED ICEBREAKER

Photo by Tim Bird

EQUIPMENT & SYSTEM SUPPLIERS / DIGITAL SERVICE PROVIDERS

LAMOR CORPORATION
The global leader in oil spill response & recovery

LAMOR
ENVIRONMENTAL SOLUTIONS

Lamor Corporation, headquartered in Finland with strategically located offices, hubs and partners worldwide, is a global market leader in oil spill response and environmental solutions for a wide range of scenarios and climate conditions.

The company has an extensive portfolio of Arctic oil recovery applications, including high-capacity vessel-mounted and inbuilt skimmers, pumps, heavy duty oil booms and dedicated ice-class oil recovery vessels.

Lamor Corporation has supplied the oil recovery systems for some of the most innovative icebreakers in the world. For example, Polaris, the world's first LNG-powered icebreaker, and the unique, oblique icebreaker Baltica. The built-in oil recovery system (LORS) represents the latest technology in winterization features and has a recovery rate of 200 m^3 of oil per hour even in harsh weather and ice conditions. The system is equipped with Lamor cargo pumps, which are world renowned for handling very viscous products.

Lamor has successfully participated in many oil spill drills, exercises and equipment tests. For example, the "BSEE Ice Month Testing at Ohmsett" and the Advanced Oil Spill Response in Ice Course at CRREL conducted by Alaska Clean Seas in 2013.

Client references for arctic equipment deliveries for icebreakers and ice-class vessels from the past four years include: Arctia, Gasprom Neft Shelf, GosMorSpasluzhba, Karmorneftegaz, Norwegian Coast Guard, Shell Alaska, Sovkomflot and Swedish Coast Guard.

STERNMAX IS A HIGH CAPACITY ADVANCING ARCTIC SKIMMER DESIGNED TO SEPARATE OIL FROM DRIFTING ICE WITH A HIGH RECOVERY RATE OF 560 M^3/H (2465 GPM)

ABB is a pioneering global technology leader in the marine industry for electrical power and propulsion systems for ships. Building on a 125-year history of innovation, ABB is helping to create the future of industrial digitalization and is at the forefront of the energy revolution.

ABB is uniquely positioned to manufacture total electric power and propulsion solutions for icebreaking vessels. The company's main products are produced in-house, enabling them to control and secure complete deliveries and to simplify lifetime maintenance and service. By using ABB throughout the vessel, the right specifications, configurations and dimensions are implemented to achieve optimal system interaction and functionality.

PROVEN ABB TECHNOLOGY IN USE TODAY INCLUDES:

PODDED PROPULSION – Podded systems deliver up to 20 percent better fuel economy, superior maneuverability, greater flexibility of design, and lower maintenance in a smaller footprint compared to conventional driveshaft propulsion systems. ABB´s Azipod® propulsion is the leading propulsion system for icebreaking vessels and has proven its unique reliability and icebreaking capability in a wide range of ship types. Azipod propulsion has changed the traditional perception of icebreakers, and is a perfect match for the new generation of commercial vessels which can operate independently in ice without the assistance of icebreakers.

DOUBLE-ACTING SHIP (DAS) HULL DESIGN – DAS with podded propulsion provides better capability than legacy designs while requiring less equipment, allowing for smaller, lighter ships which cost less to construct. Furthermore, hulls optimized for both open water (bow-first) and ice breaking (bow-first or astern) offer better performance in both environments with lower power requirements (up to 50 percent less) compared to conventional designs, providing fuel savings and lower long term operational costs.

ONBOARD POWER SYSTEMS – Power distribution systems designed to operate at variable frequency allow diesel generators to run at optimal levels (i.e. fewer units running at peak performance), improving fuel efficiency and reducing emissions.

ADVANCED OPERATIONS AND MAINTENANCE – Remote (onshore) monitoring and condition-based maintenance reduces O&M costs and increases uptime. ABB is a total system integrator and their portfolio of services covers the entire vessel life cycle. For example: project management and engineering, site support, commissioning, installation supervision, warranty and after-sales support. ABB has strong Service presence and ever growing organization, which works in close cooperation with the business unit in Finland.

Vessel design by Aker Arctic

nestix

NESTIX OY was founded in 1982 and has been a subsidiary of Hexagon Intergraph AB since June 2016. The company develops shop floor management solutions for the shipbuilding industry and for pipe steel fabrication. They follow the philosophies of lean manufacturing, digital shipbuilding and industry 4.0 strategies for intelligent fabrication and smart production.

NESTIX has almost 500 customers in 40 countries and more than 8000 professionals use their solutions on a daily basis. Its customer base includes major shipyards, offshore yards, pipe fabricators, steel service centers, mechanical engineering companies and steel construction companies. The fabrication processes supported by NESTIX have been utilized in many of the biggest cruise ships in the world and in a number of extremely complex naval vessels.

NESTIX provides engineering & design data agnostic import capabilities as well as integration with standard schedule and ERP systems. By taking material availability, project schedules, resources and a direct connection to the machines into account, a productive and efficient shop floor schedule and a detailed fabrication plan leads to business intelligence reporting that's based on real-time information.

NESTIX PROVIDES:

- Intelligent integration with engineering & design solutions that can lead to a significant reduction in time spent on work preparation
- Consistent and automatic management of change
- Smart backwards and forwards scheduling functionality resulting in an optimized shop floor
- A production schedule with individual work center instructions, thereby shortening throughput times and improving resource utilization
- Improved material management through powerful nesting and remnant management
- Real-time interactions with resources, machines and work centers (through different technologies, such as PC monitors, QR or bar codes, RFID and other) and therefore up-to-date business intelligence information, such as availability to produce (materials) as well as capacity to produce (resources)
- Full traceability of materials, logistics and production

NESTIX HAS ALMOST 500 CUSTOMERS IN 40 COUNTRIES AND MORE THAN 8000 PROFESSIONALS USE THEIR SOLUTIONS ON A DAILY BASIS

Wärtsilä is a global leader in advanced technologies and complete lifecycle solutions for the marine and energy industries. By emphasizing sustainable innovation and total efficiency, Wärtsilä maximizes the environmental and economic performance of the vessels and power plants of its customers. It has over 200 locations in more than 70 countries around the world. With the knowledge gained from operating in harsh Finnish conditions and more than 50 years of experience in delivering products and solutions for advanced icebreakers and vessels with high ice-class specifications, Wärtsilä offers efficient and reliable propulsion machinery that is more than capable of operating in demanding arctic temperatures with extremely low air suction.

THE WÄRTSILÄ 31 ENGINE

Following its introduction in 2015, the Wärtsilä 31 engine was recognized as the world's most efficient 4-stroke diesel engine and it was the engine of choice for a new state-of-the-art Russian icebreaker, the 'Vladivostok'. This vessel was built for FSUE Atom ot, part of Rosatom, the State Corporation for Atomic Energy.

The Wärtsilä 31 is available in 8 to 16 cylinder configurations and has a power output ranging from 4.7 to 9.8 MW at 720 and 750 rpm. The Wärtsilä 31 has the best fuel economy of any engine in its class. At the same time, it maintains outstanding performance across the complete operating range. Its modular design enables a significant reduction in maintenance time and costs, thereby improving power availability and reducing the need for spare parts.

THE GROWING IMPORTANCE OF LNG FUEL

Wärtsilä has been at the forefront of technological developments that have made the use of liquefied natural gas (LNG) viable as a marine fuel. Since LNG is the cleanest burning fuel available for passenger and cargo ships today, it has obvious advantages for icebreakers since they typically operate in and close to ports and other emission control areas (ECAs).

The world's first LNG-fuelled icebreaker was the 'Polaris'. It was built for Arctia Shipping and it runs on Wärtsilä dual-fuel engines. Since there is no large cargo space needed on an icebreaker, there is room to place the gas storage tanks. Icebreakers can be at sea for weeks at a time so large gas storage tanks are needed, but by optimizing the size of the tanks in relation to the size of the vessel, they can run for long periods on gas. The Wärtsilä dual-fuel engines enable a switch to conventional marine diesel fuel when necessary.

A TOTAL SOLUTIONS SUPPLIER

Wärtsilä has extensive experience in supplying propellers and thrusters for vessels with high ice-class requirements. And for LNG fuelled vessels, Wärtsilä offers its range of dual-fuel engines and the Wärtsilä LNGPacTM, a complete fuel gas handling system for LNG fuelled ships. It includes the bunkering station, the LNG tank and related process equipment, as well as the control and monitoring system. Wärtsilä's portfolio also includes sophisticated automation, navigation and electrical systems, as well as dynamic positioning technology, and sonar and underwater communications technology.

Wärtsilä supplies a range of environmentally friendly solutions. For example, Arctia Offshore's 'Fennia' and 'Nordica' are fitted with the Wärtsilä NOx Reducer (NOR), an emissions after-treatment system based on SCR technology to reduce emissions of nitrogen oxides (NOx). The system is compliant with various NOx emission control regulations, such as the IMO's Tier III rules. Wärtsilä ballast water management systems (BWMS) have also been installed on an icebreaking PSV built for Sovcom ot at the Arctech yard.

WÄRTSILÄ IS A GLOBAL LEADER IN ADVANCED TECHNOLOGIES AND COMPLETE LIFECYCLE SOLUTIONS FOR THE MARINE AND ENERGY INDUSTRIES

TRAFOTEK

Trafotek has been providing the major shipyards of the world with transformer and electrical filter solutions since 1983. Luxury cruise liners, icebreakers and offshore rigs rely on Trafotek for high-quality energy out at sea. Currently, there are over 900 vessels sailing the world's oceans with Trafotek transformers. With 23 icebreakers on their reference list, they are an experienced supplier of power solutions for harsh conditions.

Trafotek transformers have a small footprint thanks to optimized core construction, intelligent structural solutions and efficient cooling. And to decrease the permanent load that a vessel has to carry, Trafotek has made minimizing transformer weight a priority.

Company's transformers are designed and manufactured to withstand serious vibrations and shocks. The transformer housing is specifically designed for marine use and a wide range of transformer accessories can be selected to meet a customer's specific needs.

The power output of Trafotek dry-type transformers ranges from 1 kVA to 12.5 MVA, with a maximum voltage of 24 kV. Cooling can be air natural, air forced or water-based with a heat exchanger. Third party certification for marine and offshore applications such as ABS, LR, RINA, DNV-GL, BV and NK is available and transformers can be configured for electrical propulsion or distribution.

Marioff is a global leader in high pressure water mist fire protection technology. The company designs, develops, manufactures, installs and maintains HI-FOG® systems for ships at sea, commercial buildings and industrial applications. Marioff is a part of UTC Climate, Controls and Security, a unit of the United Technologies Corporation. Marioff's headquarters and factory are located in Finland.

With a long history in marine fire protection, Marioff HI-FOG® systems are tested, proven and certified to comply with international and national maritime safety requirements and regulations, including approvals from all major classification societies. HI-FOG® has also passed the rigorous U.S. Navy fire tests. HI-FOG® effectively minimizes fire damage through fast activation and by using the least amount of water possible. It can also offer fire protection during vessel construction. Today, HI-FOG® systems protect machinery spaces, vehicle decks, accommodation, galleys and store areas onboard a large number of ships worldwide.

Marioff's client references include a wide variety of vessels. Naval platforms range from patrol craft and mine countermeasure vessels up to destroyers and helicopter carriers, and from diesel electric/AIP boats to SSNs. On the civilian side, Marioff has protected icebreakers, supply vessels, tugs and other work boats, passenger car ferries as well as luxury yachts and cruise ships, ranging from very specialized expedition cruise vessels to the world's largest cruise liners.

MARIOFF IS A GLOBAL LEADER IN HIGH PRESSURE WATER MIST FIRE PROTECTION TECHNOLOGY

STARKICE

Starkice Oy designs and delivers turn-key solutions for shipping, harbors and offshore installations. Their main products and services are related to de-icing solutions and operational optimization for mission critical deck areas, rescue zones or other areas, such as observation decks, balconies and gangways.

In addition to their PolarPad pre-fabricated heating elements, they offer an Intelligent De-Icing System (IDS) that consists of one main unit, sensors, separate heating elements (PolarPad or cables), connection cables and auxiliary control cabinets. The system automatically senses ice on a surface and turns on de-icing elements. Additionally, separate de-icing areas can be established based on the level of importance (critical rescue area vs. comfort-related de-icing) or based on different climate conditions or location (starboard, portside, aft, fore etc.). IDS can be used as ice accumulation warning and sensoring system, if manual removal is preferred.

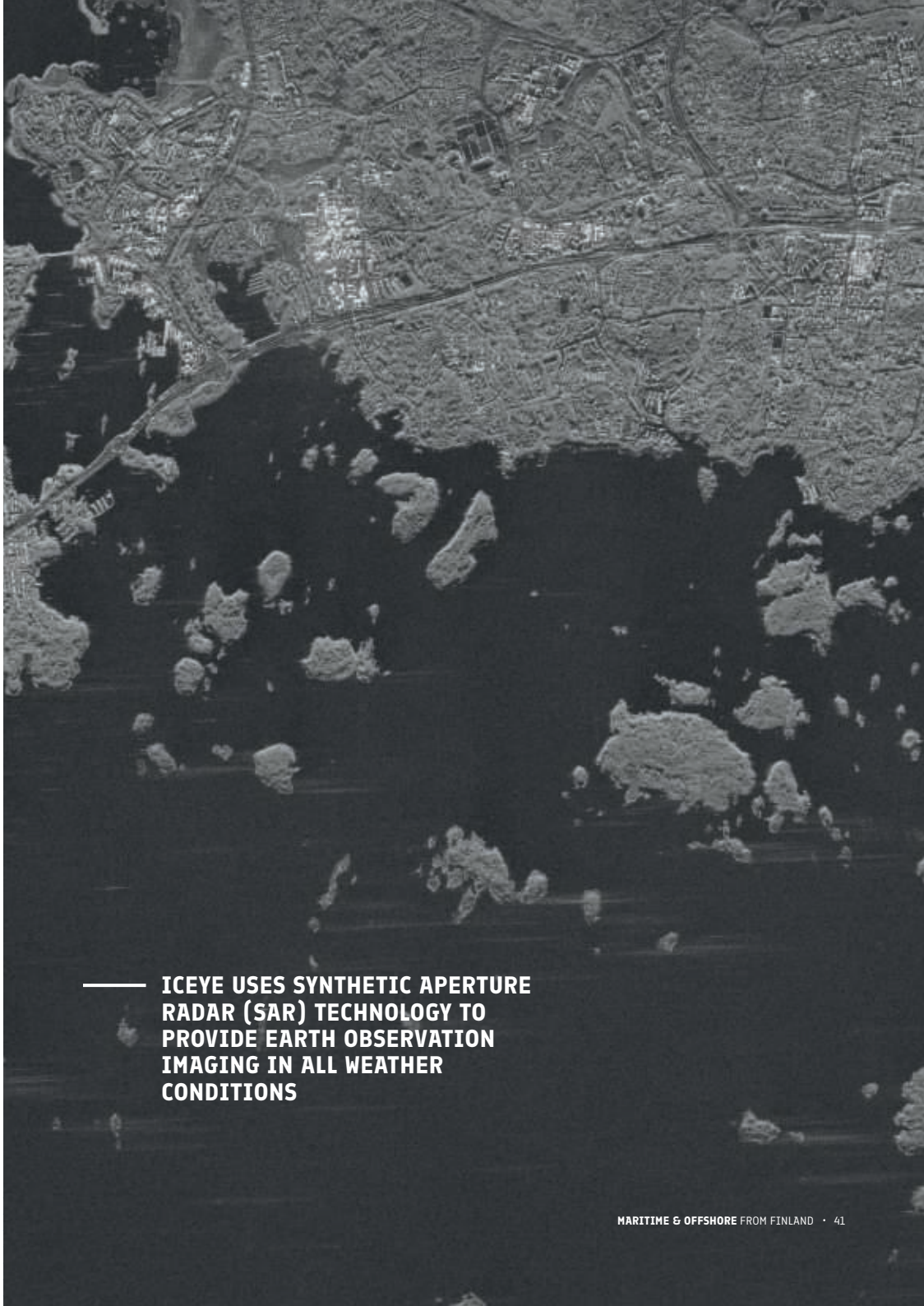
The main unit has a specially developed software program that is based on Starkice's extensive experience operating in arctic weather conditions. The main unit also has data logging and web-based access to system data. This feature is called Starkice Cloud and it can also be used for financial reporting and cost optimization of the fleet. It operates with GSM/satellite networks and data send/receive can be fully adjusted based on a customer's needs.

STARKICE OY OFFERS DE-ICING SOLUTIONS AND OPERATIONAL OPTIMIZATION FOR MISSION CRITICAL DECK AREAS

ICEYE

ICEYE provides commercial earth observation data and value-added services. Their data can be used to track changes around the world at any time. Specifically, they use Synthetic Aperture Radar (SAR) technology to provide earth observation imaging in all weather conditions. Their unique SAR microsatellite design allows them to operate a large constellation of satellites that enables unprecedented access to SAR data. They aim for an average 3-hour delay from order to acquisition. And with the high number of satellites in their constellation, ICEYE can provide large size imagery (50 x 100km) with a 3-meter resolution on short lead times. They provide frequent revisits, including rapid mosaicking of larger areas, and they also co-operate with other satellite operators and data providers to offer complementary data layers.

ICEYE VISION is a web-based user interface for real-time adaptive tasking. Rapid acquisitions can be directly tasked from a graphical user interface with everything from confirmation to delivery happening within the same system. ICEYE also provides API access for customers who require deeper integration with existing operational systems or software.

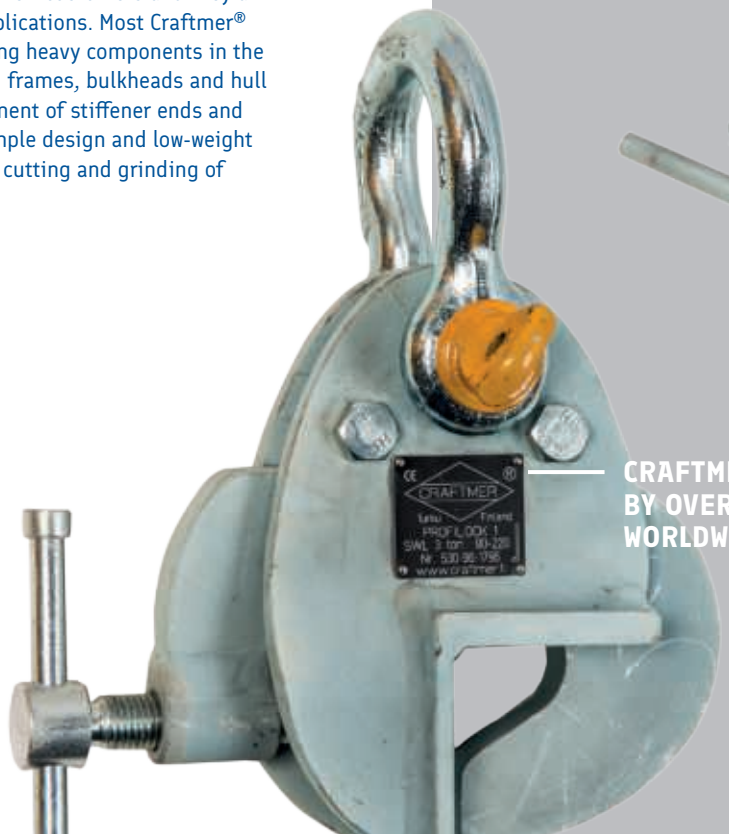


ICEYE USES SYNTHETIC APERTURE RADAR (SAR) TECHNOLOGY TO PROVIDE EARTH OBSERVATION IMAGING IN ALL WEATHER CONDITIONS

Craftmer® Oy specializes in developing standardized and custom-made tools for shipbuilding. Their tools allow for easier positioning of large pieces in relation to each other during the installation of heavy steel structures at shipyards and other heavy workshops. Craftmer also offers consulting to shipyards during the hull assembly stage of production.

Craftmer's business dates back to the 1970s when they first produced the 'Jakki' with a pushing or pulling force of up to 12 tonnes. After extensive testing and optimization, the ease of use and materials/weight/capacity relationship of the Jakki has been refined and today more than 4,000 Jakkis have been produced. All Craftmer products are designed and manufactured in their workshop in Finland.

New products are developed in close co-operation with their customers and they aim to solve problems for specific working conditions or applications. Most Craftmer® products help apply the right amount of force for shifting heavy components in the assembly of ship or large steel structures. For example: frames, bulkheads and hull sections. Craftmer products are also used for the alignment of stiffener ends and plate edges during the welding process. They have a simple design and low-weight construction that helps eliminate unnecessary welding, cutting and grinding of temporary lugs.



CRAFTMER TOOLS ARE USED BY OVER 50 SHIPYARDS WORLDWIDE

PARTNERING WITH THE FINNISH POLAR MARITIME NETWORK

FINNISH COMPANIES AND ACADEMIA PROVIDE WORLD-LEADING EXPERTISE AND THE LATEST TECHNOLOGIES

FINNISH SOLUTIONS MAXIMIZE EFFICIENCY, OPERATIONAL CAPABILITIES AND SUSTAINABILITY

NEW ICEBREAKERS CAN BE BUILT IN FINLAND EFFICIENTLY AND COST-EFFECTIVELY

PARTNERSHIPS, CHARTERING OR JOINT VENTURES OFFER AFFORDABLE WAYS TO BOOST ICEBREAKING CAPACITY

FINLAND IS A FORERUNNER IN BILATERAL PARTNERSHIPS FOR ICEBREAKING SERVICES

AS ONE THE MOST STABLE AND SECURE COUNTRIES IN THE WORLD, FINLAND IS A TRUSTED PARTNER BOTH IN BUSINESS AND WORLD AFFAIRS

Photo by Tim Bird

POLARIS: THE FIRST LNG-POWERED ICEBREAKER IN THE WORLD

Commissioned in September 2016, the icebreaker Polaris is the latest addition to the Finnish fleet. Polaris is the first icebreaker in the world to feature environmentally friendly dual-fuel engines capable of using both low-sulfur marine diesel oil (LSMDO) and liquefied natural gas (LNG). Like other Finnish multifunctional icebreakers, Polaris is also capable of oil recovery and rescue operations. Finland will renew its whole fleet of eight icebreakers by 2030.

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