

RoRo conversions

Convert to increase profitability



Throughout the lifetime of your ship

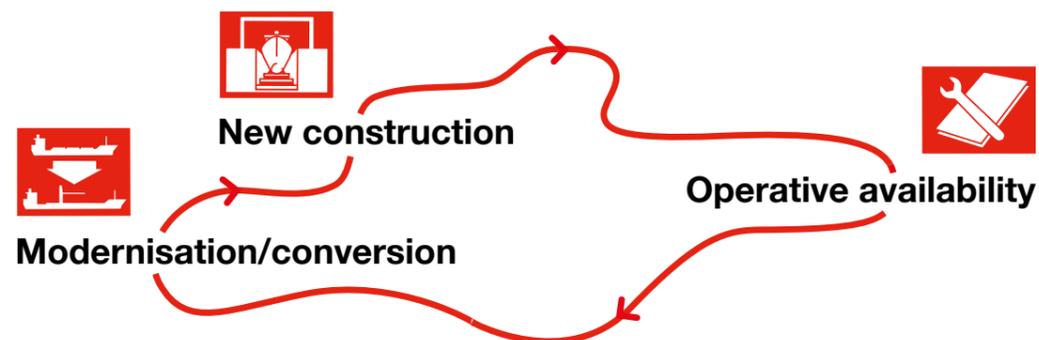
Continuously upgrading your ship throughout its lifetime and converting original cargo access solutions enable you to meet the demands of all types and sizes of cargo and port infrastructures.

MacGregor has the expertise and the resources to upgrade outdated cargo flow systems to the latest performance standards. New RoRo cargo access equipment is based on state-of-the-art technology and adapted for easy service and maintenance. Modernisation means more efficient cargo handling and low maintenance requirements.

MacGregor's conversion solutions are a cost-efficient way of enhancing or altering the original use of a ship so that it meets changing market requirements and thereby extends its lifespan. A conversion could be a retrofit or the upgrade of an existing cargo flow system. Alternatively, it may involve a complete delivery, including an initial study, technical solutions, design, manufacture and installation, all of which are often performed in the shortest time possible to reduce the ship's off-hire period.

MacGregor is a global company with facilities located near shipyards and ports worldwide. Once a MacGregor system is in service, we endeavour to provide life cycle support in the form of maintenance and service solutions that ensure the operative availability of the equipment.

Later in the vessel's lifetime, our capability to modernise and convert the original solution helps the shipowner get even more from the investment by optimising the performance to match new market needs.



Convert to competitiveness

MacGregor's RoRo conversion team has carried out several hundred RoRo ship and shore conversions over the past 30 years.

New patterns in routes and global trade call for fast reactions. Your ability to adjust to new opportunities is vital if you are to keep up with competition and increase profitability.

Upgrade to meet changing demands

Changing rules and regulations, plus new infrastructure and port conditions can quickly make an existing RoRo ship less viable in its operations.

Continuous upgrading of your ship enables you to meet the demands of all types and sizes of cargo and port infrastructures. MacGregor provides a life cycle perspective on marine cargo flow. We offer a complete range of services and products, which help you to realise the full potential of your ship.

Creating customer value

MacGregor has a long experience in developing, designing and manufacturing cargo access equipment which makes us the perfect partner when it comes to converting and modernising your RoRo vessels.

You will benefit from solid knowledge based on more than 75 years of marine industry experience, as well as an understanding of the needs of your business.

Our customised technical MacGregor solutions are designed to create efficient traffic flow.

Complete turnkey deliveries

Our know-how and efficient global service network ensure short lead times and quick realisation and turnkey delivery of the smallest alteration up to a complete conversion.

MacGregor solutions are built around expertise and long-lasting, reliable products, giving you the highest return possible on your investment.

Conversions carried out in port and at sea

Our conversions are a cost-efficient way of extending the lifespan of your ship. Even if most of the work has to be carried out in port or at a shipyard, our resources allow conversions to be carried

out at sea. Every operation is carefully planned to minimise the impact on your ship's schedule.

Convert to increase profitability

MacGregor's line of conversion products includes standardised as well as new products to facilitate your ship's new role and improve its competitiveness.

Our equipment are easily installed in all types of ships and ensure maximum levels of both security and quality.



We can perform turnkey delivery of the smallest alteration up to a complete conversion.

Innovative solutions serving any purpose and need

The well-documented experience and skill of MacGregor's RoRo conversion team gives you multiple choices for solving every conceivable situation. We have the resources needed for a quick realisation of complete turnkey conversion projects. The installation work can partly be carried out at sea to reduce the ship's off-hire period.

We can convert RoRo cargo access equipment for all types of ships, for example:

- Hoistable car decks
- Ramp covers
- Hoistable ramps
- Side ramps
- Tilting ramps
- Shore ramps
- Stern ramps/doors
- Bow ramps
- Bow doors
- Inner bow doors
- Side doors
- Access doors for ROV
- Flood control doors
- MOOREX mooring systems onboard or ashore
- Tender embarkation platforms
- Crane pedestals



Stern ramps/doors

MacGregor delivered the first RoRo stern quarter ramp in 1956, and since then we have developed our concept in close cooperation with innovative shipbuilders and shipowners.

Regardless of whether your ship needs a straight stern ramp, quarter ramp or slewing ramp, we are able to supply the optimum solution. If required, the ramp can also serve as a watertight door when pivoted or folded into its closed position.



Hoistable ramps

Our hoistable ramps allow more efficient utilisation of cargo space than fixed ramps. There are several ramp choices:

- one end of the ramp is raised or lowered
- tilting ramp with adjustable ends
- ramp, which in closed position, form a watertight boundary on ramps without sealing. The hoisting of the ramp can either be done by direct-acting cylinders or by wires pulled by a hydraulic jigger-winch.



Hoistable car decks

Hoistable car decks with ramps are divided into sections that can be individually operated. Once the car decks are in the loading position, cars can drive via ramps onto the car decks. This will increase car capacity by approximately 100%. They can be provided with car lashing equipment.

Hoistable car decks have panels that are individually height-adjusted by means of hydraulic cylinders or electric drives when frequent and fast operation is required. A mobile deck lifter is another alternative if adequate operating time is available. Car deck systems of lightweight plywood construction can reduce the weight of the car decks by up to 20 per cent.

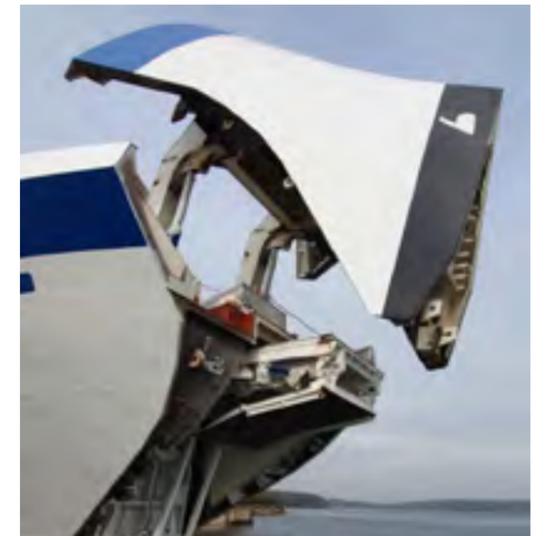


Bow access

Many ships with Ro-Ro capability, incorporate access by the bow as well as by the stern. The bow doors and bow ramp facilitate for an efficient cargo flow and quick turnaround in port. Most RoPax ferries need an efficient drive through facility. Bow access is also invaluable on train ferries, naval support ships and heavy lift ships.

Bow doors or a bow visor are the two options for the opening. Bow doors can be of parallel stow type (or swing-arm type), clam-type, directly-hinged type, side-hinged or wing-type. Bow ramps can be hydraulically operated.

Bow access requires, by regulation, the highest degree of integrity. Some ships have three successive barriers to water ingress. In most designs two watertight closures will be considered adequate. When the bow ramp is in its stowed position, it is utilised to double as the inner door and thus seals the aperture in the collision bulkhead. It is divided in two or more sections, for example two main sections and an additional folding section with tapered end flaps. When deployed, the bow ramp provides access from main deck to the shore. When closed and secured, it forms a weathertight door at the collision bulkhead.



Ramp covers

The ramp cover is a hatch cover over a fixed ramp. It fulfils the same requirements for load-carrying capacity and the same tightness as the surrounding fixed deck. Options are side-hinged or one-piece end-hinged ramp covers. The side-hinged ramp cover, usually built in one or more sections, provides the best solution when a long ramp is required. It is usually operated via direct-acting hydraulic cylinders, but jigger-winch operation can also be selected.

The ramp covers are custom-designed to incorporate features that vary for different vessel types and the type of cargo to be carried. The design will be influenced by factors such as maximum vehicle weight, headroom, traffic intensity and automatically foldable handrails for example.



Mooring and auto-mooring solutions

MOOREX® mooring system is a self-tensioning mooring arrangement placed on the shore side or onboard. MOOREX® is placed at an optimal rope angle and longitudinal position this keeping the vessel safely moored alongside both longitudinally and athwartships even in difficult weather and tidal conditions.

- MOOREX® ashore saves space onboard. Available from 10-60 tonne capacity.
- MOOREX® onboard is a flexible option, in the event a vessel changes route, systems immediately become available as soon as shore bollards are installed at the new port of call. Manoeuvred through small watertight openings in the hull and attached to shore bollards.



Ferries converted for efficient two-tier loading



The bow was opened up to arrange new bow doors. A new bow ramp was arranged on main and upper decks.



The new bow ramp has a clear driving width of 3,5m and is coated with Bimagrip to prevent vehicles from skidding.



Modification of existing stern ramp, upper stern ramp with slope structure.

Background

MacGregor's RoRo conversion team was awarded a conversion contract by Stena RoRo, on behalf of Stena Line, in 2010 to convert *Stena Trader* and *Stena Traveller* in preparation for their charter by Marine Atlantic for service on Canada's east coast.

MacGregor conversion solution

Both ships required a major modification to enable integration with Marine Atlantic's shore terminals. The existing two-tier linkspans enabled simultaneous loading or discharge from the ship's bow or stern.

By using this efficient configuration, ship turnaround time in port is kept to a minimum. As the ships were capable of stern loading only, new bow and stern access was required. The original design recognised that one day bow access might be required, so the fore parts of both vessels were suitably configured and pre-fitted with appropriate fittings to enable the addition of bow doors.

Scope of supply

- Modification of existing stern ramps
- Upper stern ramp with slope structure
- New bow ramp (main and upper decks)
- Opening up bow, arranging new bow doors
- New front door
- New hoistable car decks

- MOOREX® mooring bollards in the hull
- ### Critical planning

Each ship had to be shortened by 12m to fit safely into Port aux Basques. Initial proposals from the RoRo Conversion team included a feasibility study for evaluation by Marine Atlantic.

This critical planning included cargo flow, traffic envelopes as well as interface between vessels and port facilities. MacGregor's designers constructed layouts, carried out stress analysis and assessed vehicle movements with a dedicated vehicle simulation programme. Three-dimensional models were made to test the functionality of system elements under different conditions. For example ramp geometry was tested to ensure its suitability under a variety of quay conditions, taking into account operating angles, changing draft as well as vessel heel and trim.

Benefits

- Fast and efficient port turnaround times is achieved by two-level loading and discharging over the bow and stern.

Installation and time schedule

Thanks to MacGregor's expertise and planning, with all the preparations complete, the installation work carried out at Lloyd Werft Shipyard took only two months per vessel. We provided a large installation team with up to



Photos: Oddway Film & Television

M/V Blue Puttees & Highlanders

Owner: Stena RoRo
Charterer: Marine Atlantic
Length, oa: 199,5m
Gross tonnage: 28,460 gt
Draft: 6,20m
Passengers: 1,000
Lane metres: 2,840m
RoRo system from MacGregor: Front door, bow ramp, bow doors and hoistable car decks
Year built: 2010/2011 at Lloyd Werft, Bremerhafen, Germany
Former names: Stena Trader & Stena Traveller

Electrically-operated hoistable car decks makes PCTCs cleaner and more efficient



Six electrically-driven car deck panels were installed on *Celestial Wing*.



Electrically-powered deck machinery is well-suited to PCTCs as hydraulic oil leakages to the sea and cargo damage is eliminated.

Background

The pure car truck carrier (PCTC) *Celestial Wing* was built in 2005. The owner, Act Maritime Company, a subsidiary company to MOL (Mitsui O.S.K. Lines), is a leading operator in Japan. The vessel was converted at Universal Shipbuilding Corporation's Innoshima shipyard in Japan and was re-delivered in April 2010.

The main contract for the work was secured in 2008 with MacGregor's marine team in Japan, which placed a design and key component order to the RoRo conversion team in Sweden, for the MacGregor car decks.

Target

Increase the cargo capacity. The vessel will also have a more flexible internal cargo access arrangement provided by the increase in clear height in some areas and the hoistable decks, by installing electrically-operated car deck panels.

Conversion solution

- Car decks: six electrically-operated car deck panels from, totalling approximately 1,150m², and components were installed.
- Increase of the clear height in the stern ramp and side ramp regions and the hoistable car decks for a more flexible internal cargo access.
- High and heavy cargo can access

the upper decks via a ramp inside the vessel.

Scope of supply

- Design and key components for six electrically-operated car deck panels.

Electric drive benefits



We have been promoting electric-drive operation of our cargo access equipment in Japan for many years, especially targeting PCTC owners and shipyards building these vessels. Electric drive technology has a number of advantages:

- Installation friendly, as there is no need to fit hydraulic pipes onboard and generally has a reduced set-up time which leads to costs benefits.
- Electric drives are fast and easy to operate with automatic speed up and slow down functions.
- High reliability and are easy to monitor.

- Maintenance friendly with simplified inspections. easy to monitor and service, enabling peak efficiency. Energy is saved, because electric drives run only when manoeuvring equipment.
- Energy losses are much smaller, because electrically-driven systems are not affected by pressure drops within the piping system.
- Time, money and energy are saved while shipbuilding; it is easier to install electrical cable than piping and no pump units are needed.
- Lower power consumption enables a ship to be designed with reduced power generation needs.

Celestial Wing

Owner: Act Maritime Company, a subsidiary company to MOL, Mitsui O.S.K. Lines
Length, oa: 180 m
Breadth, mid: 30m
Gross tonnage: 44,146gt
Draft: 9m
Vehicle capacity: 3,930 cars
Speed: 20 knots
RoRo system MacGregor: Car decks
Year built: 2005

Electrically-driven hoistable car decks for shortsea RoRos



Electrically driven hoistable ramp.



Electrically driven hoistable car decks of lightweight construction with plywood top are installed on Finnulp and Finnmill.

Background

Finnlines is one of the largest European shipping companies specialising in freight and passenger services.

In 2008, MacGregor was awarded a conversion contract for 3,000m² of electrically driven plywood car decks and hoistable ramps to be installed on its 25,654gt shortsea RoRo sisterships, Finnulp and Finnmill.

Finnlines had, at the same time, placed orders for electrically driven car decks for six newbuildings at Jinling Shipyard in China.

Targets

Increase the cargo capacity and the flexibility by installing electrically-driven car decks.

MacGregor's conversion solution

- Increased loading capacity
- Electrically driven hoistable car decks of lightweight construction, including a plywood top to reduce weight and improve stability.
- One level of liftable car decks and one hoistable ramp.
- The eleven hoistable car deck panels, including fittings, installed on each vessel weigh about 274 tonnes.
- The hoistable ramp is designed to operate loaded with four cars and can take a uniformly distributed load of 190

kg/m². It occupies a total area of 90m² and is 24m long, including flaps, with a flapsection width between kerbs of about 3.4m. The ramp weighs around 16 tonnes, including fittings and components.

- Car decks and access ramp are all electrically operated with an electric jigger winch installed in the deck panels and in the access ramp.
- Using the electric jigger winches the panels are hoisted and lowered by wires. In the lowered position, the panels hang on suspension links at the ship's centreline and fixed supports at the ship's sides. In the stowed position, the panels are supported by the operating wires with the jigger winch locked by an electrically operated wedge.
- Recessed guides are arranged at the ship's sides to guide the panels during hoisting and lowering.
- The installation included audible and visual alarms.
- Operating panels with touch screen control.

Installation and time schedule

The conversion project was carried out at a northern European shipyard. The work began in January and was finalised in March 2009. The installation of the equipment took approximately 28 days.

Benefits with electrical operation:

- Hydraulic oil leakages are eliminated and there is no need to fit hydraulic pipework on board.
- Electric drives are easy to monitor and maintain.
- Energy savings, as electric drives are economic, competitive and environmentally friendly.

Scope of supply

- Turnkey responsibility for the delivery of hoistable car decks and ramp, all with electric operation.

M/S Finnulp & Finnmill

Owner: Finnlines PLC
Builder: Jinling Shipyard
Year built: 2002
Length, oa: 187,06m
Breadth, mld: 26,5m
Draught, design: 6,90m
Gross tonnage: 25,654gt
Freight capacity: 2,680 lane metres
Passengers: 12
Speed, service: 20 knots
RoRo system MacGregor:
 Hoistable car deck system and hoistable access ramp

RoRo access package including sliding stern and bow doors



New weathertight, two-pannelled, side-sliding stern doors were installed.



Conversion of existing bow doors and reinforcement of bow door steel structure.

Background

French ferry operator SeaFrance Dover-Calais Ferries took delivery in 2008 of its fast RoPax ferry *SeaFrance Molière*, formerly known as Jean Nicoli (ex Superfast X). The 2002-built vessel underwent an extensive refit at Dunkirk shipyard in 2008.

Targets

- Increase the capacity as the vessel effectively replaces SeaFrance Renoir and SeaFrance Manet on the cross-channel service on the Dover-Calais route. New capacity: 1,200 passengers, 660 cars or 110 trucks.
- Optimised and faster loading and discharging by having double decks, for the ship's new role in shortsea ferry operations.

Conversion solution

MacGregor's RoRo conversion team maintained as much of the existing arrangement as possible. Extensive amendments were made to bow and stern doors to fit with the terminals in Dover and Calais.

- Conversion of the existing bow doors, with reinforcement of the bow door steel structure to suit the new arrangement.

This was the most complex aspect for MacGregor as the huge forces imposed on the ship's hull have a direct effect on the bow doors. Their

impact was countered by reinforcing the steel structure at the lower part of the door leaves.

- Installation of new sliding stern doors.

Scope of supply

- MacGregor re-used, as much as possible, the existing bow door equipment for the new bow door arrangement.
- The lower part of the bow doors was cut out and altered to suit the vessel's new extension on deck 3 and 'cow catcher'.
- The steel structure of the door leaves was reinforced. The doors have been equipped with new stoppers and locking devices to fulfil the bow door rules and requirements of Norwegian classification society Det Norske Veritas (DNV).
- A new rubber sealing arrangement was installed at the lower part of the door, which is tightened against the tightening bar construction on the new deck 3 level in order to achieve weathertightness. The existing rubber packing at the sides and upper edge was also renewed, but as much as possible of the existing mechanical, hydraulic and electric fittings, equipment and components of the existing bow door arrangement was re-used, including the doors.

- Free driving width through the converted bow doors is about 5.0m.

- New weathertight, two-pannelled, hydraulically-operated, side-sliding stern doors. They were installed inside the new transom sections and are operated by hydraulic cylinders, hydraulic motors, and chain and fixed guide rails above the door.

In the closed position, the door is locked by mechanical wedges at the lower edge and at the sides and guiding slots at the upper edge. The lifting cylinders press the doors down into the locked position. They are operated by push-button control with power taken from the existing hydraulic circuit.

SeaFrance Molière

Owner: SeaFrance Dover-Calais Ferries
Length, oa: 203.3m
Breadth, mld: 25m
Gross tonnage: 30,285gt
Draft: 6.50m
Freight capacity: 1891 lane metres
Passengers: 1,200
Cars/trucks: 660 cars or 110 trucks
RoRo system from MacGregor:
 Sliding doors
Year built: 2002 by HDW, Germany
Former names: Jean Nicoli, Superfast X

Bulkhead doors meet SOLAS stability regulations on RFA Argus



Robust and reliable sliding bulkhead doors have been fitted onboard RFA Argus. They incorporate innovative technology and are developed from proven designs.

MacGregor's RoRo conversion team received the contract in 2009 from A&P Falmouth Ship Repair Yard, to design and build watertight and weathertight doors for RFA Argus, according to SOLAS rules and regulations. It also provided installation assistance.

As part of a major upgrade and life extension project, the UK Navy's Royal Fleet Auxiliary ship Argus was converted to undertake a new primary role for receiving casualties, with a secondary task of helicopter training.

Major equipment upgrades were also undertaken to increase the vessel's operational capabilities and upgrade it to meet future regulations for SOLAS, sewage treatment plants, fire and watertight integrity.

MacGregor conversion solution

Watertight and weathertight bulkhead doors meet SOLAS stability regulations.

Scope of supply

- Design and hardware delivery
- Installation assistance
- Built to Lloyd's Register of Shipping (LR) classification requirements
- SOLAS stability regulation compliant
- Watertight and weathertight sliding bulkhead doors, located on hangar deck, on port and starboard sides
- Watertight and weathertight top hinged bulkhead doors, located aft of the ramp

- Watertight and weathertight small sliding bulkhead door, located on hangar deck, starboard side

The ship has undergone a conversion that redefines its key role. Built in Italy in 1981 as the container vessel *Contender Bezzant*, it was taken out of merchant trade during the Falklands war and entered naval service in 1988, primarily serving as an aviation training facility.

Now RFA Argus serves as a Primary Casualty Receiving Facility (PCRF) providing facilities including two operating theatres and 100 beds. As a logistics ship it can be adapted to transport various quantities of equipment very quickly.



RFA Argus is a casualty receiving ship, capable of treating 100 service/civilian personnel, and an aviation training facility. It can carry up to 500 service personnel and has been designed to accommodate diverse and demanding roles.

RFA Argus

Owner: Ministry of Defence, Royal Navy, United Kingdom

Builder: Jinling Shipyard

Year built: 1981

Length, oa: 175m

Draught, design: 8,1 m

Deadweight: 12,221 dwt

Speed, service: 18 knots

RoRo system from MacGregor:

Watertight and weathertight bulkhead doors, SOLAS stability regulation compliant.

Electric drive improve performance and minimises environmental impact



Environmental benefits

Electrically-driven RoRo cargo access solutions are environmentally-friendly, cargo safe, energy efficient and easy to service. Electric drive minimise the environmental impact and reduce the amount of hydraulic oil carried onboard, minimising the risk of cargo damage by hydraulic oil. Electric actuators replace the direct acting hydraulic cylinders used for operating smaller items and in cleating and locking devices.

Energy savings

Compared with a hydraulic system, electric operation saves energy! Hydraulic drives require continuous pump operation, whereas electric drives run only when the equipment is manoeuvred. Energy losses are also much lower than with a hydraulic system. For example, electrically-driven systems are not affected by pressure drops within the piping system. In addition, it is also

Operative availability

MacGregor's ambition is to ensure the operative availability of your cargo flow systems. Our experts are on standby worldwide to provide a rapid response to your needs.

Global presence – local service

We operate in approximately 50 countries and our service network consists of more than 60 service centres in major ports around the globe, staffed by specialists.

We supply original MacGregor spare parts and repair services on a planned schedule, on demand, or on an emergency basis.

Planned maintenance

MacGregor's planned maintenance concept relies on the solid foundation of



possible to feed power back into the ship's power supply when larger winches, such as those found on quarter ramps, lower heavy loads.

Electric control system

All equipments are operated by control panels. The operation sequences are controlled by PLC's (Programmable Logic Controllers) via push-buttons, joysticks or switches. Lamps indicate the status of cleats and whether they are locked or unlocked.

Advantages of electric drives compared with hydraulic drives

For the shipowner:

- No oil pollution or damage to cargo by hydraulic oil
- Energy saving as no continuous running is needed
- No change in operating time in cold conditions
- Maintenance friendly
- Easy to monitor

For the shipbuilder:

- Cable wiring is easier than piping
- No flushing work required
- No need for high pressure hydraulic skills
- No pump unit needed

our worldwide service network, and allows you to plan your operating budget.

On-demand service

Our service centres worldwide solve problems as they arise, helping to keep your ship up and running. We also provide a comprehensive damage assessment and repair service.

MacGregor Onboard Care (MOC) service contracts

An MOC service contract offers a modular service concept where you can choose the necessary modules to suit your individual needs in terms of operating security, budgets and comfort.

Crew training

Tailor-made theoretical and hands-on crew training in the maintenance and

Easy to monitor and service

Electric drives are easy to monitor and service. When using all electric components, onboard monitoring systems (OMS) make diagnostic fault-finding easy. The equipment can be linked to remote diagnostic systems (RDS) to provide continuous data input for round the clock analysis. The health of a piece of equipment can be assessed at any time. Automated speed up and slow down functions make electric drives easier to operate than hydraulically driven equipment.

Electrically-operated MacGregor RoRo equipment

- Stern quarter, stern and side ramps
- Ramp covers
- Internal ramps
- Car deck systems
- Lifting platforms
- Shell doors
- Linkspans

operation of MacGregor equipment and systems.

Drydockings

Let us know your schedule well in advance and we will plan drydocking services for you accordingly.

Modernisation

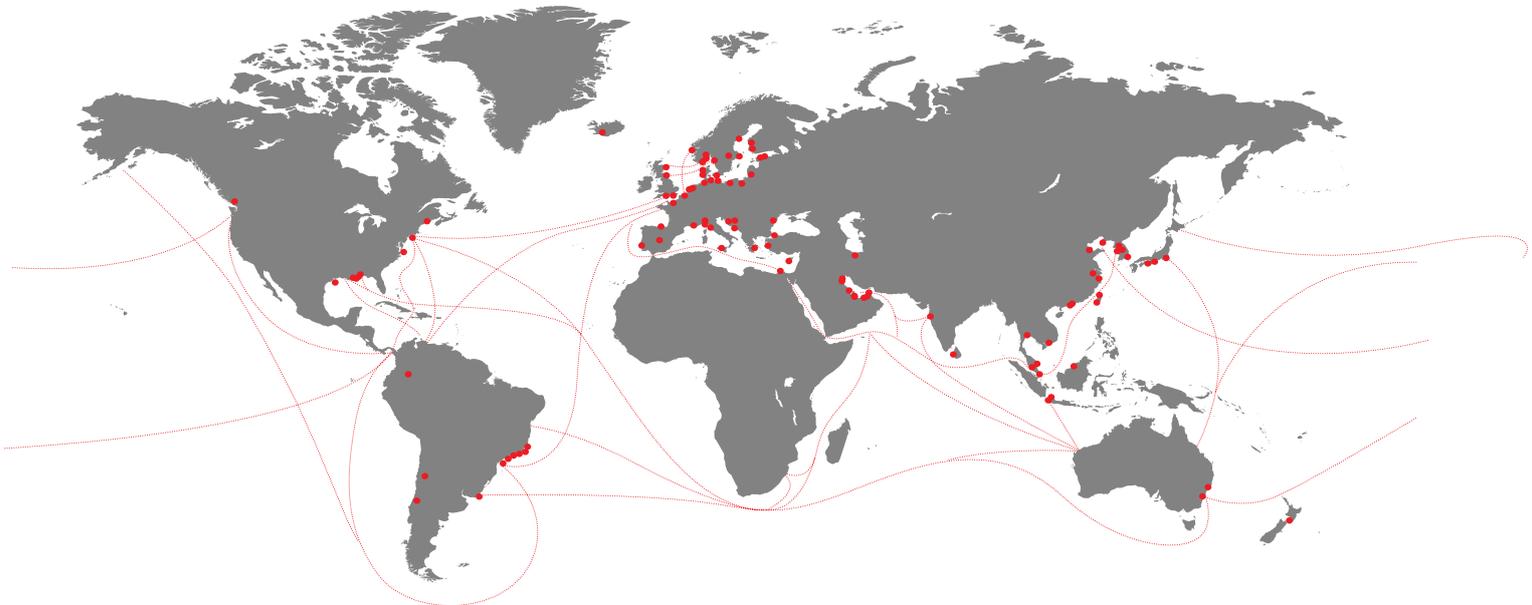
MacGregor has the expertise and the resources to upgrade ageing cargo access equipment to the latest performance standards.

Conversion

MacGregor's conversion packages adapt, enhance or change the original functionality of the system, re-designing it to meet changing market requirements.

Wherever needed, you can rely on our support.
We serve our brands globally:

- Ankerlökken Marine
- Allset
- ASCA
- Becker
- BMH
- Conver-OSR
- Grampian Hydraulics
- Flintstone
- Greer Marine
- Hamworthy
- Hatlapa
- Hydramarine
- Hägglunds
- Interschalt
- KGW
- KYB - ASCA
- KYB - Kayaba Industries / Navire Cargo Gear
- Luezhoe
- MacGregor
- MacGregor-Conver
- MacGregor-Hägglunds
- MacGregor-Kayaba
- MacGregor-Navire
- Navire Cargo Gear
- Nordströms
- Ozean Service & Reparatur
- Platform Crane Services (PCS)
- Plimsoll
- Pusnes
- Porsgrunn
- Rapp Marine
- Triplex
- Vestnorsk Hydraulikkservice (VNH)



MacGregor shapes the offshore and marine industries by offering world-leading engineering solutions and services with a strong portfolio of MacGregor, Hatlapa, Porsgrunn, Pusnes and Triplex brands. Shipbuilders, owners and operators are able to optimise the lifetime profitability, safety, reliability and environmental sustainability of their operations by working in close cooperation with MacGregor.

MacGregor solutions and services for handling marine cargoes, vessel operations, offshore loads, crude/LNG transfer and offshore mooring are all *designed to perform with the sea*.

MacGregor is part of Cargotec (Nasdaq Helsinki: CGCBV).

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