Photo by Sea Sky Martin-Rotterdam

GERARDUS MERCATOR

IHC COMPLETES 18,000m³ TWIN-SCREW TRAILING SUCTION HOPPER DREDGER FOR BELGIAN ACCOUNT

Builders : IHC Holland, Kinderdijk, The Netherlands
Owners : Ondernemingen Jan de Nul, Aalst, Belgium

Located at Kinderdijk, the Netherlands, *IHC Holland* designs, builds and supplies capital goods and services for the dredging industry, the alluvial mining industry, on- and offshore piling companies, shipping companies, shipbuilders, sand and gravel mining organisations and other civil engineering contractors. The construction of thousands of specialist vessels and items of equipment over a period of more than 100 years has created an enormous resource of vast experience and know-how.
Design and construction activities take place in modern production facilities in Kinderdijk and Sliedrecht. *IHC* products are also built with full assistance from *IHC* at other yards, such as in the countries of destination. The designing and production of parts, instruments and automation systems, in which specialised product know-how is essential, is also undertaken in-house.
Services to customers include the provision of advice, training of crews, the supply of spare parts (generally from stock) and the renovation of economically or technically out-dated equipment. With the supply of a total package of products and services for the dredging industry *IHC Holland* meets the most divergent requirements of private dredging and mining companies and government institutes. The company has an estimated share of 50% of the world dredging vessel market. Some 75% of domestic turnover is exported.

General

In November 1994, Belgian dredging contractor *Ondernemingen Jan de Nul* and *IHC Holland* signed the contract for design, construction and delivery of a 18,000m³ twin screw trailing hopper suction dredger. The dredger, named *'Gerardus Mercator'* was launched at *IHC Holland's* Kinderdijk shipyard in September 1996. The official name-giving ceremony will take place at a later date.
The *'Gerardus Mercator'* currently is one of the

largest trailing suction hopper dredgers in the world. With her massive hopper capacity of 18,000m³ the vessel is the largest hopper dredger ever built by *IHC Holland*. A larger hopper dredger with a hopper capacity of 23,000m³, however, is currently under construction at *Verolme Heusden Shipyard* for account of *Boskalis*.

Built under yard number CO 1211 the *'Gerardus Mercator'* features the following main characteristics:

Principal particulars

Length b.p.	142.30 m
Beam	29.00 m
Depth	13.10 m
Draught (int. freeboard)	9.54 m
Draught (dredging mark)	11.51 m
Hopper capacity	18,000 m³
Deadweight at 11.51m	29,150 t
Service speed (laden)	15.5 knots
Electric portal crane	45 t
Accommodation	40

Pipelines

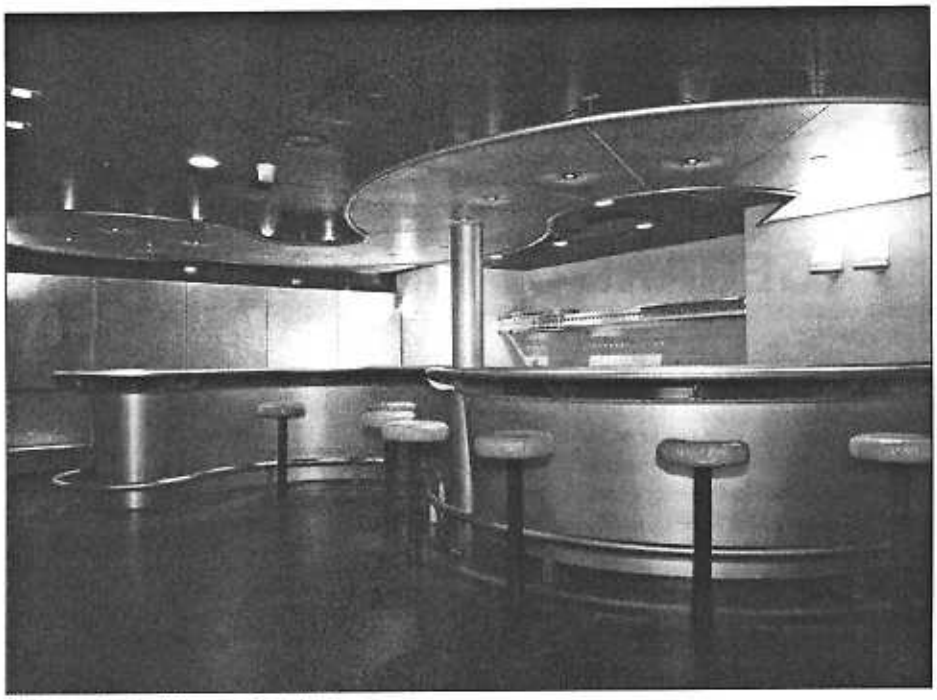
Suction pipes diameter	1,200 mm
Discharge pipe diameter	1,000 mm
Dredging depth	35/55/105/112 m

Installed power

Suction pumps (double walled)	2 x 3,000 kW
Discharge pumps	14,000 kW
Submerged dredgepump	3,200 kW
Jet pumps	2 x 1000 kW

Machinery

Main engines	2 x 9,450 kW
Shaft generators	2 x 4,500 kW
Auxiliary engines	3 X 924 Kw
Harbour engine	320 kW
Bow thruster	2 x 1,000 kW



Living quarters include a spacious bar

Classification

The *'Gerardus Mercator'* has been built under survey and to the requirements of and with a certificate of *Bureau Veritas* for Class I 3/3 ✱ E Hopper Dredger, (Deep Sea), AUT-MS with service notation 'Dredging within 15 miles from shore or within 20 miles from port'.

Superstructure

A fully air conditioned accommodation is arranged on the foreship, above main deck and designed for a complement of forty. Air conditioning is with an air conditioning plant supplied and installed by Spakenburg based *Heinen & Hopman*. The accommodation comprises the following deck levels: A-deck (wheelhouse), B-deck (converter room), C-deck (four cabins, office, survey office, toilet, two single-berth cabins), D-deck (24 single-berth cabins, change room, entrance lobby), main deck (galley, messrooms, five double-berth cabins, tv room/saloon, bar, hospital, electronic workshop, bar, locker), tweendeck (laundry, dry provision stores with refrigerated stores, gymnasium, stores, bonded stores). All deck and accommodation lights are make *Aqua Signal*, supplied by *Theunissen Technical Trading BV*. The trading company also supplied the *Vingtor* integrated electronic telephone/talk back/PA system for alarm and music distribution.

View of the galley

Noise Reduction

The vessel has been such designed and constructed that inconvenient noises are avoided as much as possible. Noise reducing measures include:

- floating sound-insulating floor coverings on main deck;
- insulation of all outer ceilings and steel outer walls of accommodation spaces;
- panelling, partition walls, ceilings, floating floors are not in contact with steel bulkheads and decks;
- flexibly mounted diesel gensets.

Noise levels and measurements on board comply with *Bureau Veritas* Guidance Note NI-174-RD3/CN and do not exceed the maximum permissible sound levels. Werkendam based *Drumarkon* has fitted the *Isolamin* modular system, the *Momek* firedoors, the *Premec* wet units, the *Cape Marine Board* and the *Polyrey* laminates. Further, vibration levels have been limited to such a low value that during normal working conditions a minimum of discomfort for the crew occurs. All steel outside bulkheads of cabins, messrooms, offices, etc. are sheeted with 50mm thick non-combustible panels. Steel inside the bulkheads in way of cabins, messrooms, offices, recreation rooms, etc. are sheeted the same way. All sheetings are fitted free from the steel walls. Ceilings provided in cabins and messrooms consist of 25mm thick non-combustible panels. Also the partition bulkheads are of non-combustible panels with a total thickness of approximately 50mm.

Deckhouses

On the aftship a deckhouse is fitted at the same level as the coaming deck. The aft deckhouse accommodates the emergency generator room,

... of the dredgemaster's control console

the welders' workshops, and ventilation spaces. The aftdeck carries the funnel containing the main and auxiliary engines exhausts. The funnel, provided with louvres, also serves as a natural exhaust for the engine room.
Forward, under the wheelhouse, a converter room with a height of 1.80m is provided covering the whole area of the wheelhouse.

Hull Construction

The vessel is of the single deck type with forecastle, raised aftdeck and an accommodation deckhouse on the foreship. The dredging installation is placed on the aftship. Transverse watertight bulkheads divide the vessel in the following compartments:

- forepeak with chain lockers and water ballast tanks (used as trim tanks);
- bowthruster room;
- store with deeptanks for fuel oil and fresh water;
- hopper with centre box keelson and buoyancy spaces with fuel oil tanks at sides;
- pumproom;
- engine room with control room;
- aftpeak with steering gear room and ballast water tank and dry peak tank.

The hull is a fully welded construction with hard chine bilges and built to the longitudinal frame system, supported by transversal web frames with extra stringers. At the hopper ends, the hopper structure is extended in such a way that forces are gradually led into the deck and double bottom construction of fore and aftship.
The hopper itself is provided with a coaming on the main deck, extending up to forecastle deck level. The hopper coaming is single walled, with stiffeners and frames at the outside. The trunk-deck above the hopper is of a box type construction, internally stiffened. The plating of the hopper is plain on spoil side. A double bottom is provided in way of the bowthruster room, forestore, pumproom and engine room. Tanks are fitted in the buoyancy spaces below tweendeck. A cofferdam is located between hopper and fuel oil tanks

On the stern a double plate streamlined skeg is fitted on centre line. In way of the propellers, a streamlined tunnel is fitted, integrating the upperside of the propeller nozzle and running up to the aft end of the rudder. Skeg, nozzles and rudders are such designed that when grounding with maximum trim, nozzles and rudders stay clear of the bottom.
The underwater hull is protected by a *Chemetall* cathodic protection system consisting of a number of aluminium anodes for a two years protection in tropical waters. Also the hopper bottom doors are provided with an anode each. Extra anodes are fitted in way of propellers, bowthrusters, sea chests etc.

Tank Arrangement

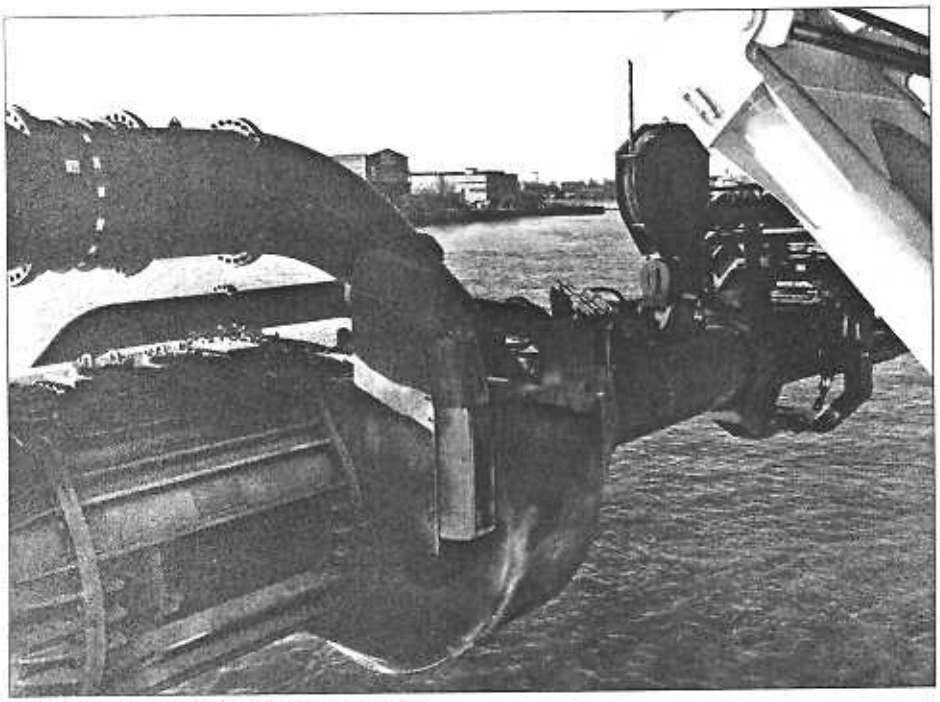
Trimming tanks in the forepeak and in the aftpeak, connected to the delivery pipeline of the jetwater pumps, enable quick filling of the tanks in order to reduce the vessel's trim in light ship condition or partly loaded condition or full load condition. The forward trim tank can be emptied by gravity. The aft trimming tank can be partially emptied by gravity.
Bunker tanks for heavy fuel oil are provided in the buoyancy spaces below tweendeck. The total capacity for heavy fuel oil is 2,400m^3 distributed over six tanks. Lubricating oil tanks are fitted in the engine room's double bottom section where also a dirty oil tank and a sludge oil tank is provided together with the sump tanks of the main engines.
Two fresh water tanks with a total capacity of 200m^3 are provided above the double bottom and are provided with remote level monitoring. A 10m^3 fresh water tank is fitted in the engine room for supply to machinery systems.
The forepeak and aftpeak are utilised as ballast tanks. The tanks are filled by a jetpump. The bottom of the forepeak tank is located above the light waterline, making it possible to empty the tank by gravity. All valves are controlled from the wheelhouse. All ballast tanks are also connected to the bilge/ballast system and are provided with the necessary sounding and venting pipes and provided with remote capacity monitoring by means of a pressure transducer mounted outside the tank.

Dredging

The hopper dredger is capable of dredging by means of one or two trailing suction pipes and can deliver the spoil either into the hopper or directly overboard when the dredged spoil is too light. The hopper has coamings and is open at top. The spoil can also be dumped to the sea bottom through two rows of hinged double-type box-shaped bottom doors of the positive opening type. Each bottom door is operated by a hydraulic cylinder, remote controlled from the wheelhouse. A novel feature is that before dumping the vessel's draught can be decreased in such a way that dumping with minimum clearance is possible.
Pumping the spoil from the hopper to the shore is by means of the dredge pumps and a self-emptying system, with starboard pump or with both working in series. A bow connection arrangement is fitted suitable for coupling to a flexible floating pipeline, as well as a bow jetting installation. A side discharge installation can be fitted as well. The hopper load can be diluted at selected hopper spaces by means of two jetwater pumps to facilitate unloading of the spoil during dumping and during pumping ashore. The hopper is fitted with four cylindrical-type overflows which are continuously adjustable operated by hydraulic cylinders remote controlled from the wheelhouse. The drag heads are provided with high pressure water jets for loosening compact soil.

Hopper

The hopper has a capacity of 18,000m^3. The coaming deck is at the 18,000m^3 level. At fore and aft end and at the sides of the hopper coaming the height has been increased in order to avoid spillage of spoil when the vessel is pitching and rolling. This splash coaming is sufficiently high for a heel angle of 5 degrees with, at the same time, a pitch angle of 2 degrees, assuming a maximum spoil level of 18,000m^3. The splash coaming has a minimum height of 1m and is fitted around all openings.
The hopper is provided with four adjustable overflow ducts adjustable between 9.2 to 17,3m above base. One of the four overflows can be adjusted from maximum level down to about 7.7m above base. The form of the hopper has been made optimal for good settling and discharging of the spoil, either by dumping or by self-emptying. The hopper's longitudinal walls are vertical. It's centre box keelson's sides are inclined. The hopper is completely free of obstacles.
For dumping twenty double box-type bottom doors are arranged in two rows. The load can also be discharged by self-emptying by using the dredgepumps. For this purpose, two channels are fitted alongside the centre box keelson, each with ten hydraulically operated upper-doors. Self-emptying channels are connected to the suction of SB dredgepump. This system is also used for dewatering the hopper, prior to loading. A hopper flushing installation is fitted for fluidising the spoil prior to dumping or self-emptying. The system is divided in ten sections, corresponding with the ten bottom door sections. Flushing water is supplied by the jetpumps, working in parallel. The jets of water are directed efficiently towards the bottom doors.



Holec electric motor is fitted on the suction pipe

Extra jets are directed towards the upper doors of the self-emptying channels. The bottom doors are of all welded closed box construction, internally stiffened and protected. The bottom doors seal against a rubber seal fitted around each door. This seal is completely watertight as well from the inside as from the outside.
Each double bottom door is opened and closed by a double-acting hydraulic cylinder, enabling positive opening and closing. The cylinders are controlled from the wheelhouse, each cylinder is separately controlled. Each bottom door can be opened up to an intermediate position (determined by the vessel's rise after using the shallow water dumping system), or up to maximum opening.

Shallow Water Dumping

In the centre box keelson four shallow water dumping doors, each measuring 1.8 x 4.0m are provided. These doors when opened, do not protrude below the vessel's base line. By means of these doors part of the load can be dumped, even when no keel clearance is available. The doors are fitted in such a way that as much as possible of the load can be dumped. After partial unloading, the rise of the vessel is used for opening the main bottom doors up to the intermediate position to continue the unloading process. The doors are arranged in such a way that during pre-dumping the vessel will remain on even keel. The shallow water doors are located in a trunk in the centre box keelson. The doors are of welded closed-box construction. The system is monitored and controlled from the wheelhouse with individual control for each door.

Hopper Flushing System

For facilitating the dumping of the load or for diluting the load when self-emptying a hopper flushing system - fed by the jetpumps - has been installed. Each jetpump discharges to the central jetwater line in the centre box keelson. This central line has a branch at each bottom door section leading to the top of the centre box keelson. Two branches are led to the forward end of the self-emptying channels. Four branches are led to the shallow water doors. Two branches are led, one to the forward hopper end bulkhead, one to the aft hopper end bulkhead. Each branch is fitted with a remote controlled hydraulic butterfly valve. All valves in the system are provided with electric remote position indication in the wheelhouse.
By means of distribution pipes nozzles are positioned in each bottom door section in such a way that the diluting action for dumping and self-emptying is optimal.The branches to forward and aft hopper end bulkheads are provided with nozzles on top of the inclined part of the bulkhead.

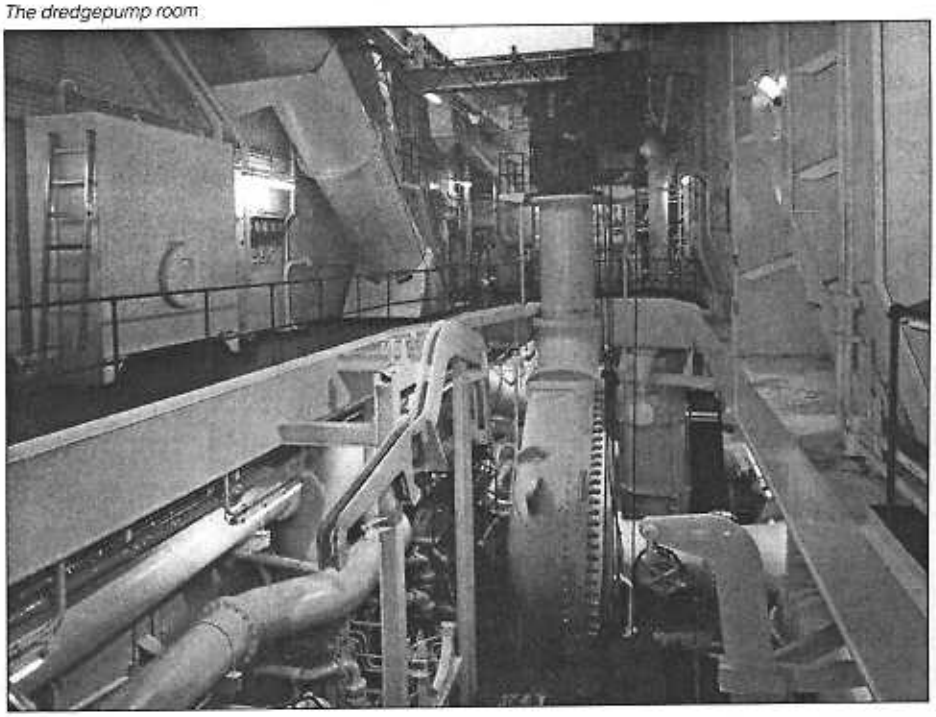
Hopper Loading

The discharge lines to the hopper have a diameter of 1,100mm. Directly on the pump discharges a cast steel stand pipe is fitted. In the discharge of SB pump a branch is fitted for connection to the suction PS pump. In the discharge of each pump density and velocity measuring pipes are fitted. On coaming deck both discharge lines are provided with a branch to the shore discharge line with a 1000mm rubber ring sluice valve. After this branch a 1,100mm rubber ring valve is fitted in each discharge pipe. Behind these valves both discharge lines are connected to a combined hopper loading line.
Further, three loading boxes are provided, one fore, one aft and one at mid length of the hopper. Between the hopper loading line and each loading box, two connections with regulating valves, one SB and one PS, are provided.
In the discharge line of each pump, after the velocity and density measuring pipe, a branch for light mixture overboard (AMOB) is fitted.

Dredgepumps

The dredgepumps are installed in the pumproom in the aftship. Each dredgepump is driven by a *MAN-B&W* medium-speed main engine via a gearbox. The dredgepumps can run at two nominal speeds (i.e. for trailing low speed is used; when shore discharging either low speed or high speed duty is used for both or either dredge pumps). The dredge pumps are designed for a power on the pump shaft of 7,000kW when running at high speed. The dredgepumps are of the double-wall type with a wear resistant inner casing fitted in a pressure resistant outer casing with covers.
The dredgepump shaft seals are of the well-known *Liquidyne*-type, supplied by *IHC Lagersmit*. The mounted three-stage execution has a bush diameter of 560mm. The water discharge to these seals is direct taken from the flushing water system of the dredge pump. In this discharge line, a self-cleaning settling pipe is fitted to minimize the abrasive wear on the running surfaces of the *Liquidyne* seal. In addition to the dredgepumps seals, *IHC Lagersmit*

The dredgepump room



also supplied the sterntube sealings and bearings.

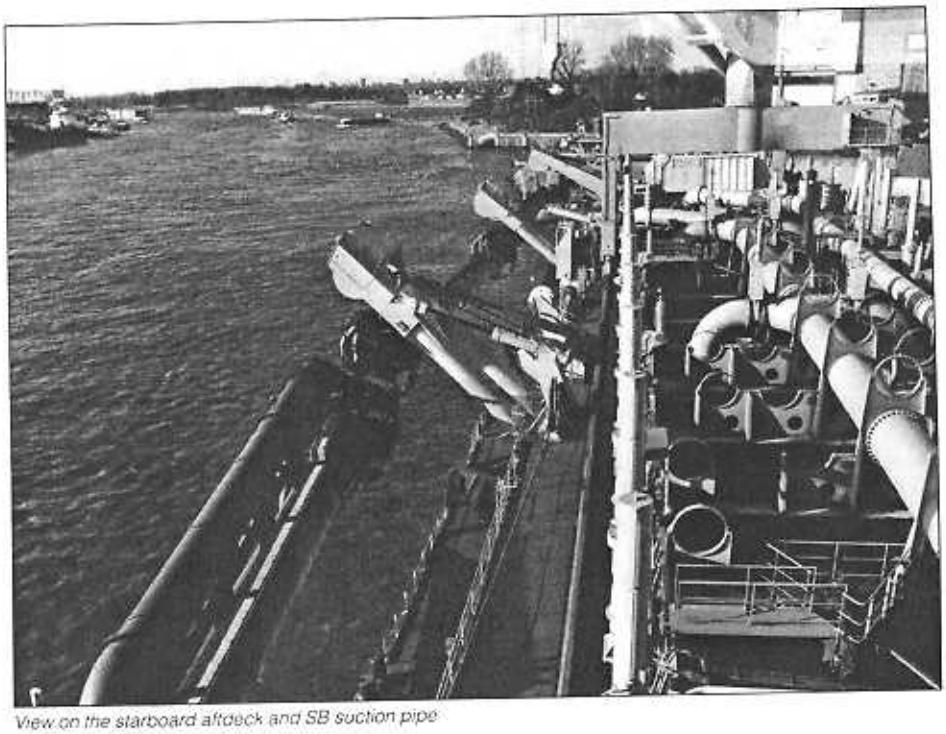
Suction Pipes

The two suction pipes have an internal diameter of 1,200mm. The length of the suction pipes is based on a 55m dredging depth below empty waterline. The angle between suction pipe and baseline is 45 degrees. Between draghead to hull connection the suction pipe consists of a straight pipe with steel flanges with an eyeplate for the hoisting wire, a long turning gland with seals, two flanges, and a universal joint consisting of two pipe pieces with pivot arms, a cardan ring with four swivel pins with rubber fenders at vessel's side. The fender is also providing protection for the jetwater pipes on the cardan ring. The suction pipes are provided with recovery cables. These cables enable the recovery of a suction pipe when a hoisting wire has been broken. On the suction pipes supply pipes and pressure hoses are provided for jetwater supply to the dragheads. Between draghead and lower straight pipe a flexible rubber discharge hose for jetwater is fitted.

Two identical jetwater pumps are installed for supply of jetwater to the dragheads and hopper. The jetpumps are installed in the pumproom and are driven through *L+S Navilus* reduction gearboxes type *GAA 360 So*, with a ratio of 2.07:1 and through *L+S* highly elastic *Spiroflex* couplings, type *KJO 150*, design *1300*. For draghead jetting both pumps run in series. For hopper flushing both pumps run in parallel. Trim tank filling (fore peak and aft peak) is performed by either pumps; but only one pump at the same time. For degassing, both pumps run in series.

Two degassing installations, one for each pump, have been installed. The gas/silt mixture is led to a separation tank in the pumproom.

The upperside of the tank is connected to an ejector unit for creating a vacuum. The ejector unit is fed by the jetpumps. A connection pipe runs between separation tank and ejector unit to a sufficient height in order to avoid entry of silt in the ejector unit. The silt is removed by an ejector driven by jetwater. The ejector discharges to outboard through a discharge line located well below the empty waterline.



View on the starboard aftdeck and SB suction pipe

55/112m Dredging Depth

Both regular suction pipes can be adapted for 55m dredging depth. These adaptations consist of lengthening of the lower pipe with an extra pipe piece with flanges and jetwater pipes

Further, the draghead gantry is to be moved to a new location more aft. For this reason the draghead gantry's fixed part is provided with a flange connection to the foundation on deck. With the suction pipe for 35m dredging depth the draghead is located well forward of propellers and nozzles.

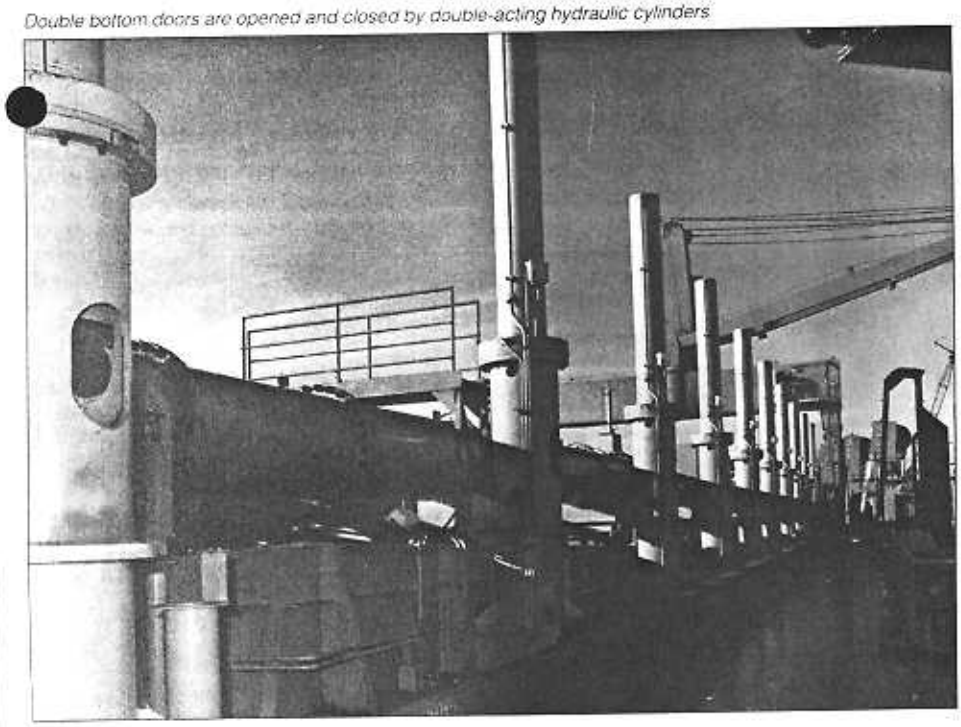
Each suction pipe is provided with a draghead with self-adjusting visor. The dragheads are supplied by the owner. The complete suction pipe arrangement is suitable for fitting a draghead with hydraulic control of visor and waterflap. The dredge pipelines are fitted with rubber ring gate valves with hydraulically operated gates. These sluice valves are controlled from the wheelhouse and are provided with continuous positioning monitoring for remote signalling, as well as limit switches for open/close.

For deep dredging operations an extended suction pipe for a dredging depth of 112m is fitted at starboard side. This installation is provided with a submerged 3,200kW dredgepump powered by a watertight AC asynchronous electric motor. The deep dredging suction pipe has a nominal diameter of 1,200mm and consists of:

- a draghead suspended by the draghead gantry;
- a lower straight pipe with turning gland and jetwater line;
- two gimbal joints;
- an intermediate straight pipe with jetwater line;
- an electric driven submerged pump;
- a dummy upper pipe;
- a sliding piece with suction bend;
- a service frame.

Draghead and intermediate straight pipe of the deep dredging suction pipe are hoisted by means of the draghead and intermediate gantry and winch of the 35/55m suction pipe. The dredgepump features a four-blade impeller.

Double bottom doors are opened and closed by double-acting hydraulic cylinders



Shore Discharging

When shore discharging both dredgepumps can run in series. Therefore a 1,100mm diameter serial line with rubber ring gate valve is fitted between SB and PS pump. It is also possible to discharge with only SB pump, while PS pump is pumping water to the hopper. In the discharge lines to the hopper, before the connection to the hopper loading pipe, branches to the 1000mm shore discharging line are fitted. Both 1000mm discharge lines are connected and the 1000mm discharge line runs to the foreship. In this discharge line a branch can be fitted for a discharge installation over the vessel's side.

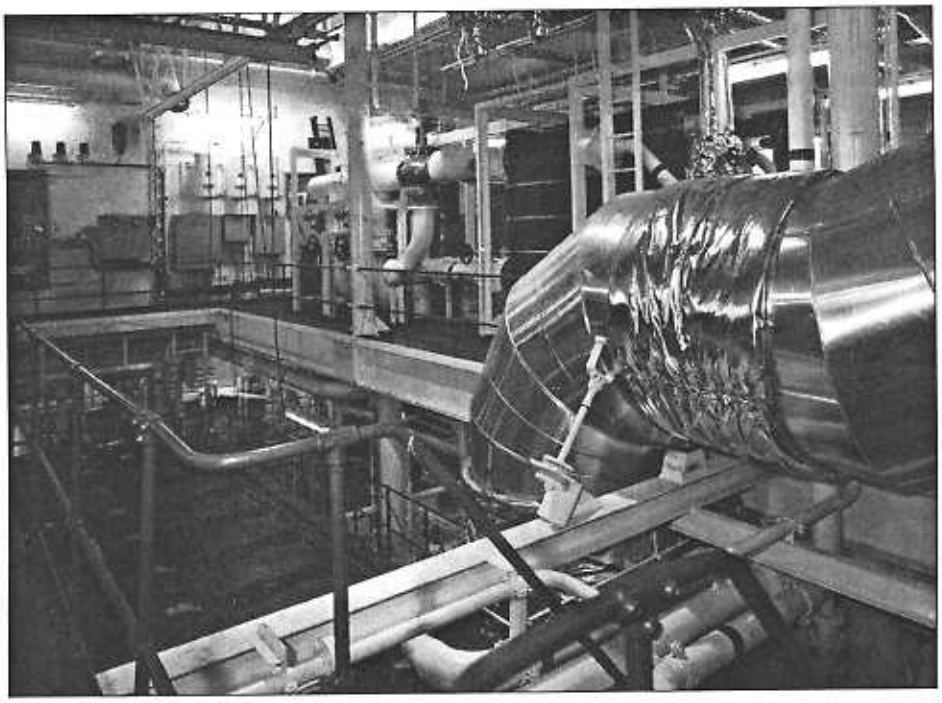
When emptying the hopper the spoil can be discharged through a system discharging over the side, through a bow connection or can be jetted over the bow. For selecting bow connection or bow jetting two 1000mm rubber ring gate valves are fitted in the shore discharge line.
The bow connection arrangement, make *Van der Graaf*, consists of a 1000mm diameter balljoint. The coupling mechanism is hydraulically operated. For hoisting the ball joint a hydraulic winch is installed on the forecastle deck. A shore discharging system for discharging over the vessel's side, with vessel moored, can be installed on the ship, on the centreline. The system consists of a branch pipe with rubber ring sluice valves in the shore discharging line, a swivel construction with flexibly mounted U-formed pipe, and a turning gland. The shore discharging system is moved by means of hydraulic cylinders and hydraulic slewing gear and can be used on SB and PS.

Engine Room

The *'Gerardus Mercator'* has an automated engine room, suitable for unattended operation, according to the requirements of *Bureau Veritas* AUT-MS. Control of the propulsion and steering installations is from the wheelhouse.
The engine room automation system of the hopper dredger consists of a *Praxis Automation Technology G-Data* system. The system basically consists of a G-MOWS Marine Operating System, a G-CAM Alarm, Monitoring and Control system, and a G-CABIN Extension Alarm System. The G-CAM system is fitted in the engine control room featuring three different types of self-running I/O boards. A total of G-MOWS working stations are placed in the ECR and on the bridge, directly connected to the G-CAM system. The G-CAM system is a microprocessor based system for measurement, monitoring and control of the vessel's machinery. The G-CABIN is an extension of the G-CAM alarm, monitoring and control system for unmanned machinery space operation.
Main and auxiliary engines are suitable for running on heavy fuel oil. The machinery installation embraces two *MAN-B&W 9L48/60* main diesel engines. The main engines can be started and stopped locally and from the ECR. Speed control for main engines is possible from the navigation desk, the dredging desk and in the ECR. The main engines are suitable for continuous running at full torque between 70 and 100% of maximum speed. Each propeller installation consists of a four-blade CuNiAl *Lips* cp-propeller with a diameter of 4.60m turning in propeller nozzles attached to the ship's structure by a vertical outrigger and incorporated in the propeller tunnel.

Each main engine drives:
- a *Lips* controllable pitch propeller via a L+S highly elastic clutch, type *Pneumaflex KAP 410*, design *1000*, a *L+S* reduction gearbox type *GUH* with a ratio of 3.96:1;
- a dredgepump from its forward end via a *L+S* two-speed reduction gearbox type *GJZ 1715*.

Changing of the output speed during operation is via *Quilshafts L+S Pneumastar* clutches, type *KUM 450* and *KUM 390*, attached to the gearbox. Between engines and gearboxes *L+S* highly elastic *Spiroflex* couplings, type *KJP 410*, design *1656*, are fitted. Between gearboxes and generator drives *L+S* highly elastic *Spiroflex* couplings, type *KJO 280*, design *1300* are fitted.



A topview of the engine room

Electrical Installation

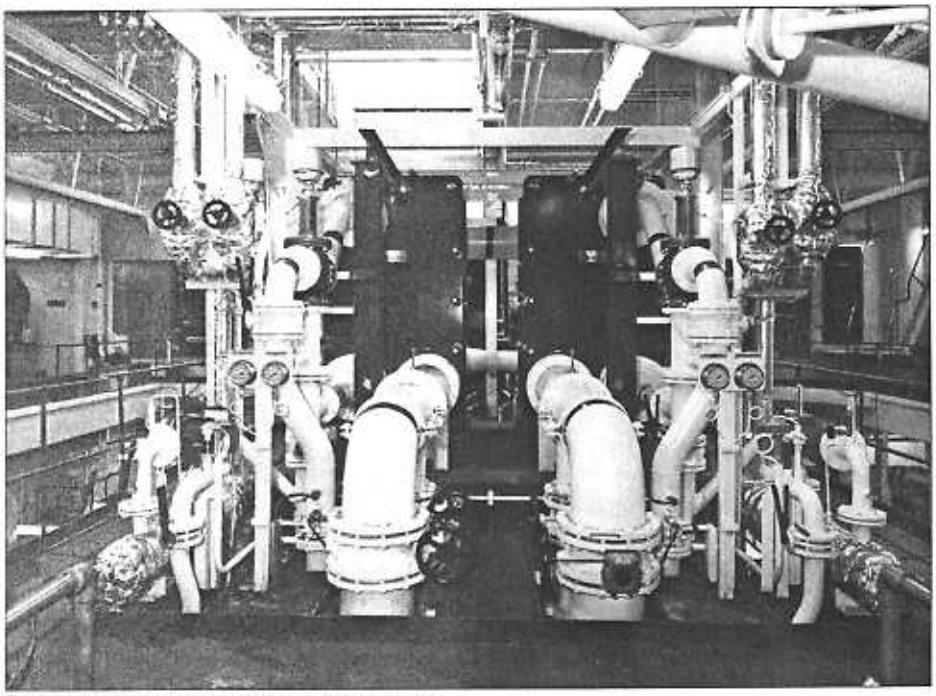
The complete electrical installation and automation, designed by *R&H Systems*, was installed by *GTI Marine & Offshore* and consists of several electric systems:
- a three-phase, 3 x 660V/42-60Hz system (fed by two main generators which are driven by the propulsion engines. The power circuit supplies the power consumers such as the hydraulic pumps, the bowthruster motors and the jetpump motors both via a variable speed drive).
- a three-phase, 3 x 440V/60Hz system (supplied by three auxiliary generators or by the main generators through a transformer, or the shore supply. The system supplies to all auxiliaries via the auxiliary switchboard);
- a three-phase, 3 x 440V/60Hz system (supplied by the emergency generator and supplying to the emergency switchboard);
- a three-phase, 3 x 220V/60Hz system (supplied by the auxiliary switchboard via transformer and supplying to lighting, small consumers, and stand still heating systems);
- a three-phase, 3 x 220V/60Hz system (supplied by the emergency switchboard via transformer and supplying to lighting, small consumers);
- a 24VDC systems for alarm systems, monitoring systems, other consumers and for emergency supplying to nautical equipment (supplied by the 440V system via batteries and rectifiers);
- a three-phase 3 x 220V/50Hz system fed by a rotating convector;
- a three-phase 3 x 220V/50Hz UPS system.

Auxiliary Power

The auxiliary generator sets are suitable for supplying to all auxiliaries, the 220V/60Hz system and the emergency switchboard. The emergency generator is automatically started as soon as the 440 V system fails. Main generator sets consist of two identical self-regulating, self-excited brushless AC generators installed in the engine room. Each generator is driven by the propulsion engine through a reduction gearbox. Accumulator systems include a 24VDC rectifier/accumulator system, fed by the 440V auxiliary switchboard via a charger/rectifier. Further, two identical transformers are installed each with 60% of the required capacity for the 220V/60Hz lighting distribution system.
The three auxiliary generators are each driven by a four-stroke turbocharged marine diesel engine make *MAN 6L 23/30* with a maximum continuous rating of 930kW at 900rpm. Main and auxiliary engines are capable of running, starting and stopping on HFO with a maximum viscosity of 380cSt at 50˚C.
The *Caterpillar* emergency diesel engine, delivered by *Geveke Motoren*, is capable of running on MDO. The auxiliary engines can be started/stopped locally and from the ECR. Speed control of the auxiliary engines is from the main switchboard. The emergency diesel engine is started and stopped at site or started automatically when the 440V system fails.

Steering Gear

Directional control is with two *Barkemeijer* rectangular and free-hanging rudders with streamlined sections. The rudders, of the high efficiency type and featuring a flap for increased lift, have a maximum rudder angle of 45 degrees to both sides. Manoeuvrability at slow speed is improved by two 1000kW *Lips* bowthruster units, remote controlled from the wheelhouse.
Two *Brusselle Marine* independent electro-hydraulic steering gears are controlling the rudders. The hydraulic system of each steering gear is fed by two electric-driven hydraulic pumps, both normally in operation and capable of operating separately. Each pump, together with its driving motor, is mounted on a common bedplate. The pumps are installed in the steering gear compartment and can be started either locally or from the navigation desk in the wheelhouse. The maximum effective rudder angle is 45 degrees to both sides. The equipment is suitable for use with a Dynamic Positioning system.



...ling systems include APV plate heat exchangers

The steering gears are remotely controlled from the navigation control console in the wheelhouse by means of a double electric steering system, consisting of one main system and the second serving as emergency system. In case of emergency it is possible to control the steering gear from the wheelhouse by means of a second electric circuit, and/or if required, by means of local control.

Engine Room Auxiliaries

Engine room auxiliaries further include: a *Delta Marine* incinerator, two 130m³/h bilge/fire/general service pumps, pumproom bilge ejectors and bilge pumps, oily water separator with a capacity of 2.5m³/h, a dirty oil/sludge pump, two hydrophore sets, sanitary hot water circulating pumps, calorifiers, a freshwater generator with a capacity of 15t/day, a *Bio Compact* sewage treatment installation, a *Facet Industrial* bilge water separator, two fuel oil transfer pumps, fuel oil/lube oil separator units, fuel oil booster units, ...e oil pumps, a cooling water system, *Atlas Copco* starting air compressors and receivers, working air compressor and receiver, operating air compressors and receivers, gland pumps for flushing of shaft sides and suction sides of the dredgepumps, two flushing pump sluice valves, exhaust gas silencers, a central greasing system, a thermal oil system, and freshwater transfer pumps. *Van Leusden* supplied two 2t, type *FNE-R&P* 2/1 engine room hoist cranes, each rack and pinion driven, complete with a speed selfbraking drive motor, rubber bumpers on wheelboxes and limit switches. The Etten-Leur based crane company also supplied the 30 tons single girder hoist trolley crane, type *FNE-R&P*, fitted in the pumproom, and the 10 tons crane, type *TGE-R&P* 4/1 rope reeving, fitted in the welding room.

Deck Equipment

Two *Brusselle Marine* windlasses of the horizontal hydraulically driven type are placed on the forecastle deck. Each windlass is equipped with one disengageable cast steel cable lifter for 78mm diameter stud link chain cable of high tensile strength steel, grade Q3. The cable lifter is provided with a hand-operated screw spindle brake and a hand-operated steel dog clutch. For mooring purposes, one cast iron warping head with a diameter of 720mm is provided, at the side of the winch. The windlass is driven by a hydraulic motor via a totally enclosed gearbox.
The winch main shaft runs in bronze bearings or roller bearings. The winch is controlled locally (electro-hydraulic control), and has continuous speed control. Two chainstoppers, combined with guide roller are fitted between hawse pipes and windlasses.
On the aft deck a hydraulic winch is installed. The winch is provided with a hydraulically operated brake and clutch and is suitable for free paying out, free fall, and paying out with controlled brake force. The clutch can be operated with running winch and under load. The winch is driven by a hydraulic motor via a totally enclosed gearbox. The winch is provided with a rope guiding and spooling system and is operated by means of a portable remote electric control panel.
Anchoring equipment includes two *Pool TW* anchors. The anchors are stowed forward in a recess in the hull in order to avoid interference with the bow discharge unit. The two anchor chains are 78mm diameter grade Q3 stud link chains. All anchor chains are provided with *Kenter* joining shackles, and anchor swivels. Anchors and anchor chain cables were supplied by *Wortelboer* Rotterdam.
The dredger is fitted with two steel masts, one on the forecastle and one on the wheelhouse at the aft end, carrying the prescribed lights and signals. The foremast is fabricated of steel pipe. The main mast consists of two pipes carrying a platform with mast on vessel's centerline. The platform, provided with railings, carries the radar scanners and other navigation equipment. The masts are equipped for carrying, hoisting and lowering the required signals for navigation and dredging.

Deck Crane

On deck a travelling hydraulic deck crane runs the full length of the hopper to facilitate repairs and handling of heavy weights. The crane, supplied by *Uittenbogaart*, also serves the hatchways, workshops, pump and steering gear room, and provision store room. Reaching about 4m outboard the crane is also used for installing the suction pipe for extended dredging depth. The crane has a swl of 45 tons for the main hoist, and a minimum/maximum outreach of 3.75/18.5m. The auxiliary hoist has a maximum capacity of 5 tons.
In the foreship aft of the accommodation a moonpool is fitted forming an integral part of the vessel's structure. Moonpool dimensions are 1.4 x 1.4m with a clear opening in the bottom plate of 1000mm diameter. For conducting of a measuring lorry, four U-profiles are arranged inside the moonpool from deck level to the bottom. The moonpool is covered by a hatchway where above a beam for hoisting the measuring trolley is installed.

Wheelhouse

The wheelhouse has walls with windows inclined at an angle of 15 degrees to the vertical. The wheelhouse is fitted with windows all around with sun protection visor. The windows have been such arranged that an optimal view from the operator's positions is obtained. Navigation and dredging desks are arranged and constructed in such a way that the operator can operate all essential equipment while seated at the desk. From its position the helmsman has an unobstructed view on the foreship (i.e. bow connection arrangement), the vessel's sides, the vessel's stern, and an allround view on the surroundings. The navigation desk is arranged in a U-shape. The dredge control desks are fitted in the back of the wheelhouse. When seated the dredge operator has an unobstructed view on the suction pipe gantries, the suction pipe winches, the swell compensators, and the hopper.
The form of the deckhouse and layout has been optimised in close cooperation with the owner and has resulted to placing the control desks in the protruding parts of the wheelhouse where fore and aft walls are not perpendicular to the vessel's centre line but inclined in order to reduce blind angles.

Navaids & Communications Equipment

The wheelhouse is fitted with a comprehensive range of navigational aids, communications equipment and control systems. Control systems are distributed over the following control desks: central navigation desk, wing navigation desks, dredging control desk, engine room control desk, communications desk, survey desk, and instrumentation panel. Internal communications systems were delivered by *Alphatron* Rotterdam.
All desks are designed in accordance to ergonometric demands. Control of the navigation systems is possible at three locations: central navigation desk, port wing desk, starboard wing desk. For switching from one control station to another a failsafe system is installed.
The navaids and communications equipment includes: a magnetic compass; a gyro compass; an autopilot; a steering and rudder indication system;an echosounder; a doppler speed log; two radar systems; an air whistle; three search lights; GMDSS equipment (navigation zone A3); telegraph/pitch control system; telephone/PA

system; GPS; and a GSM telephone. Near the navigation control desks a survey desk/console/table is provided fitted with the radio positioning systems and surveying systems.

Fire-fighting Equipment

The engine room with separator room, stores, and workshops is protected against fire hazards with an *Ajax Fire Protection* fixed CO_2 fire extinguishing system with the gas bottles located in a separate space. The bottles are connected to a permanent system of piping and control valves for effective distribution of the fire extinguishing gas into the engine room. The oil fired thermal oil boiler as well as each thermal oil exhaust gas boiler are each connected to a fixed mounted CO_2 bottle. Electric siren alarms with revolving light are provided in engine room and other spaces to warn personnel before release of extinguishing gas is executed. When extinguishing gas is released the ventilation units of the engine room are stopped automatically.

A fire detection system is installed covering all accommodation and machinery spaces on board. An alarmpanel is fitted in a 19-inch instruments rack in the wheelhouse, provided with alarm claxon and lamps indicating section on fire. A repeater panel is fitted in the ECR.

Fire-fighting equipment includes two 15m rubber hoses, 20m nylon fire hoses, nozzles, *Storz* couplings, powder extinguishers, CO_2 extinguishers, a mobile powder extinguisher of 50kg in the engine room complete with hose and nozzle, two fireman's outfits, each consisting of protective clothing, safety lamp, fire axe, and two breathing apparatus, complete with face mask. Further, one portable foam applicator with tank and airfoam nozzle.

Life-saving Appliances

Life-saving appliances fitted on board, supplied by *Datema Delfzijl*, are in full accordance with relevant rules and regulations and include: automatic inflatable liferafts; lifebuoys; life jackets; a line throwing appliance; twelve parachute signals; one automatic inflatable liferaft for 6 persons; and survival suits. Further, two totally enclosed *Mulder & Rijke* lifeboats are provided, of which one serves as rescueboat. Each lifeboat is capable to accommodate a minimum of 40 persons and complies with the requirements of SOLAS.

The hull and interior of the lifeboats are constructed of laminated Glass Reinforced Polyester and fire retardant resins, with integrated buoyancy tanks filled with polyurethane foam in situ. The lifeboats are provided with hinged windows forward and aft, as well as side windows at the place of the helmsman. The side hatches, hinging to the interior, are wide enough to ensure fast and unobstructed boarding. Each lifeboat is equipped with a watercooled diesel engine, suitable for a speed in calm water of 6 knots when fully loaded.

Subcontractors and suppliers of equipment fitted on board the 'Gerardus Mercator'
(partial list)

Acta/Elceestaal,
Dordrecht ..... : seaway fairlead
Ajax Fire Protection,
Amsterdam ..... : CO_2 fire extinguishing system
Alfa-Laval Industrie,
Maarssen ..... : freshwater generator; oil pumps
Alphatron, Rotterdam ..... : communications systems
A.M.W.-Marine,
H.I. Ambacht ..... : plate heat exchanger
Ancofer Nederland,
Oosterhout ..... : steel plates; profiles
Atlas Copco, Zwijndrecht .. : air compressors
Auromarine, Finland ..... : hfo feeder booster
Barkemeijer Schiffstechnik,
Germany ..... : rudders
Bennex, Spijkenisse ..... : *Kongsberg* D.P system
Bouter Grootkeukentechniek,
Zoetermeer ..... : galley & laundry equipment
Brusselle Marine Industries,
Nieuwpoort (B) ..... : winches, steering gear
Buitendijk, Werkendam .... : iron works
Bureau Veritas,
Rotterdam ..... : classification
Chemetall, Oss ..... : cathodic protection
Conservator Steigerbouw,
Rotterdam ..... : scaffolding
Coopra Rotterdam,
Rotterdam ..... : steel plates, profiles
Corrosion & Water Control
Moercapelle ..... : impressed current anti fouling system
Datema Delfzijl, Delfzijl .... : safety equipment
Delta Marine, Vlissingen ... : incinerator
Demmers Metaal,
Alblasserdam ..... : iron works, ladders, railings
Den Haan Hoogerwerff,
Dongen ..... : *Adler* winches
Dijk Constr. Bedrijf,
Brandwijk ..... : iron works
Drieveld, H.I. Ambacht .... : piping, iron works
Drumarkon, Werkendam ... : *Isomalin* modular system; *Mornek* firedoors, *Premec* wet units, *Cape Marine Board & Polyrey Laminate*
Econosto, Rotterdam ..... : valves & fittings
Eferest Stahlbau,
Wilnsdorf (G) ..... : starting air receivers
Emce Machinefabriek,
Voorhout ..... : ladder winches
Facet Industrial, Almere ... : bilge water separator
Firma Alblas, H.I. Ambacht .: deckhouse sections
Geveke Motoren,
Papendrecht ..... : emergency genset
Giessen, Van der,
Hardinxveld-Giessendam ... : propeller nozzles
Giessen Staalhandel,
Rotterdam ..... : steel plates; profiles
Graaf Van de, Zwijndrecht .. : sterntube
Grijp Buizen, Papendrecht .: pipes; tubes
GTI Marine & Offshore,
Rotterdam ..... : electrical installation
Hamos Holland, Sliedrecht .: stainless steel bolts & nuts
Hatenboer Demi, Rotterdam : UV drinking water sterilizer
Heinen & Hopman,
Spakenburg ..... : airconditioning; heating system; mist eliminators
Helder & May, Rozenburg .. : floor systems
Hempel, Vlaardingen ..... : paint systems
Het Anker, Schelluinen ..... : portholes; windows
Hydraudyne Bruinhof,
Rotterdam ..... : gearboxes; flexible couplings
Hydraudyne Pneumatiek,
Rotterdam ..... : pneumatic installation
Hydraudyne Systems & Engineering, Boxtel ..... : hydraulic installation
Hydroflex Hydraulics,
Oud Beijerland ..... : pipe couplings
Hytop, Sliedrecht ..... : appendages
IHC Lagersmit, Kinderdijk .. : sterntube sealings, bearings, dredgepump sealings
IHC Parts & Services,
Kinderdijk ..... : dredging installation

IHC Systems,
Sliedrecht ..... : integrated automation system
Jac. Gorts Scheepsinterieur,
Alblasserdam ..... : upholstery
Jonker Fa, Kinderdijk ..... : iron works
Ketting Machinefabriek,
IJmuiden ..... : *Atlas Copco* starting air compressors
Krete Isolatietechniek,
H.I. Ambacht ..... : Isolation
Kroon, Hoogezand ..... : doorfittings
Lankhorst Staalkabel,
Alblasserdam ..... : steel cables
Las Mobiel, Sliedrecht ..... : iron works
LCS, Krimpen a/d Lek ..... : piping, iron works
Leeuwen Van, Zwijndrecht .. : steel pipes; fittings
Leun Installatiebouw Van,
Sliedrecht ..... : iron works; railings, foundations
Leusden Van, Etten Leur ... : cranes
Lips, Drunen ..... : cp-propeller systems; bowthruster units
Lodige Holland, Den Bosch : elevator
Loggers Rubbertechniek,
Dordrecht ..... : rubber compensators
Machine Support,
Zoeterwoude ..... : *Epocast* chockings
MAN B&W Diesel,
Augsburg (G) ..... : diesel engines
Marin Assist, Zoeterwoude .: liferafts
Marktechnical,
's Gravenmoer ..... : *Trafag* pressostats; pressure transmitters; temperature switches
Mennens & Co,
Rotterdam ..... : bolts & nuts
Merwede Shipyard,
Hardinxveld-Giessendam ... : furniture
Metallurgica, Rotterdam ... : steel plates; profiles
Midden-Nederland, Tiel .... : paint application
Mol Metaalbedrijf,
Maassluis ..... : piping; iron works
Mostert Pijpleidingen,
Papendrecht ..... : piping
Mulder & Rijke, IJmuiden .. : closed lifeboats
Nami Piping & Construction,
Ridderkerk ..... : section construction
Nederlek Piping,
Krimpen a/d IJssel ..... : piping; iron works
Neeff Pijpleidingen,
Vlaardingen ..... : piping
New Monting Construction,
Ridderkerk ..... : section construction
Nieuwburggroep,
Krimpen a/d IJssel ..... : packings
Nijhuis Pompen,
Winterswijk ..... : flushing pumps
NMC Alblasserdam,
Alblasserdam ..... : iron works
Noordenne,
Hardinxveld-Giessendam ... : steel plates
Noorloos Lasbedrijf,
Sliedrecht ..... : iron works
NR Koeling,
Krimpen a/d IJssel ..... : refrigerating system
ODS/Hoogovens,
Barendrecht ..... : steel & copper pipes
Praxis Automation, Leiden .: E.R. automation system
RDP Smeertechniek,
Lokeren (B) ..... : grease installation
R&H Systems, Rotterdam .. : integrated dredge monitoring & automation system; electrical machinery, main switchboards; complete electrical installation
Schat Harding, Utrecht .... : davits
Scheeps- en staalbouw
Slikkerveer, Ridderkerk .... : section building
Schelde Marine Services,
Vlissingen ..... : incinerator
Seton Pijpleidingen,
Papendrecht ..... : piping
Silca Apparaten Bouw,
Gameren ..... : iron works; ladders; railings; foundations
Simrad Norge, Kongsberg .. : DP system
Staal Service Bergen,
Bergen ..... : steel plates; profiles
Stokvis Trading, Oosterhout : bolts & nuts
Struik & Hamerslag,
Strijen ..... : carpentry
Technische Unie, Dordrecht : sanitary equipment
Thofex, Rotterdam ..... : workshop machines
Tille Scheepsbouw,
Kootstertille ..... : section building
Trelleborg-Velp, Ede ..... : expansion joints
Uittenbogaart, Rotterdam .. : gantry deck crane; fairleads; guide rollers; sewage unit
Unirax, Breda ..... : floor support system
Unitor Ship Services,
Rotterdam ..... : oxygen/CO_2 system
VAF Instruments, Dordrecht : flow meters; *Palco* torque meters
Van der Giessen-de Noord
Pipe System, Alblasserdam : air chests piping
Veder Hendrik, Rotterdam .. : steel wires; rigging; inventory marine rope store
Verlinde Nederland,
Soesterberg ..... : taps
Vervako, Heusden ..... : section building
Westfalia Separator, Cuijk .: oily water separators
Wiesloch, Spijkenisse ..... : thermal oil installation
Wijk & Boerma Pompen,
Groningen ..... : freshwater pumps
WIKO Isolatietechniek,
Rotterdam ..... : accommodation isolation
Winel, Assen ..... : watertight sliding doors; steel doors
Wortelboer, Rotterdam .... : anchors; anchor chain cables
Zwijnenburg,
Krimpen a/d IJssel ..... : iron works


GERARDUS MERCATOR

18,000 m³ TRAILING TITAN GERARDUS MERCATOR

Three years ago IHC Holland was the first in the world to begin building jumbo trailers. The trend definitely caught on. With 'Gerardus Mercator' for dredging contractor Ondernemingen Jan de Nul of Aalst, Belgium, the IHC Caland Group has produced its second – and biggest to date – super trailing-suction hopper-dredger. The third one, Ballast Nedam's 'Amsterdam', was built by sister company Merwede shipyards and a fourth, an even bigger one for Van Oord/ACZ is on the stocks. 'Gerardus Mercator', yard number CO 1211, was launched in September 1996 and delivered in February 1997. A proud ship, for a proud company, bearing a proud name.

NAVIGARE MERCATOR EST

Many Flemish scientists, artists and merchants acquired their greatest fame after they had left Flanders, which was, during the cultural Golden Century of the Low Countries, under fundamental foreign rule. Many big Dutch names, such as the marine painters Jan Porcellis and Adam Willarts, the priest and geographer Petrus Plancius, and merchants like Balthazar de Moucheron, Isaac le Maire, Louis de Geer and Jacob van Eeghen hailed from Belgium.

Gerardus Mercator (Latin for Gerhard Kremer), arguably the most famous of all fugitive Flemish, contributed greatly to western navigation and hence to North-Western Europe's mondial expansion. After studying with the great astronomer Gemma Frisius – the first to suggest measuring the moon's distance as means of finding longitude – and the engraver Gaspar à Myrica, Mercator gained a great reputation as calligrapher, instrument maker, geographer and, especially, cartographer. In 1544 he was arrested on heresy charges – a common fate of deserving intellectuals. After his fortunate but unusual release, Kremer moved to Duisburg (Germany) and proceeded to develop the chart projection that bears his name. Mercator's projection is, to this day, still the most widely used and the most practical for navigation.

While old Mercator gave later generations a primary tool for finding their way across the sea with his conformal charts, the ship bearing his name promises to provide mankind with one of the mightiest tools it ever had for fashioning the sea's frontiers. Not only are these very large hopper dredgers very economical indeed for long distance reclamation projects, they also make possible dredging jobs for navigation purposes that were otherwise prohibitively expensive, such as maintaining deep water channels across the North Sea. The new ship epitomises mankind's progress: no longer do humans accept nature's constraints and duly record them in charts; rather they take the initiative and try to remove all that stands in their way, if need be with overpowering jumbo trailers. So, while human Mercator's charts changed navigation, steel *Gerardus Mercator*'s pumps – totalling 9,200 kW – and trailing heads – max. 112 m dredging depth – will change the charts.

VIGOROUS VESSEL

Gerardus Mercator's fully welded, hard chine hull is longitudinally framed as well as strengthed with athwart web frames, to marry shipbuilding efficiency with strength. Centre and side keelsons, continuing as far as practical and integrated in the double bottoms forward and aft, further help to create a stiff structure, which combines a relatively shallow draught of 11.51 m fully loaded with great initial stability. With 27,650 tons of spoil maximum loading weight, the hopper's impact on the ship's structure is considerable, especially in a seaway. Therefore the hopper is designed so as to gradually dispose forces into the deck and double bottoms at both ends. The very full sections forward allow weight to be carried quite near to the stem, in other words, to combine a bigger hopper with a shorter hull.

The massive 29,150 TDWT (at 11.51 m draught) ship is pushed through the water at 15.5 knots by two 9,450 kW main engines, driving from their aft end two four-bladed 4.60 m diameter controllable pitch propellers in nozzles, through highly elastic clutches and 3.96:1 gearboxes transmitting 8,600 kW at 500 rpm. From their forward ends, the main engines drive the dredge pumps, through two speed reduction gearboxes. These transmit 4,500 kW at 161 rpm when trailing and 7,000 kW at 267 rpm when pumping ashore. The engines are started and stopped locally or from the engine control room (ECR); speed will normally be controlled from the bridge. The diesels are suitable for continuous running at full torque between 70 and 100% of maximum speed. The main generators supply, through a three-phase 3 x 660V/42...60 Hz system, the hydraulic pumps, two 1,000 kW bowthrusters and two 1,000 kW jetpumps.

The starboard main engine may, in 'sailing' as well as 'dredging' mode, be operated in 'generator mode'. It is then coupled to the main switchboard for supplying all auxiliaries, running at constant speed. When 'sailing' mode is selected (on the bridge), 'dredging' mode is automatically blocked and the dredgepump couplings disengaged. 'Generator' mode is selected in the ECR.

Mercator's power pack further boasts three 924 kW auxiliary diesels and a 320 kW harbour/emergency engine. The auxiliary generators feed a three-phase 3 x 440 V/60 Hz system for all auxiliaries, the 230 V/60Hz system and the emergency switchboard. The emergency generator is automatically started when the 440 V system fails. Main and auxiliary engines run on HFO with maximum viscosity 380cSt at 50°C.

ADAPTABLE DREDGING

Precision is everything in modern dredging. *Gerardus Mercator* boasts full automation and computerisation of the dredging process (see below), which enable the crew to achieve the highest goal in marine contractors' efficiency: dredging exactly to specifications with the lowest possible costs per cubic metre. *Mercator*'s instru-

mentation and survey equipment tell the operator exactly where to dredge, for how long and what the result is. To make the most of this information with a jumbotrailer, one needs technology with which jumbo can be conned in the tightest spots.

Working in conjunction with two controllable pitch propellers working in nozzles, the vessel has two 17.5 m^2 rectangular free hanging high efficiency rudders with adjustable flaps for better hydrodynamics. They are each moved by two independent electrically driven hydraulic pumps, which turn the rudders from hard (i.e. 45°) to port to hard to starboard within 20 seconds. Manoeuvring at low speed can be helped by two 1,000 kW bowthrusters. The whole steering and conning arrangement is normally controlled from the bridge.

In a dredger the size of *Mercator* one expects the pumps to swallow a sweeping supply of spoil in the shortest possible time. One is not disappointed. The two double walled dredge pumps work in the pump room, forward of the engineroom. The dredge pumps' 3-stage LIQUIDYNE shaft seals (bush diameter 560 mm) take their water discharge from each pump's flushing water system. To minimise the abrasive wear on the running surfaces of the seal, a self cleaning settling pipe is fitted in the discharge line.

The main dredge pumps make possible a maximum dredging depth of 55 m with both 1,200 mm internal diameter suction pipes.The suction pipes are designed for dragheads of up to 32.5 tons and can cope with an axial load of 1,440 kN. The arrangement is suitable for fitting a draghead with hydraulic control of visor and waterflap. An extended pipe can be fitted to starboard. With a 3,200 kW submerged pump, powered by a watertight AC asynchronous electric motor, this increases maximum dredging depth to a staggering 112 m. The submerged pump has a four-blade impeller and can run in a vertical position continuously.

While dredging, the spoil will usually be dumped in the hopper, which is what hopper-dredgers have been invented for in the first place. In the discharge pipe of both dredge pumps, density and velocity measuring sensors tell the dredging master how much and what he is loading. If there is too little matter in the water, the Automatic light Mixture Over-Board (AMOB) device will do its job and allow it to be pumped over the side straight away. AMOBs, incidentally are, with swell compensators, among the first semi-intelligent pieces of automation with which IHC made life on board trailing-suction hopper-dredgers easier, even before the second World War. Today these devices are as standard on trailers as propulsion engines.

Two 6,350 m^3/hr, 1,000 kW jetpumps help dislodge sediments, either compacted on the seabed or clogged in the hopper. When used on the dragheads the jetpumps work in series; when flushing the hopper, parallel. They then discharge on a central jetwater line in the centre box keelson, from where it branches out to strategically placed pipe nozzles, 20 for each bottom door section. Hydraulic butterfly valves in the branches are controlled from the bridge, where each valve's position is displayed. The jetpumps also feed the ejector units of the dredge pumps' degassing installations and serve the bowjetting pipe.

The hopper features four 1,900 mm diameter overflow ducts, fully adjustable from 9 to 16.90 m above base, one from 7.50 m. Adjustment by hydraulic cylinder is done from the bridge. In the moving upper part of each overflow an anti-turbidity valve is fitted. Platforms and catwalks make working on the overflows' tops safe. The hopper's coamings allow a list of 5° and pitching of 2° with the hopper filled up to its full 18,000 m^3. Against the hopper's aft bulkhead ladders give access to the centre box keelson's top and from there to the hopper's bottom.

MULTI-SIDED DISCHARGING

In any seagoing vessel trim is important, but especially in jumbo trailers, which are expected to negotiate shallow waters and frequently change their hold's load. In *Gerardus Mercator*, trimming tanks in fore and aft peak are connected with the delivery pipeline of the jetwater pumps, which allow the vessel to be quickly brought on an even keel. The forward tank can be emptied by gravity, the aft tank partially so. All ballast tanks have pressure transducers mounted outside the tank for remote monitoring and hydraulic butterfly valves controlled from the bridge.

For discharging spoil ashore through the 1,000 mm internal diameter bowpipe, the pumps work in high speed mode at 7,000 kW on each shaft. A 1,000 mm internal diameter pipe between starboard and port pump enables both to work in series, or one to pump water in the hopper, the other to discharge over the stem, or one to discharge over the side while the vessel is moored alongside a quay, etc.

Right in the bow a 1,000 mm balljoint coupling with hydraulically operated mechanism can take a floating pipeline for discharge over the stem. It is laid out so as not to interfere with mooring equipment. A bowjetting pipe with a 350 mm nozzle, fitted alongside the bowline gantry, likewise avoids the connection system. The side discharge system, moved by hydraulic cylinders and slewing gear, can be used from amidships on either the port or starboard side.

Discharging can, of course, be carried out with much less ado if the spoil need only be dumped at sea. In that case two rows of 10 double box-type bottom doors do the job. This can even be done with virtually no clearance under the keel. In the centre box keelson sit four extra 1.8 x 4.00 m shallow water dumping doors, which do not stick out below the ship's bottom when opened. Through these doors, positioned so as not to influence trim when weight is dumped from them, part of the load can be dumped, until the vessel floats high enough for using the regular 20 doors, provided care is taken that the vessel does not 'dump itself aground'.

HIGH LEVEL OF COMFORT

Although *Gerardus Mercator* bristles with power, the 40 crew will hardly notice in their air conditioned, thoroughly sound insulated quarters forward. Living in 30 single and five double cabins, the crew's level of luxury is a far cry from old Mercator's day, when 200 scurvy and typhus sufferers could be crammed for months on end into a space barely the size of the new ship's wheelhouse and half its height. There is a choice of off-duty rooms, apart from the mess there is also a tv-room/saloon, a bar, a gymnasium and, for the involuntarily off-duty, a hospital.

The floating, sound insulating floor coverings on the main deck; the insulation of all outer ceilings and steel outer walls of accommodation spaces and the flexibly mounting of all diesel generator sets, keeps the inside quiet. Great care has been taken to the 50 mm thick non-combustible panelling, partition walls, ceilings and floating floors coming in contact with the steel bulkheads and decks. Also in the ship's bowels, noise levels comply with Bureau Veritas' Guidance Note NI 174-RD3/CN.

The dominating superstructure forward is crowned by the multi-faced bridge with its protruding wings, from where all the vessel's functions can be governed. The engine room, for instance, is laid out for unmanned operation to the requirements of Bureau Veritas AUT-MS.

The high level of comfort which distinguishes the vessel is continued in the bridge's ergonomically laid out consoles. The navigation desk's rail-mounted chair enables one man to manage all the controls with no need to get on his feet. Even the very design of the bridge itself is the embodiment of ergonomics, with all sun-protected windows raking 15° forward, conning positions well out from the deckhouse's bulk to avoid 'dead' corners and the dredging operator's console standing out aft with a superb view of the entire dredging installation.

TOUCH AND GO

Ondernemingen Jan de Nul are shipowners who know how to make good automation profitable, and *Gerardus Mercator* is the fourth of their fleet of fully automated large dredgers. In fact the automation knowledge that IHC Systems and De Nul have accumulated between them culminates in this new jumbotrailer, the unavoidable flaws of earlier versions having been ironed out along the way.

As is the habit these days with IHC's dredger automation, the entire Integrated Monitoring and Control (IMC) system had been thoroughly tested through simulation technology before being fitted on board. The operators had been trained in the process so, when the

ship became operational, they felt at home behind the screens. IMC is based on decentralised processing of ca. 2,700 I/Os in a completely redundant ethernet/glassfibre network with 10 operator stations. The monitor screens of which, incidentally, only need to be touched on relevant functions to get the message.

The keyboard and touch screen operated IMC system is today's top of the range in man-machine interface, and the most efficient and accurate way of presenting and controlling the dredging process. IMC's comprehensive trend, log, alarm and diagnostic functions, give operators real-time insight in the board systems' status. This drastically cuts back on time spent out of service for repairs. If the ship's technical staff cannot solve the problem, they can plug in – via a satellite link – to IHC Systems for telediagnostics and control.

Integrated systems such as *Mercator*'s do not only automate and computerise the dredging process but also everything else that has anything to do with navigation and propulsion. A fortunate difference with older systems is that possible failures of sensors can be overruled.

Now the days of cross-staff and Davis quadrant have long since past, and even the sextant's days seem to be numbered, the navigation system's inputs come from such sources as gyro compass, doppler speed log, echo sounder, telegraph/pitch control, DGPS and two radar systems. A magnetic compass and the instruments for good old astro navigation are still on board, just in case.

As may be expected in such a sophisticated vessel, all regular modern navigation and communication equipment is there, with GMDSS equipment for navigation zone A3. Yesteryear's 'sparks', with his battery of unfathomable boxes and morse keys has further been replaced with a car telephone and a telephone/PA system.

Old Gerhard Kremer devised his conformal chart projection of lasting importance while most of the world's areas had still to be charted. Either below or on the sea's surface, its working environment holds few surprises for the ship *Gerardus Mercator*. What cannot be read in the charts, can be deduced from the on board hydrographic survey equipment and DGPS of which one is for short range and one for long range with accuracy ≤ 1 m. That's what we call over 400 years of marine progress.

After commissioning, *Gerardus Mercator* headed straight for its first job, dredging a trench at the Westhinder Shipping Channel for Statoil's Norfra pipeline installation project. The work involved dredging stony unyeilding sediments with boulders of up to 1 m in diameter, typically the environment for which cutter dredgers have been invented. Extending the ladder and spuds of one of Jan de Nul's largest cutter dredgers *Marco Polo*, however, to cope with the track's depths of up to 40 m, seemed not the most economical way to deal with it. It was therefore decided to let *Mercator* have a go.

And go she did. To everyone's surprise, the giant trailer successfully completed, using an extra wide draghead, a trial excavation of a 750 m long trench, taking the biggest boulders and very compact clay in its stride. In the process continuing an IHC tradition of performing beyond expectations.

PRINCIPAL CHARACTERISTICS

Length overall	152.90	m
Length between perpendiculars	142.30	m
Beam	29.00	m
Depth	13.10	m
Draught, intern. freeboard	9.54	m
Draught on dredging mark	11.51	m
Hopper capacity	18,000	m^3
Max. loading capacity	27,650	t
Deadweight at 11,51 m	29,150	t
Suction pipes diameter	1,200	mm
Discharge pipe diameter	1,000	mm
Dredging depth	35/50/55/105/112	m
Double walled suction pumps	2 x 3,000	kW
Discharge pumps power	14,000	kW
Submerged dredgepump	3,200	kW
Main engines	2 x 9,450	kW
Shaft generators	2 x 4,500	kW
Auxiliary engines	3 x 924	kW
Harbour engine	320	kW
Jet pumps	2 x 1,000	kW
Bow thrusters	2 x 1,000	kW
Electric portal crane	45	t
Sailing speed (loaded)	15.5	knots
Accommodation	40	persons

Built to the rules and requirements of
Bureau Veritas I 3/3 ✠ Hopper Dredger (Deep Sea), AUT-MS

OPLEVERINGEN *door F. Kok*

Gerardus Mercator

De op 20 februari door IHC Holland in Kinderdijk opgeleverde sleephopperzuiger Gerardus Mercator, bouwnummer CO 1211, is met een hopperinhoud van 18.000 m³ de grootste hopperzuiger die IHC tot dusver heeft gebouwd. Dit gebeurde in opdracht van Ondernemingen Jan de Nul, in Aalst, België.
Vorig jaar ontving IHC opdracht voor een nog weer grotere zuiger, hopperinhoud 20.000 m³, van Van Oord ACZ in Utrecht.

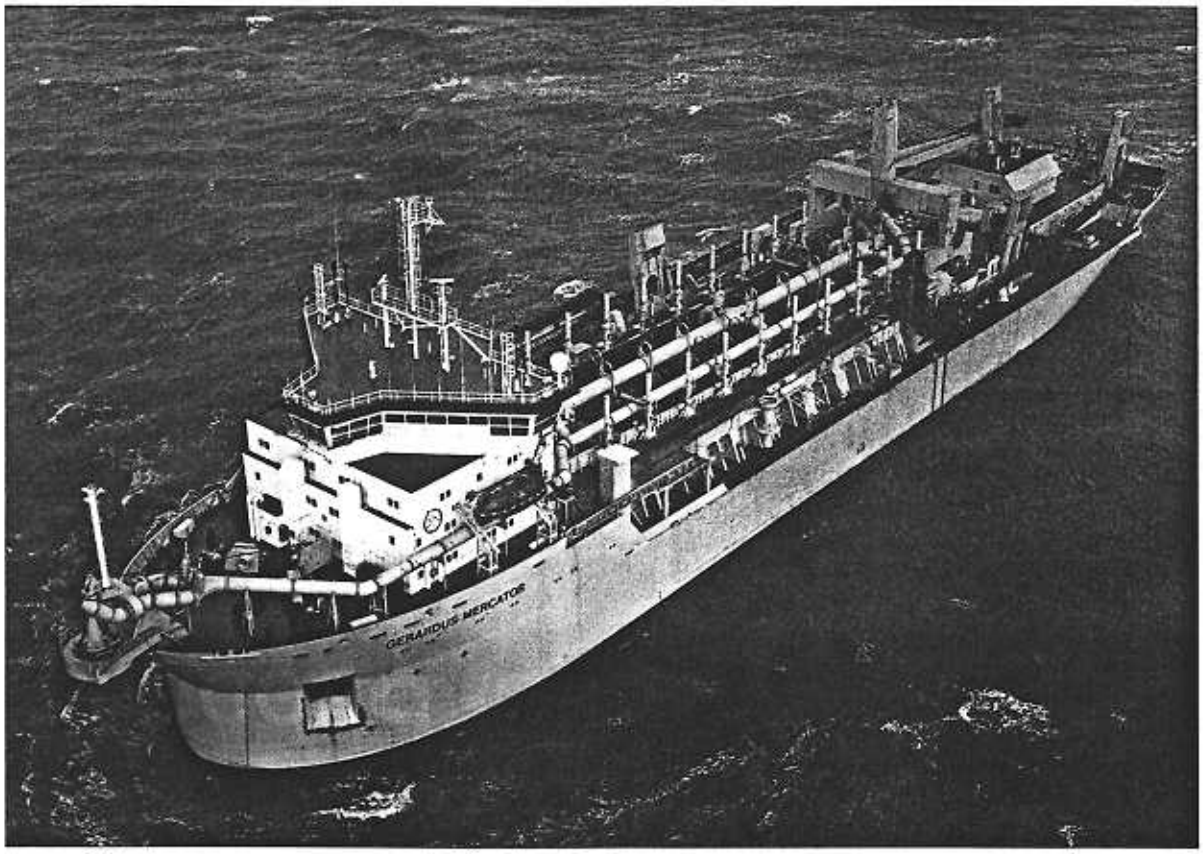


Fig.1. De Gerardus Mercator (foto: IHC/Sea Sky Martin).

De voornaamste gegevens van de Gerardus Mercator zijn:

Lengte o.a.	152,90 m.
Lengte l.l.	142,30 m.
Breedte mal	29,00 m.
Holte	13,10 m.
Diepgang int. vrijboord	9,54 m.
Diepgang op baggermerk	11,51 m.
Draagvermogen op 11,51 m	29.150 t.
Hopperinhoud	18.000 m³.
Beladen snelheid	15,5 kn.

Het schip is gebouwd volgens de voorschriften en onder toezicht van Bureau Veritas voor de notatie I 3/3 ✠ E Hopper Dredger, Deep Sea, AUT-MS, with service notation 'Dredging within 15 miles from shore or within 20 miles from port'.

INDELING

De langsscheepse indeling van het schip is:

- Voorpiek, met waterballasttank.
- Dwarsschroevencompartiment.
- Compartiment met dieptanks voor brandstof en drinkwater en opslagruimten.
- Hopper, met kippenkooi en zijkasten.
- Pompkamer.
- Machinekamer.
- Achterpiek, met waterballasttank.

De zijkasten naast de hopper zijn van een tussendek voorzien, waaronder brandstoftanks zijn geplaatst, die door kofferdammen van de hopper worden gescheiden. De ruimten boven het tussendek zijn leeg en bieden een beschermde passage tussen voor- en achterschip.
Zowel het dwarsschroevencompartiment en het compartiment daarachter, als de pompkamer en de machinekamer hebben een dubbele bodem. In de machinekamer zijn daarin o.a. de smeerolietanks en tanks voor vuile olie en sludge ondergebracht.
De piektanks dienen als trimtanks en zijn zo gesitueerd dat de voorpiek geheel en de achterpiek gedeeltelijk door de zwaartekracht kan worden geledigd, wanneer het schip leeg is.
Het dekhuis op de bak telt vijf lagen. Onder het stuurhuis (A-dek) ligt een 1,80 m hoge omvormerruimte (B-dek). Op de dekken daaronder en in de bak is de accommodatie voor de bemanning van 40 personen ondergebracht: 30 man in eenpersoons hutten en 10 man in tweepersoons hutten.
Direct achter de bak is een moonpool van 1,4 x 1,4 m aangebracht voor het neerlaten van meetapparatuur.
In een dekhuis op het achterschip bevinden zich o.a. de noodset en een laswerkplaats.

MACHINE-INSTALLATIE

De Gerardus Mercator heeft als hoofdmotoren twee MAN B&W dieselmotoren, type 9L48/60, elk met een vermo-

gen van 9450 kW bij 500 tpm. Zij dienen zowel voor de voortstuwing als voor de aandrijving van de baggerpompen en de asgeneratoren.

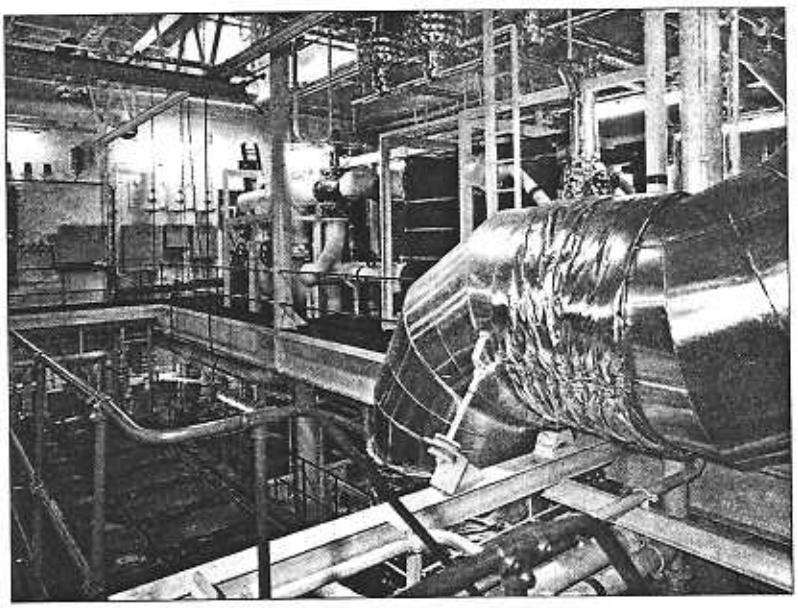


Fig.2. Blik in de machinekamer (foto: IHC).

Elke motor heeft aan de achterzijde een Lohmann & Stolterfoht flexibele koppeling, type Pneumaflex KAP 410, en een tandwielkast van hetzelfde fabrikaat, type GUH, reductie 3,96:1. De verstelbare Lips schroeven hebben vier bladen, een diameter van 4,60 m en draaien in Van de Giessen straalbuizen.
Aan de voorzijde drijft elke motor een in de pompkamer opgestelde baggerpomp aan, via een flexibele koppeling, type KJP 410, een tandwielkast met twee snelheden, type GJZ 1715, en nog een flexibele koppeling, type KJO 280; de koppelingen en tandwielkasten zijn alle van Lohmann & Stolterfoht.
De asgeneratoren worden aangedreven via een PTO op de tandwielkast van de baggerpompen. Zij ontwikkelen elk een vermogen van 4500 kVA bij 1200 tpm, 3 x 660 V, 42-60 Hz. Het 660 V systeem voedt de motoren van de hydraulische installatie, van de jetpompen en van de dwarsschroeven, alsmede via transformatoren het 440 V systeem. Dit laatste wordt verder gevoed door drie hulpsets en/of een walaansluiting. De hulpsets bestaan elk uit een MAN dieselmotor, type 6L23/30, van 924 kW bij 900 tpm, en een Holec generator, 3 x 440 V, 60 Hz.
De noodset bestaat uit een Caterpillar dieselmotor, type 3406 DI-TA, van 320 kW bij 1800 tpm, en een Van Kaick generator, 3 x 440 V, 60 Hz.
Voor verwarmingsdoeleinden is een thermische olie systeem geïnstalleerd.

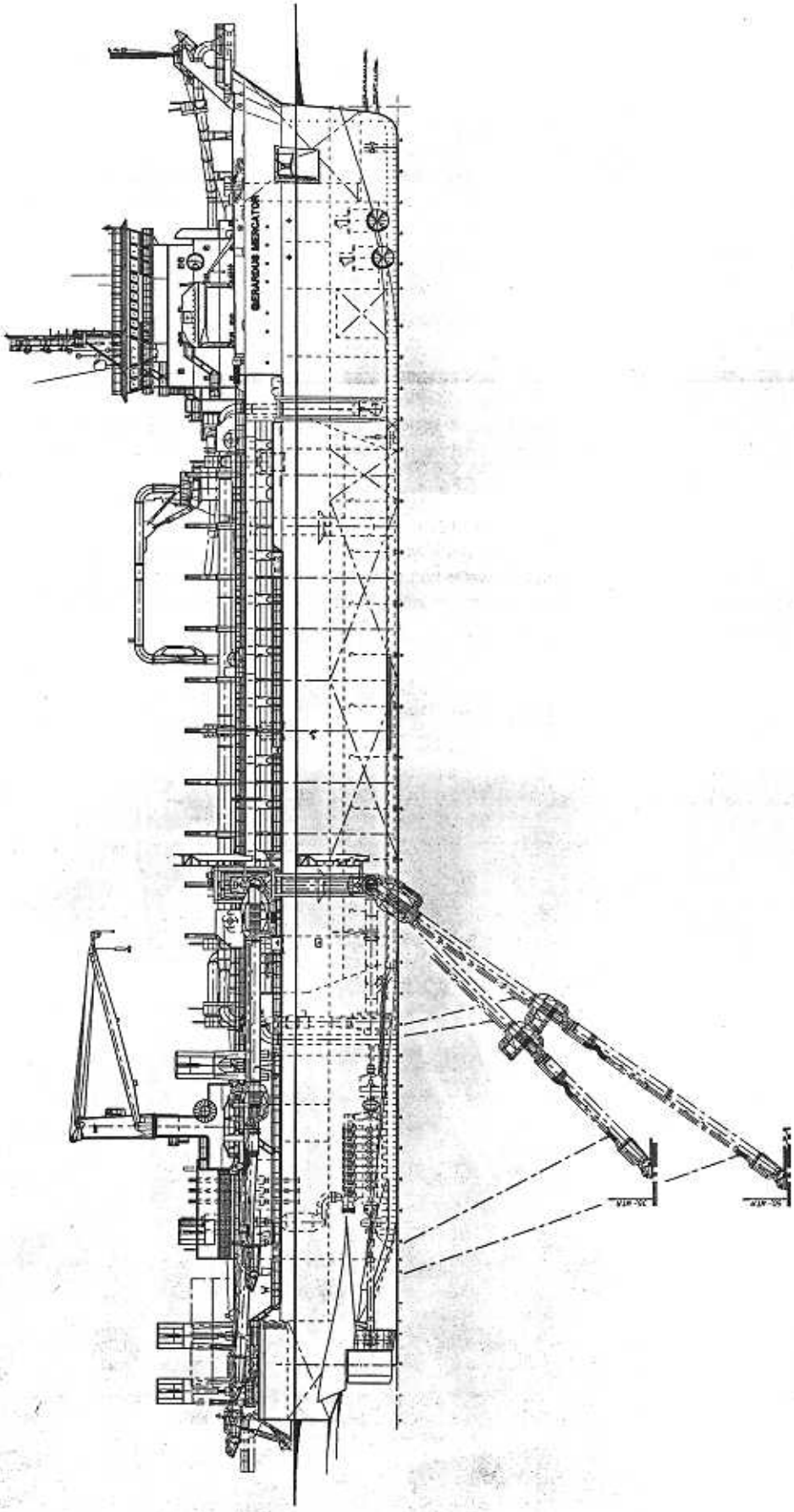
BAGGERUITRUSTING

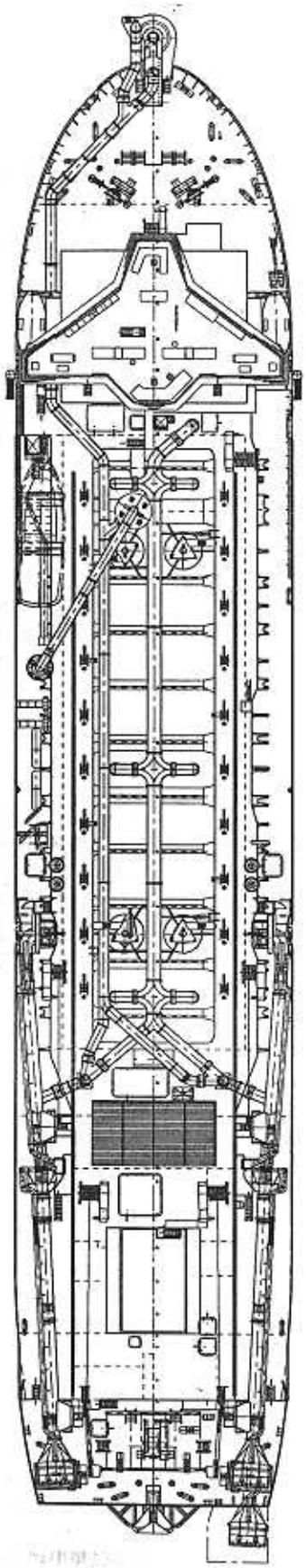
De Gerardus Mercator is aan weerskanten voorzien van een zuigbuis met een diameter van 1200 mm. Hiermee kan een baggerdiepte van 35 m worden bereikt. Door verlenging van de zuigbuizen kan tot diepten van 50-55 m worden gewerkt. De SB zuigbuis kan nog verder worden verlengd, waardoor zuigdiepten van 105-112 m mogelijk worden. In het laatste geval wordt in de zuigbuis een onderwater baggerpomp ingebouwd en wordt de zuigbuis in een veel voorlijker positie op het schip aangesloten dan normaliter het geval is (fig. 3).
De zuigbuizen zijn voorzien van jetleidingen met een diameter van 500 mm. Voor het behandelen van de zuigbuizen zijn aan elke zijde drie bokken met hydraulisch bediende lieren geplaatst. De bokken worden door hydraulische cilinders bewogen. De achterste bokken hebben aparte opstelposities voor de zuigdiepten van 35, 50 en 55 m. Voor zuigdiepten van 105-112 m zijn twee extra, wegneembare bokken met lieren beschikbaar voor het behandelen van het bochtstuk en de onderwaterpomp.

In de pompkamer staan twee dubbelwandige baggerpompen, type 280-50-120, opgesteld. Zij worden, als reeds gemeld, aangedreven door de hoofdmotoren in de achtergelegen machinekamer. Tijdens het sleepzuigen werken zij met het laagste van de twee beschikbare toerentallen en nemen dan elk een vermogen van 3000 kW op. Bij het persen naar de wal kunnen de pompen, afhankelijk van de omstandigheden, zowel met het lage als met het hoge

Fig.3. Gezicht naar achteren aan dek (SB), met de lange zuigbuis in de bokken hangend (foto: IHC).

Zij- en bovenaanzicht.





toerental werken. In het laatste geval nemen zij elk 7000 kW op.
Elke pomp is van een ontgassingsinstallatie voorzien.De pompen zijn met de zuigbuizen verbonden door een zuigleiding met een doorsnede van 1200 mm. De persleiding heeft een diameter van 1100 mm en is voorzien van apparatuur voor het meten van dichtheid en snelheid van het mengsel. Daarachter hebben de persleidingen elk een AMOB-aftakking (Arm Mengsel Over Boord). Vervolgens splitsen de persleidingen zich in een tak voor het beladen van de hopper en een tak voor de walpersleiding. De SB en BB tak voor het beladen van de hopper komen samen in een leiding met een diameter van 1400 mm die op hart schip boven de hopper tot aan de voorkant daarvan loopt. Deze leiding is op drie plaatsen van aftakkingen voorzien die het mengsel naar stortbakken voeren, via welke de hopper wordt beladen.

De onderwaterpomp die voor zeer grote zuigdiepten in de SB zuigbuis wordt gemonteerd (fig. 4), wordt aangedreven door een elektromotor van 3200 kW.

Dumpen

Voor het lossen van de lading zijn aan elke zijde van de kippenkooi tien dubbele doosdeuren met rubber afdichtingen aangebracht. Zij worden bediend met dubbelwerkende hydraulische cilinders.
Speciale voorzieningen zijn getroffen om op zeer ondiep water te kunnen lossen, wanneer in eerste instantie de bodemdeuren niet gebruikt kunnen worden omdat zij in geopende stand te ver onder het schip uitsteken. Op vier plaatsen zijn in de kippenkooi stortkokers aangebracht, die aan de onderzijde open zijn en die normaliter door doosdeuren van 1,8 x 4,0 m in de schuine wand van de kippenkooi van de hopper zijn afgesloten. Wanneer deze deuren worden geopend steken zij niet onder het schip uit en kan een deel van de lading worden gelost. Daardoor wordt de diepgang zoveel kleiner, dat de bodemdeuren gedeeltelijk geopend kunnen worden. Er wordt dan weer een deel van de lading gelost, zodat tenslotte de bodemdeuren geheel geopend kunnen worden om het lossen te voltooien.
Voor het fluïdiseren van de lading is een groot aantal nozzles aangebracht: op de top van de kippenkooi, rondom de bodemdeuren, bij de 'ondiep-waterdeuren' en bij de eindschotten van de hopper. Het benodigde water wordt geleverd door de jetpompen via een centrale leiding in de kippenkooi.

Persen naar de wal

Voor het persen naar de wal wordt de lading uit de hopper gezogen via twee rechthoekige kanalen ter weerszijden van de kippenkooi. De kanalen zijn aan de bovenzijde elk voorzien van tien doosdeuren van 4,5 x 0,7 m, die worden bewogen door dubbelwerkende hydraulische cilinders. Beide kanalen hebben aan de voorzijde een waterinlaat en zijn aan de achterzijde aangesloten op de zuig van de SB baggerpomp. Het lossen gebeurt door deze pomp alleen of door beide pompen in serie. Voor de laatste mogelijkheid is een verbinding tussen de pers van de SB pomp en de zuig van de BB pomp beschikbaar.
Het leegzuigsysteem wordt ook gebruikt om vóór het beladen het water uit de hopper te verwijderen.

Op het voorschip splitst de persleiding zich in twee takken: naar de boegaansluiting voor een drijvende leiding en naar een spuitmond voor 'rainbowing'.

Fig.4. De onderwaterpomp (foto: IHC).

De SB en BB takken voor het walpersen worden verenigd tot een enkele walpersleiding met een diameter van 1100 m, die aan BB zijde naar het voorschip loopt.

De hopper is van vier ronde, in hoogte verstelbare overvloeikokers voorzien.

In de pompkamer staan verder twee jetpompen, die o.a. de sleepkoppen van jetwater voorzien. De pompen hebben een capaciteit van 6350 m^3/h bij 4,25 bar en worden aangedreven door elektromotoren van 1000 kW elk, die in de machinekamer staan opgesteld. De jetpompen dienen verder voor het fluïdiseren van de lading bij het lossen, voor het snel vullen van de piektanks voor het corrigeren van de trim en voor het voeden van de ontgassingsunits.

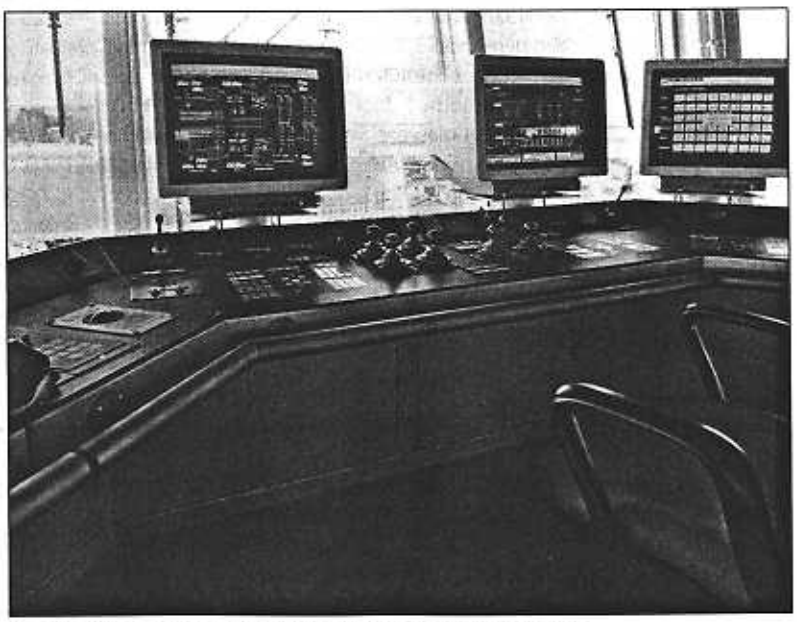


Fig.5. De baggerlessenaar aan de achterzijde van het stuurhuis (foto: IHC).

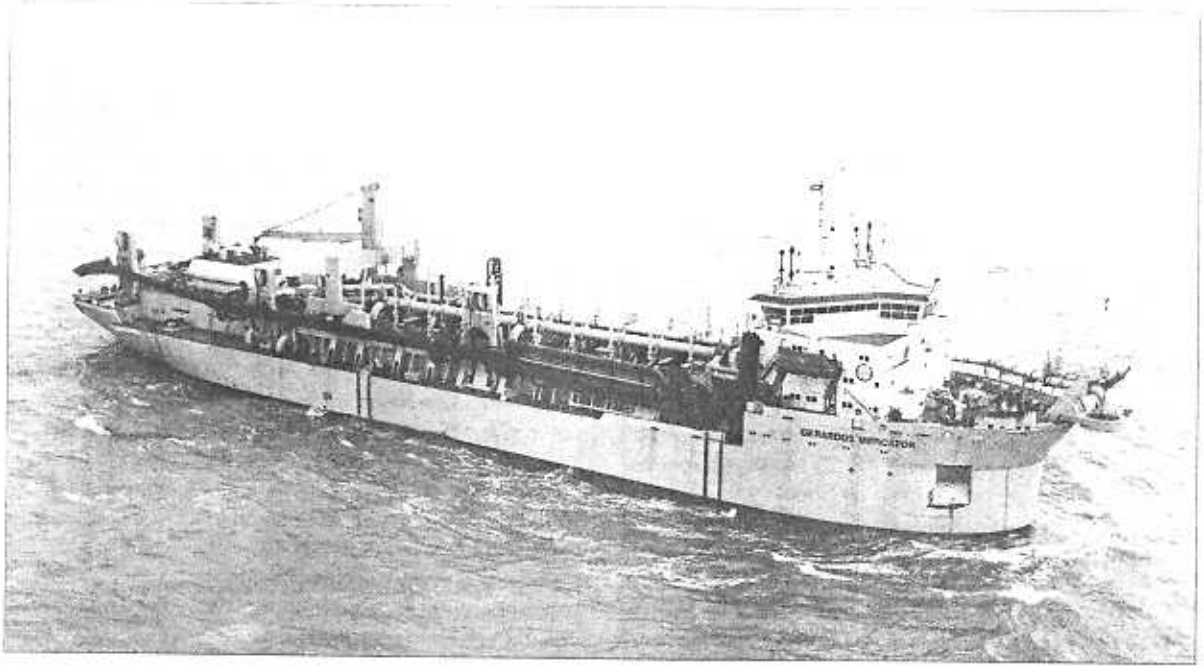


Fig.6. De Gerardus Mercator (foto: IHC/Sea Sky Martin)

Voor het tot stand brengen van de boegaansluiting is op het bakdek een hydraulisch werkende Brusselle koppellier geplaatst met een trekkracht van 550 kN.

VERDERE UITRUSTING

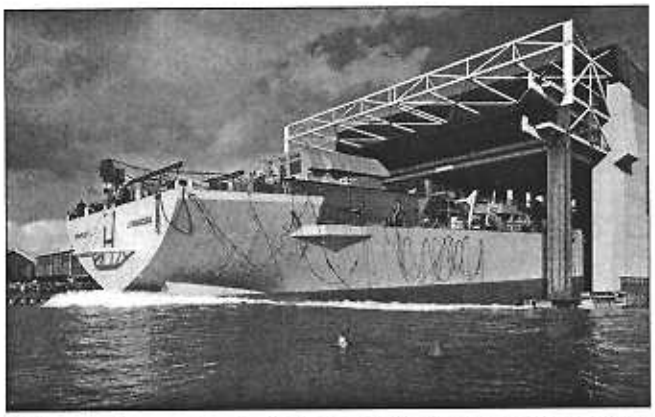
De uitrusting van het schip omvat o.a.:

- Twee vrijhangende, rechthoekige Barkemeijer flaproeren, met Brusselle stuurmachines.
- Twee elektrisch aangedreven Lips dwarsschroeven in het voorschip, elk 1000 kW.
- Twee hydraulisch aangedreven Brusselle ankerlieren op het bakdek, elk met een nestenschijf voor 78 mm ketting en een verhaalkop.
- Een hydraulisch aangedreven Brusselle lier op het achterschip, voorzien van een trommel met draadgeleiding voor behandeling van het hekanker, alsmede van twee verhaalkoppen.
- Een rijdende, hydraulisch werkende dekkraan, met een SWL van 45 t en een bereik van 3,75 tot 18,50 m.
- Twee geheel gesloten motorreddingboten, gebouwd door Mulder en Rijke van met glasvezel versterkte kunststof, elk voor 40 personen en opgesteld onder Schat davits.
- Vier opblaasbare vlotten voor elk 25 personen en één voor zes personen (op het achterschip).

Lijst van toeleveranciers Gerardus Mercator (niet volledig)

Ajax Fire Protection, Amsterdam	*CO2-installatie*
Alfa Laval, Maarssen	*zoetwatermaker, oliepompen*
Alphatron, Rotterdam	*communicatiesystemen*
AMW-Marine, H.I.Ambacht	*platenwarmtewisselaars*
't Anker, Schelluinen	*ramen en poorten*
Barkemeijer Schiffstechnik, Duitsland	*roeren*
Bennex, Spijkenisse	*Simrad DP systeem*
Bouter Grootkeukentechniek, Zoetermeer	*kombuis- en wasserij-uitrusting*
Brusselle Marine Industries, België	*stuurmachines, lieren*
Chemetall, Oss	*kathodische bescherming*
Datema, Delfzijl	*veiligheidsuitrusting*
Econosto, Rotterdam	*afsluiters en appendages*
Facet Industrial, Almere	*lenswaterreiniger*
Geveke Motoren, Papendrecht	*noodset*
v.d. Giessen, Hardinxveld-Giessendam	*straalbuizen*
GTI Marine & Offshore, Rotterdam	*aanbrengen elektrische installatie*
Heinen & Hopman, Spakenburg	*AC en verwarmingssystemen*
Hempel, Vlaardingen	*verf*
Hydraudyne Bruinhof, Rotterdam	*tandwielkasten en flexibele koppelingen*
Hydraudyne Pneumatiek, Rotterdam	*pneumatische systemen*
Hydraudyne Systems & Engineering, Boxtel	*hydraulische systemen*
IHC Lagersmit, Kinderdijk	*afdichtingen schroefaskoker en baggerpompen, lagers*
IHC Parts & Services, Kinderdijk	*baggeruitrusting*
IHC Systems, Sliedrecht	*installeren automatisering baggerbedrijf*
Ketting, Ijmuiden	*Atlas Copco compressoren*
v. Leusden, Etten Leur	*loopkranen*
Lips, Drunen	*schroeven en dwarsschroeven*
Machine Support, Zoeterwoude	*Epocast gietvullingen*
MAN B&W Diesel, Duitsland	*hoofd- en hulpmotoren*
Marine Assist, Zoeterwoude	*vlotten*
Midden Nederland, Tiel	*schilderwerk*
Mulder & Rijke, Ijmuiden	*reddingboten*
NR Koeling, Krimpen a/d IJssel	*proviandkoelinstallatie*
Praxis Automation, Leiden	*automatisering machinekamer*
R&H Systems, Rotterdam	*hoofdaannemer voor automatisering baggerbedrijf en elektrische installatie*
Schat Harding, Utrecht	*davits*
Schelde Marine Services, Vlissingen	*incinerator*
Thofex, Rotterdam	*gereedschapswerktuigen*
Uittenboogaart, Rotterdam	*dekkraan, verhaal- en meergerei, sewage installatie*
Westfalia, Cuijk	*separatoren*
Wiesloch, Spijkenisse	*thermische olie installatie*
Winel, Assen	*stalen deuren*
Wortelboer, Rotterdam	*ankers en kettingen*

Launching of 18,000 M³ Trailing Suction Hopper Dredge "Gerardus Mercator"



Ondernemingen Jan de Nul's new 18,000 m³ trailing suction hopper dredge "Gerardus Mercator," launched from IHC's covered slipway at Kinderdijk, Netherlands.

In November 1994, the Belgian dredging company Ondernemingen Jan de Nul ordered from IHC Holland, the design, construction and delivery of a 18,000 m³ trailing suction hopper dredge. The new vessel, named *Gerardus Mercator*, was launched from IHC's covered slipway at Kinderdijk, Netherlands.

The twin-screw dredge has two suction tubes for a maximum dredging depth of 55 meters. To starboard, an extra tube with underwater dredge pump can be fitted, that can be used to reach a dredging depth of 112 meters. The hopper, with four overflow ducts, has two rows of 10 double-bottom doors (each), for discharging the load.

Through a self-discharge suction system, the hopper's contents can also be pumped over the bows, either on a floating pipeline or released directly by "rainbowing." Discharging through an athwart shore connection is possible as well. The main engines drive, from their aft-end, two variable pitch propellers in nozzles; in front they drive the dredge pumps, which are mounted in a separate pump room. The vessel has two electrically-driven bow thrusters.

The *Gerardus Mercator* has on board the latest IHC integrated automation technology for control and registration of the dredging process. Air conditioned crew's quarters are on the main deck forward. The traveling hydraulic deck crane has 40-ton lifting capacity. ❐

"Gerardus Mercator's" Principal Characteristics

Length (Overall)	*152.90 m*
Length bp	*142.30 m*
Beam	*29.00 m*
Depth	*13.10 m*
Draught (Intern. Freeboard)	*9.54 m*
Draught (Dredging Mark)	*11.51 m*
Hopper Capacity	*18,000 m³*
Loading Capacity (at 11.51 m)	*26,750 t*
Dead Weight (at 11.51 m)	*18,000 m³ (23,580 yd³)*
Suction Pipes Diameter	*1,200 mm (48 in)*
Discharge Pipe Diameter	*1,000 mm (4o in)*
Dredging Depth	*35/50/55 (115/164/180.5 ft) 105/112 m (345/367.5 ft)*
Suction Pumps	*2 x 4,500 kW*
Discharge Pumps Power	*14,000 kW*
Submerged Dredge Pump	*3,200 kW*
Main Engines	*2 x 8,500 kVA*
Shaft Generators	*2 x 4,500 kVA*
Auxiliary Generator	*3 x 850 kW*
Emergency Generator	*285 kW*
Jet Pumps	*2 x 1,000 kW*
Bow Thruster	*2 x 1,000 kW*
Electric Portal Crane	*40 tons*
Laden Speed	*14.7 knots*
Accommodation	*40 persons*

Krupp Fordertechnik Stays Busy in Africa & Middle East

(Continued From Pg. 8)

Asian Sinai Peninsula. The new 600-meter-long structure will replace the present bridge which was built by Krupp in 1964. The lattice girder bridge consists of two 300-meter-long swing sections and has been designed to alternate between single-track rail traffic and two-lane road traffic, thus providing road and rail access to the Sinai Peninsula. The construction period has been set at 30 months and the bridge is due to be completed in early 1999.

The welded steel construction consists of two pivot trusses, which form a continuous girder of 140/320/140 meters when closed. The truss consists of two walls 10.5 meters apart, the height of which, varies from 15 to 60 meters.

The road is constructed as an orthotropic plate with trapezoidal stiffeners and longitudinal girders under the railway tracks. The surface of the road is an 6-centimeter-thick layer of asphalt. Each of the approximately 5,000-ton arms, rest on a pivot pier with roller-bearings (15 meters in diameter).

Swing movement (locking and unlocking) are effected by electro-mechancial motors controlled by a PLC system and may be operated in emergencies by auxiliary units or hand-power. In opened-parking position both arms are parallel to the canal banks and are each fastened to a protection jetty. The free cantilevered structure will be assembled using one temporary support structure-per-arm. ❐