

ICE MARGIN RESEARCH SHIP

MARIA S. MERIAN



*All research starts with
amazement. Suddenly,
one notices something*

Wolfgang Wickler





Bundesministerium
für Bildung
und Forschung

Climate change is one of the most pressing challenges of our time. In order to implement effective climate protection policies, scientists and politicians need models that allow them to make reliable forecasts and take targeted action. With our high-tech strategy for climate protection, we have therefore joined forces and promoted the international transfer of knowledge. The complexity and consequences of progressive global warming have placed the highest demands on researchers and scientists. A

sound understanding of the system is required to be able to better explain and predict the climatic processes and the interactions between the atmosphere, the mainland and the oceans. Only through new scientific discoveries and innovative research results will we succeed in finding long-term solutions that are both environmentally and economically sound.

As the most recent and modern addition to the German research fleet, the MARIA S. MERIAN makes an important contribution to research on climate change and its consequences. Targeted expeditions in the North Atlantic Sea and the marginal seas help scientists to understand the fundamental importance of the sea as a supra-regional driving force for climate change in western Europe.

Not only is the MARIA S. MERIAN equipped with excellent scientific research facilities, it also has outstanding driving qualities, based on solutions derived from innovative ship-building techniques. This means that science now has an excellent new device at its disposal, which can be used to substantially drive forward cutting-edge marine research and scientific education.

I wish the MARIA S. MERIAN and all scientific and technical crew members fair winds and smooth sailing at all times.



Dr. Annette Schavan, MdB
Federal Minister of Education and Research

Deutsche Forschungsgemeinschaft

DFG

As a result of climate change and the growing use of the seas, oceanography is becoming increasingly important. The rising concentration of carbon dioxide in the atmosphere is acidifying the seas, the warming up of the oceans is changing the species structures and food chains. Oceanography provides a basic understanding of the complex relationship between the ocean, sea ice and the atmosphere. New technologies enable us to study the mechanisms underlying these processes of change, to provide precise forecasts for the future and to explore habitats that, until recently were largely unknown. These new technologies also require that advances be made in ship technology. The new "swimming labs" have already fundamentally changed the way oceanographers work over the past few decades.



FS MARIA S. MERIAN enhances the German research fleet with an efficient, modern research ship, which, with its ice-classification facilities, enables work in Arctic ice margin areas and the Baltic Sea in winter. The latest German research ship mainly operates in the North Atlantic and its marginal seas, from the continental shelf seas to the open ocean. This offers opportunities for cooperation among countries bordering the North Atlantic Ocean. The next generation of scientists plays an important role in ship expeditions, since the participation in such research trips is an important part of scientific education and is to be promoted in this manner.

Professorin Dr. Karin Lochte
Chairwoman of the DFG Senate Commissions on Oceanography

Task, owners, use, financing and operators

Since 2006, the ice margin research vessel MARIA S. MERIAN has been used for German ocean research purposes and forms a platform for interdisciplinary and international scientific cooperation.

The MARIA S. MERIAN is owned by the state of Mecklenburg-Western Pomerania, represented by the Ministry of Education, Science and Culture. The costs of maintaining and operating the ship all year around are shared by the Ministry of Education and Research

(BMBF) and the German Research Foundation (DFG) at a ratio of 30:70.

They are also supported by an advisory council. The DFG Senate Commission on Oceanography is responsible for planning the scientific cruises of the MARIA S. MERIAN. The METEOR/MERIAN coordination centre at the University of Hamburg has been entrusted with managing the ship's operations.



Why does the sea appear to be so eternal and yet so eternally comforting? Because the sea combines both the idea of immensity and movement. For human beings, six or seven miles already represent infinity.

Charles de Baudelaire

The operating concept

Supporting science

The METEOR/MERIAN coordination centre at the Centre for Marine and Atmospheric Sciences at the University of Hamburg is responsible for coordinating the ship's operations. It supports the research groups in all aspects concerning the preparation and implementation of a MERIAN trip. They are responsible for handling the diplomatic applications for research permits in the waters of coastal states. Every year, the coordination centre requests budgetary funds that are needed

for operating and maintaining the scientific value of the MARIA S. MERIAN. Here, the coordinating centre works closely together with a private shipping company, which has been assigned responsibility for the technical and nautical operation of the ship through a ship management contract. This also includes the provision of an experienced crew and professional supervision on land.

MARIA S. MERIAN as a universal platform

Basis of all knowledge

MARIA S. MERIAN is one of the world's most efficient research platforms, available to all disciplines of basic marine research for work in ice-free ocean regions and the Arctic ice margin areas of the earth; 24 hours a day, all year round.

The ship offers space and cutting-edge technical facilities for advanced oceanography, including 14 lab rooms with a total of 400 square metres of useful area, room for standing up 22 containers, and 9 research winches, with up to 7 metre-long wires or cables.

Up to 23 scientists and technicians can make use of all the measuring and sampling devices they need. Water samples can be taken at any depth for chemical analyses. Thanks to the deep-sea video technology and remote-controlled submarine vehicles, specific sampling of the ocean bed is also possible.

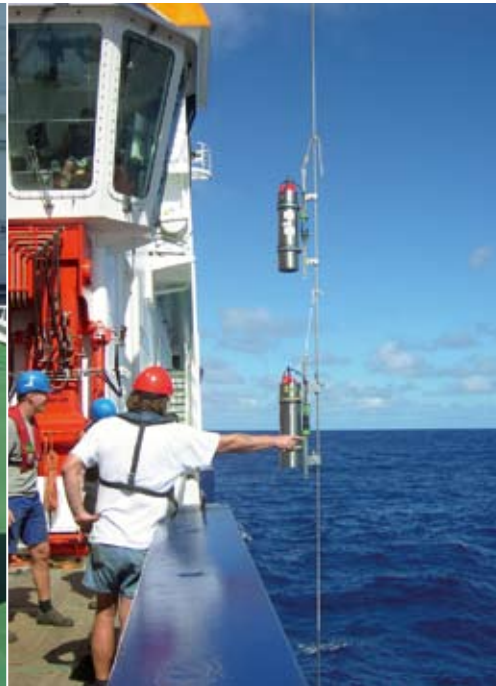


I do not know what I may appear to the world, but to myself I seem to have been only like a boy, playing on the seashore, and diverting myself, in now and then finding a smoother pebble or prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.

Sir Isaac Newton

Shock tubes up to 24 metres in length punch holes in the layers of sediment of the ocean bed; powerful compressors feed large compressed air canons for seismic exploration of the deep seabed. Nets can be employed for catching microscopic creatures and algae. Computers and lab facilities enable the first evaluations to be made at sea, water circulation systems and cooling rooms can be used for breeding aquatic animals and for the transportation of temperature-sensitive samples. Various hoisting devices on the large working deck can be used to move loads up to 12.5 tons and to lay out and haul in anchorable measuring devices several kilometres away.

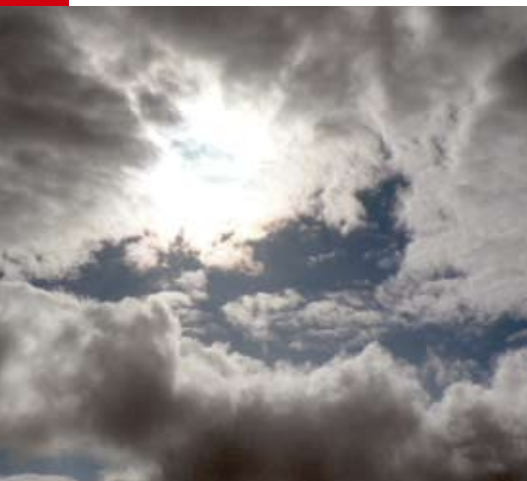
Mechanical and electronic facilities with trained staff are available as well as an operator for the on-board computer and data logging system.



Automatic on-board weather station

Knowing what the weather will be like

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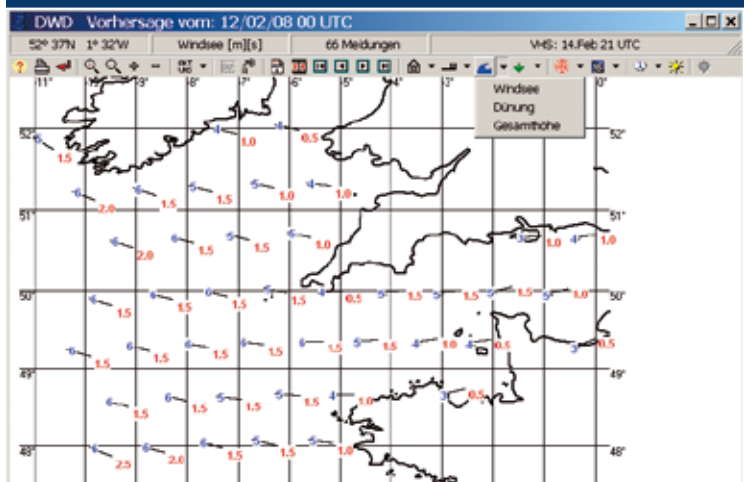
In the age of unlimited communication and world-wide connected data streams, classical tasks such as meteorological observation and consultation on board a research ship have undergone fundamental changes. The current weather is recorded by an automatic weather station of the German Meteorological Service (Deutscher Wetterdienst); equipped with modern sensors it records all relevant data, from the wind direction and speed to the humidity and temperature, as well as the air pressure per second. This data is fed into the on-board data network every 10 seconds and transmitted every second by satellite via a DCP transmitter to the world-

Equipment and Know-how

Knowledge tools

*Water, and especially the sea, opens
our thoughts...
The sea gives us strength, energy and
cultures.*

(Fabrizio Plessi, Italian artist)





wide meteorological observation network. It can therefore continuously be used as a basis for scientific investigations and makes a permanent contribution to global weather observations.

The "Research" information system was installed on board by the German Meteorological Service (Deutscher Wetterdienst) to help the captain and chief scientists to minimise the risks associated with the weather and sea conditions. The system continuously supplies the computer on the bridge with up-to-date information about the weather trend for the area of operation and planned routes.

The captain and chief scientists can thus obtain information at any time about the current weather forecast, what might be favourable or less favourable operations and plan alternatives, if need be. Furthermore, in meteorologically critical situations, the consulting meteorologist at the Maritime Weather Office can be contacted directly by phone to receive assistance and guidance with decision-making.

Ship concept

*“The sea is no landscape,
but the experience of eternity.”*

Thomas Mann



The ice margin research ship MARIA S. MERIAN is incredibly environmentally friendly to operate. This is why it was awarded the “Blauer Engel” environmental seal (blue angel).

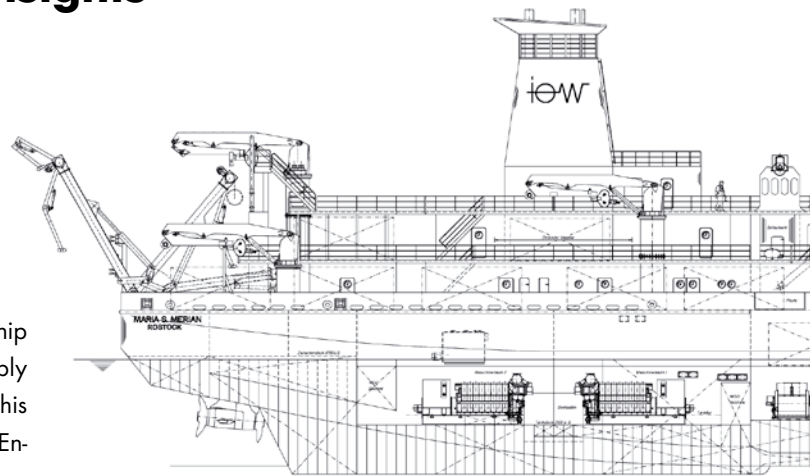
The ship earned the quality seal for the following key points:

- The ship has been designed so that the fuel tank is not directly positioned against the outer shell nor in the double bottom. Thus, the risk of oil leaking out if the hull is damaged, e.g. through ice, is minimised.
- All hydraulic aggregates situated in the outer area are operated using biologically compatible oil, so that, in the event of a leakage, sensitive environments are not damaged.
- All cooling systems are operated with a special cooling agent, which does not harm the ozone layer.
- All types of rubbish are separated on board, and processed and stored in space-saving facilities to be later deposited on land during stays in the harbour.

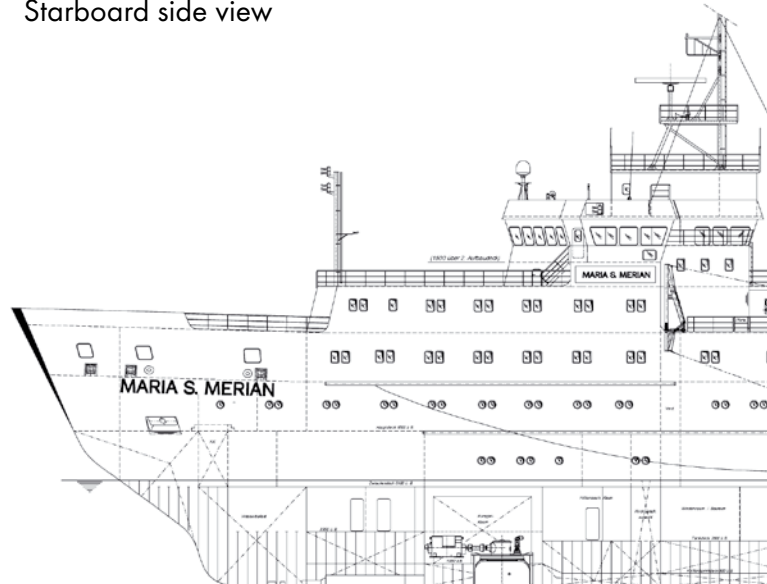
As a research platform, the MERIAN is available to all German research groups.

Among the various groups who take part in the ship’s expeditions are scientists, their cooperation partners, technicians and students. Based on international maritime law, representatives of the coastal countries are also frequently welcomed on board. Since not all participants have experience in the practical work at sea, the groups are assisted by the crew members as best they can. The ongoing operations-oriented consultation and active assistance of the crew with everyday research on board has substantially contributed to the success of the expeditions. Without them, many research groups would be unable to make optimal use of the ship’s potential and could otherwise have difficulties using the fixed on-board appliances and handling the scientific equipment.

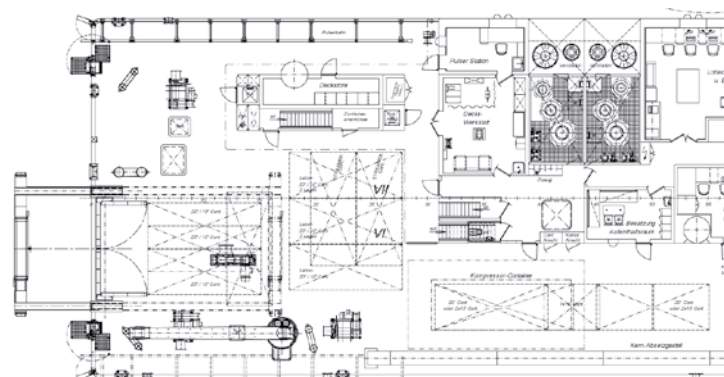
Gaining insights



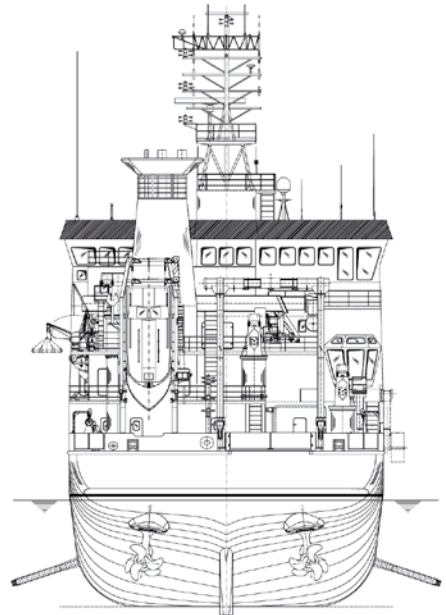
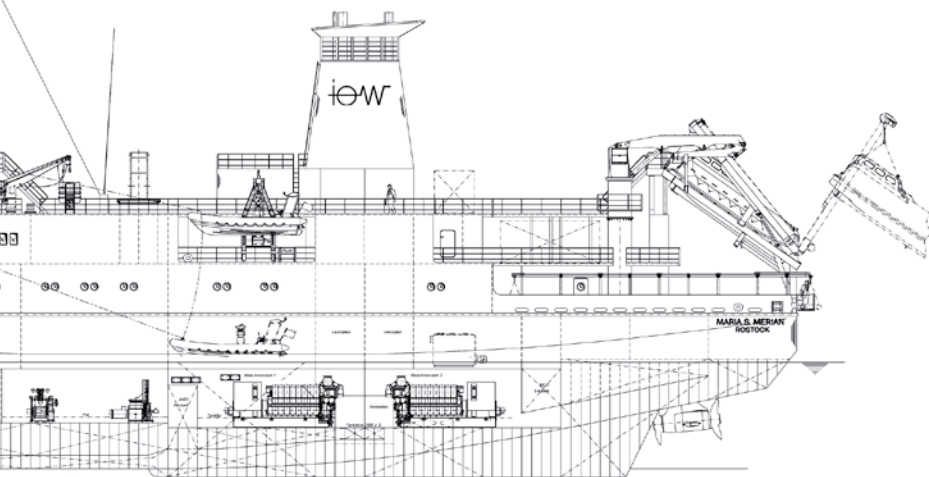
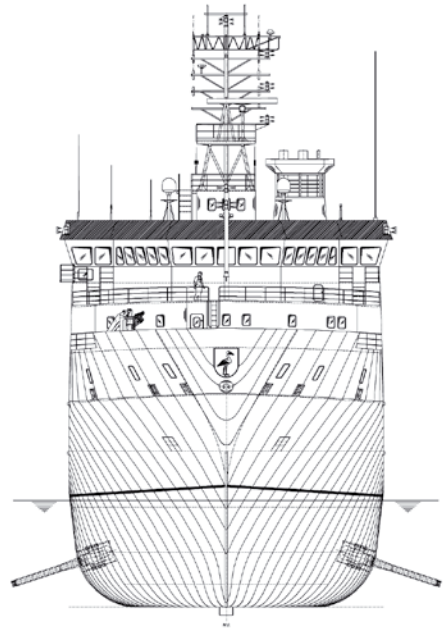
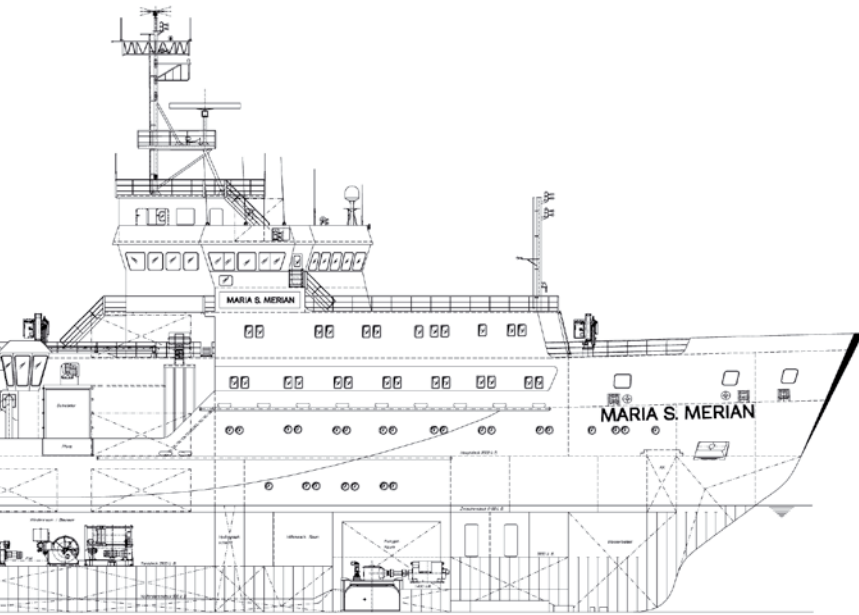
Starboard side view



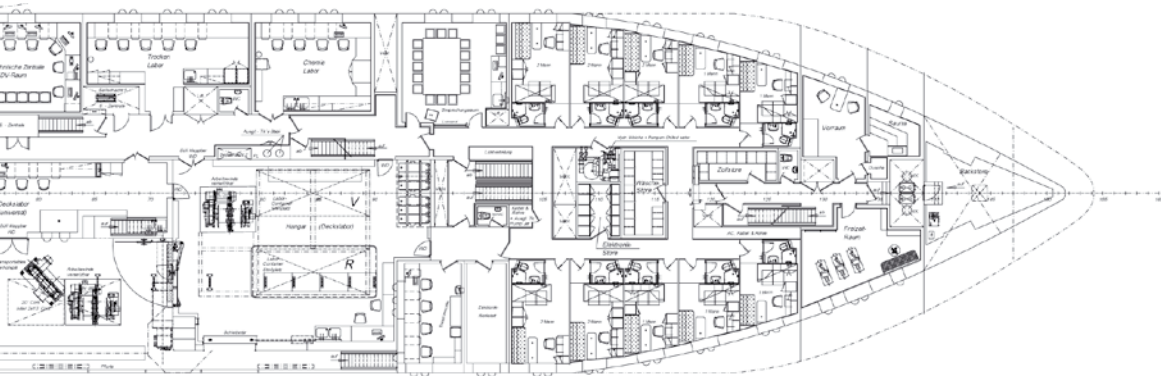
Port side view

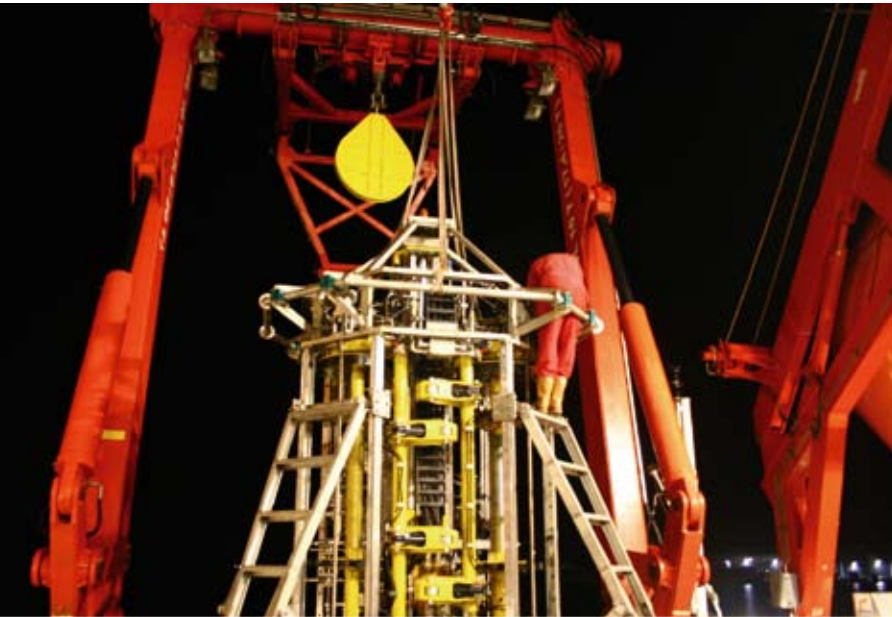


Main deck



Stern view





Power supply:

On-board power supply 690/400/230 V, 50 Hz through a transformer-stabilised on-board power supply 220 V, 50 Hz through a converter

Hoisting gear:

A frame on the stern 200 kN;
3 cranes of 50 kN;
2 breakdown cranes of 15 kN;
1 push bar 200 kN
1 push bar 70 kN

Winches:

2 mooring winches;
2 friction winches of 150 kN with a storage winch each (18mm deep-sea wire and 18mm fibre-optic wire of 7000 m);
2 single-wire winches (single-wire winches of 30 kN (11mm single-conductor wire of 6000m);
1 serial winches 20 kN (6mm serial wire or 8mm dynema rope of 3000m);
1 main mobile winch 50 kN (11mm wire, 6000m)

Container capacity:

on deck: 14 x 20' or 29 x 10'
inside: 7 x 20' or 14 x 10'

Accommodation:

for max. 23 crew members and
max. 23 scientists

Navigation equipment:

2 fibre-optic compasses;
integrated navigation
(2 radar devices, ECDIS, track pilot, Argos DF, DGPS, Doppler-log, EM-log, Sat-log);
dynamic positioning (DP), Class 1

Hydro-acoustic facilities:

EM 120 multi-beam echo sounder, EM1002 shallow water echo sounder, EA 600 vertical sonar system, sediment sonic system (parasound), ADCP, Pinger, Posidonia, video surveillance (deck/ winches), data acquisition and distribution system, automatic on-board weather station

Communication:

GMDSS A1, A2, A3, A4; Inmarsat Fleet 77 and 33, Iridium, Intercom, RDF, GSM, VHF, MF, HF

DP operation

The ship is equipped with a DP (dynamic positioning) system, which can resist winds of up to Bft 5 and permits extremely accurate manoeuvring and positioning of the ship, independent of the direction of the wind, sea conditions and current (current speed ≤ 1 kn).

This is particularly important with the use of modern research equipment such as MeBo, ROV etc.

Back-up machines

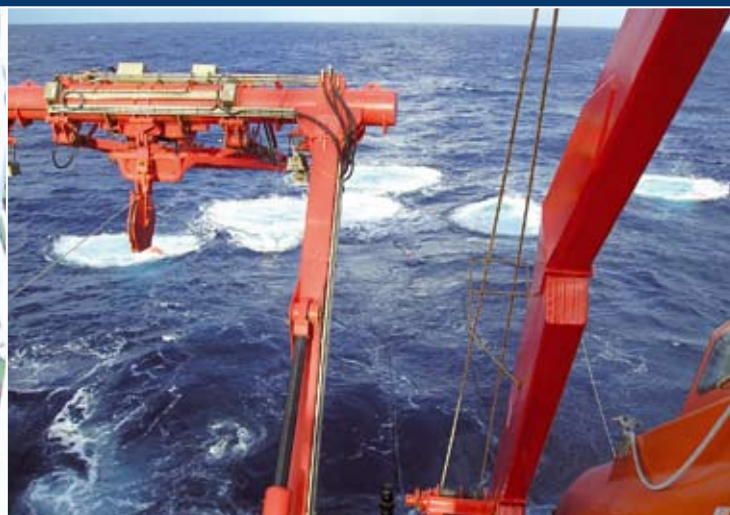
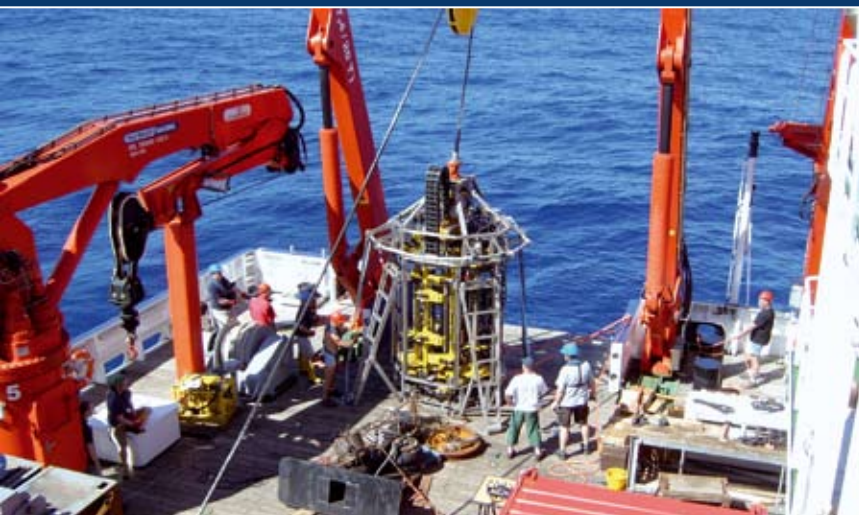
All of the ship's "vital" aggregates, such as the POD propulsions, engines, generators and control panels as well as the heaters have been installed in pairs and, apart from the POD propulsions, have even been installed in two separate machine rooms. In the event of an accident, each machine room can burn out completely or be filled with water, without the jeopardising the operation of the functioning machine room.



Peering beneath the surface

"Man must persist in his belief that the incomprehensible is comprehensible, otherwise he would cease to explore."

Johann Wolfgang von Goethe



Technical facilities for seamen: Facts and Figures

With the new ice margin research vessel, MARIA S. MERIAN, Germany is now in possession of the world's most advanced multi-disciplinary research ship. Its name was derived from the BMBF pupil competition in the "Year of the Geosciences 2002". The MARIA S. MERIAN was named after the nature researcher Maria Sybilla Merian, who undertook several long-distance research trips with her daughter, which was very unusual for the 17th century. The main area of operations is the North Atlantic Ocean until the Arctic ice ridge, as well as the North and Baltic Seas. The numerous lab and work rooms, and the large working deck offer excellent working facilities for the scientists.

Cables up to 7000 metres in length can be run out from the winches installed below deck. The sonar system installed on board can identify floor structures in up to 10,000 metres depth.

The innovative POD propulsions ensure a precise positioning at sea as well as a very silent ship operation, which is absolutely essential for many scientific measurements. The MARIA S. MERIAN fulfils the requirements of the "Blaue Engel" (Blue Angel) and the ISO certification standards for long-term ship operations.

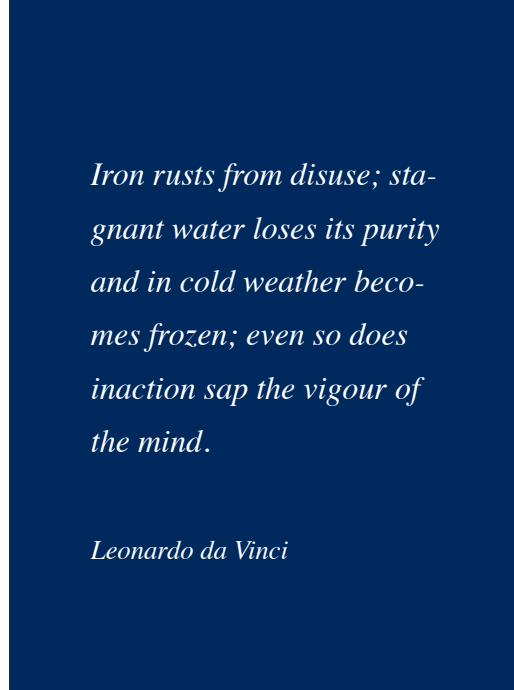
The MARIA S. MERIAN was built by the Kröger shipyard in Schacht Audorf.

The Briese shipping company from Leer will be in charge of ship management. The Maria S. Merian will be scientifically supervised by the Institute for Research in the Baltic Sea (IOW) in Warnemünde.

Owner: State of Mecklenburg-Western Pomerania
 Home port: Rostock-Warnemünde
 Flag: German
 Classification: + 100 A5 E3* Nav-OC special ship
 + MC E3 AUT RP3 50 %
 * Reinforcements according to Polar Class PC 7

Main features

Length: 94.80 m Breadth: 19.20 m
 Draught: max. 6.50 m
 Speed: max. 15 kn Tonnage: approx. 1345 tons
 Endurance: 35 days
 Propulsion: diesel-electric
 2 x 1900 KW POD
 1 x 1600 KW pump jet



Iron rusts from disuse; stagnant water loses its purity and in cold weather becomes frozen; even so does inaction sap the vigour of the mind.

Leonardo da Vinci





Areas of operation Broadening horizons

Learning is like a sea without a coast...

Konfuzius (eig. Kung-fu-tse)

Chinese philosopher, 551 – 479 B.C.

Working areas of the MARIA S. MERIAN

Basic marine researchers in Germany have four research ships at their disposal that satisfy the requirements of international, modern offshore research. Based on their construction, technical facilities and institutional classification, they were assigned to different navigational areas. Among these four research platforms, the MARIA S. MERIAN operates mainly in the Atlantic Ocean, the Arctic Ocean, the Arctic ice edges and the Baltic Sea in winter. Stopovers in the ports of the coastal states are regularly used to strengthen ties with other scientists and have made a significant contribution to the good cooperation between the maritime research institutes in Germany and the ocean states in this area of operation.





Archiving of measuring data

Since the acquisition of maritime data is extremely difficult and associated with considerable costs, the data should, if possible, be stored centrally and made available for further use. In Germany, they are collected and archived by the Oceanographic Data Centre (DOD) in the Federal Office of Maritime Shipping and Hydrography (Bundesamt für Seeschifffahrt und Hydrographie, BSH).

At the end of a research trip, the chief scientist compiles a standardised overview of the measurements performed, based on which the DOD requests data from the different groups of scientists. This is subjected to a quality control and supplemented with information on data acquisitions, measuring methods and the level of accuracy.

All data is not only available to German scientists on request, but also passed on to World Data Centres. The data stocks of the German Oceanographic Data Centre go back to the 19th century. This wealth of information has already made a significant contribution to our ability to analyse and forecast climate development and remains the basis of many calculations and the development of model scenarios in climate research.





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Deutscher Wetterdienst



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