

# SATELLITES FOR MORE SAFETY AND EFFICIENCY IN MARITIME OPERATIONS



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SATELLITES IN MARITIME**

Satellite-based services have a great potential to support the marine and maritime community. Parties like fisheries, coast guards, port authorities, shipping companies, research institutions, and many more, will considerably benefit from related innovative services in their daily work, offering a wealth of information on the oceans and coastal areas, e.g. on a variety of environmental variables, near-real time ice information, and Satellite-Derived Bathymetry, supporting marine and maritime activities and safety of navigation.

Increasing safety and efficiency and reducing the risk of operations is one of the core ambitions of carriers, ports and stakeholders in the maritime industry. In recent years, networks have developed and evaluated solutions to aid planning and vessel routing in higher latitudes, to increase safety of navigation in coastal

areas which were inadequately surveyed, and developed relevant information portals and software solutions.

In July 2019 MARSAT, a German consortium that combines experience and expert knowledge in the fields of satellite data provision and analysis, software development, and maritime services, officially completed the R&D stage of the project and reached the next, mature level, offering satellite services for the maritime industry.

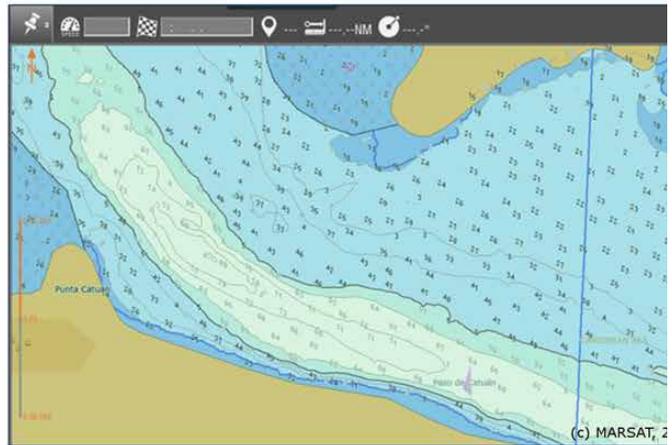
Among its partners, MARSAT includes EOMAP GmbH & Co. KG, Seefeld, Drift & Noise Polar Services GmbH, Bremen, SevenCs GmbH, Hamburg, Trenz AG, Bremen and the Institute of Shipping Economics and Logistics (ISL), Bremen/Bremerhaven.

MARSAT offers new services providing detailed data on sea ice in Polar Regions where internet connections are slow,

improved electronic navigational charts for poorly surveyed waters and software solutions to support maritime decision-making with satellite data.

## TOWARDS SMARTER ROUTING IN HIGHER LATITUDES

Commercial shipping in the Arctic is expected to increase in the coming years. Ocean routes like the Northwest Passage above North America and the Arctic route north of Russia have the potential to considerably shorten vessels' voyages, e.g. from Asia to Europe from 40 days through the Indian Ocean and Suez Canal down to about 30 days, drastically reducing shipping costs. However, operating in these areas puts special requirements on shipping companies and their crews. One crucial topic of networks like MARSAT is fully automated, 24/7, near real-time ice image information for polar waters, where



The difference SDB can make. The currently available, official electronic nautical chart of Bahia Catalinita in the Dominican Republic (left) and the improvements made by the integration of Satellite-Derived Bathymetry data (right).

Internet connections use the Iridium satellite network, a costly solution with bandwidth of only a few kb/s. Access to relevant data portals or even normal web pages is a challenge, if not impossible. Until now this limitation has hampered the use of detailed ice information on board and the availability of high-quality ice information.

MARSAT has developed a support system for tactical decision-making, including an operational satellite image database,

communication channels between ships, satellites and the internet, the automatic ship identification system (AIS), and the so-called Ice Pad. The Ice Pad is a special hardware device developed to transfer satellite imagery and ice data to ships in a highly optimized manner, including areas where only a low-bandwidth Iridium connection exists. As an example, MARSAT supported the Weddell Sea Expedition 2019 to Antarctica, conducted by an international team of researchers on the

South African research ice-breaker S.A. Agulhas II. It was shown that the Ice Pad provided the captain with valuable detailed near-real time ice information which would hardly be accessible otherwise.

#### **UPDATING ELECTRONIC NAVIGATIONAL CHARTS BY SATELLITE-DERIVED BATHYMETRY**

According to the International Hydrographic Office (IHO), approximately 50 percent of the world's coastal areas are not or not

adequately covered by nautical charts. Satellite-Derived Bathymetry can support. It calculates water depth for shallow waters using sunlight reflected from the seafloor and recorded by satellite sensors. Although the technique has been investigated since the 1970s, it required modern satellite capabilities and advances in computing power to bring SDB, as it is often called, to the broader community. Using satellite data to survey shallow waters brings many advantages compared to labour- and equipment-intensive acoustic campaigns.

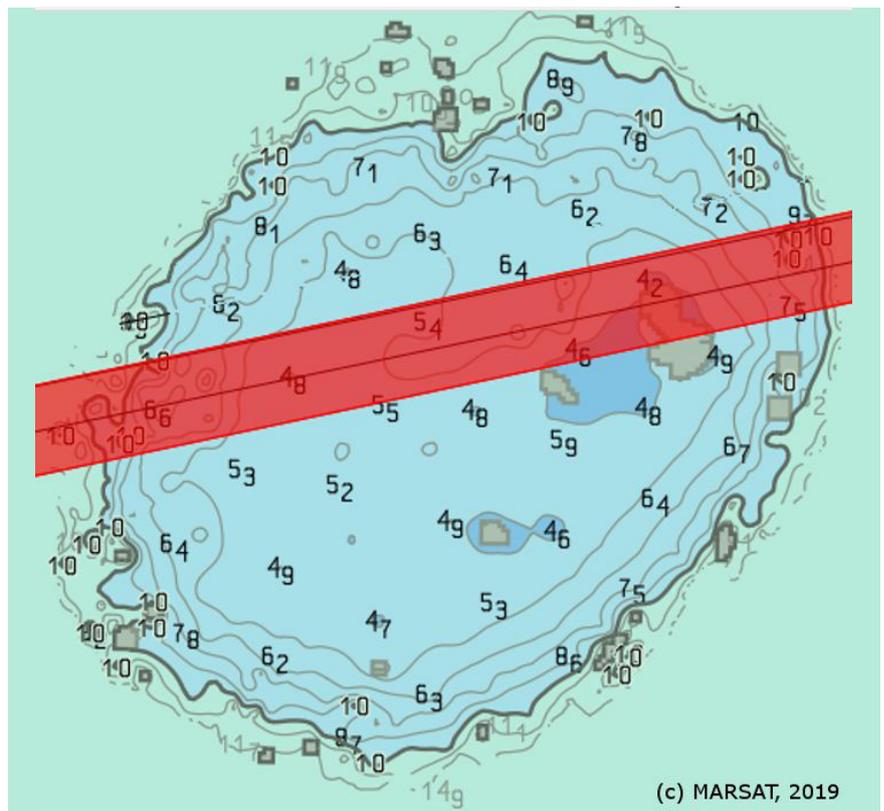
There is a steady growth in uptake of Satellite-Derived Bathymetry. Most applications are in planning and management of coastal zone environments and in engineering. Hydrographic applications have been less common so far, although some hydrographic offices are starting to systematically integrate SDB into their surveys. The MARSAT team has generated high-resolution and dense-contour electronic navigational charts (ENCs) complying with current standards. These charts are especially helpful to mariners in areas which are inadequately surveyed.

A recent incident which highlights the usefulness of SDB for maritime navigation is the grounding of 185 metre-long container vessel Kea Trader on 12th July 2017 near New Caledonia. According to the respective investigation report, one of the reasons which lead to the accident was the fact that the respective ECDIS (Electronic Chart Display and Information System) navigational chart only showed an isolated danger symbol near the path of the vessel, not indicating that the symbol in fact depicted the Recif Durand reef, about 1 km in diameter midway between the islands Ile Walpole and Ile Marie. The crew remained unconcerned by the vessel passing so close to the isolated danger and incorrectly assumed safe water within the planned route. When passing over Recif Durand, the Kea Trader navigated into shallow waters and remained stranded, eventually causing total loss of the vessel.

The MARSAT team subsequently performed an SDB analysis of the respective area. Using this innovative technology, it was possible to analyse the water depth in the vicinity of the Recif Durand reef in detail, as indicated in the picture below, which also shows the route of the Kea Trader (in red). Thus, if navigational charts are complemented by SDB information, it can help to avoid accidents like the grounding of the Kea Trader in the future.

### SMART DECISIONS BASED ON DIGITAL DATA

The demand from the maritime industry for up-to date spatial information



Recif Durand reef, surveyed by Satellite-Derived Bathymetry. Conventional navigational charts only show an isolated danger symbol. In red the planned route of the Kea Trader.

provided by satellites is obvious and much of the potential is yet to be explored. The MARSAT team has analysed the market demand and potential of satellite analytics in more detail. One of the demands of the maritime industry is the ability to access data and perform analysis in-house, as and when they need it. MARSAT has developed cloud-based software solutions to harness satellite data through modern data analytics methods in combination

with physics-based procedures. Easy-to-use web-based tools aid maritime decision making, including information portals especially for the maritime industry. These harvest available data such as global sea-state models and also allow users to access very high-resolution data from satellites. For example, the dredging industry uses these services to support sediment monitoring and seafloor characterisation.

### ABOUT THE AUTHOR

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### ABOUT THE ORGANIZATION

The Institute of Shipping Economics and Logistics (ISL) is an independent, not-for-profit research institute founded in 1954 and located in Bremen and

Bremerhaven, Germany. ISL is one of the leading maritime research and consulting institutes in Europe. Around 40 employees work together in interdisciplinary project teams, well equipped with modern instruments in practice-oriented research and development projects. Together with its partners in the MARSAT network, ISL works towards creating and integrating innovative satellite-based services for the marine and maritime community. For more information please visit <https://www.isl.org/en/>.

### ENQUIRIES

<https://marsat-project.org/en> for further details of the project.  
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