THE SEAPATH FAMILY
OUR MISSION
We shall earn the respect and recognition for our dedication to provide innovative and reliable marine electronics that ensure optimal operation at sea. By utilising and integrating our technology, experience and competencies in positioning, hydroacoustics, communication, control, navigation, simulation, and automation, we aim to give our customers The Full Picture. The Full Picture yields professional solutions and global services that make a difference enabling you to stay ahead of the competition.

OUR PHILOSOPHY
Our success depends on the success of our customers. Actively listening to our customers and truly understanding their needs, and then translating these needs into successful products and solutions is central to achieving our goal. Our people are the key to our success and we empower them to achieve. Working together in a global network of knowledge, guided by our values, engenders innovation and world class performance. Every day we have to think a little differently, because every client is unique. We aspire to translate the imagination and dedication of our staff into successful technologies and solutions. Our commitment is to add value to your operations by providing you with The Full Picture.

CONTENTS

ENABLING EXCELLENCE ........................................................................................................... 3
INTEGRATED SOLUTIONS ........................................................................................................ 4
NEXT GENERATION RESULTS ................................................................................................. 6
UNIQUE EXPERIENCE ............................................................................................................. 8
OPERATOR SOFTWARE ............................................................................................................ 9
LIFE CYCLE SUPPORT ........................................................................................................... 10
CUSTOMER SUPPORT ......................................................................................................... 11
Seapath® technology is established, proven and the preferred choice of hydrographic surveyors worldwide.

Launched in 1994, the Seapath family of high-grade heading, attitude and positioning sensors integrate innovative satellite and inertial navigation technology to deliver optimal accuracy for surveyors charting depths down to 10,000m.

Seapath technology excels in a wide variety of applications, such as:

- Hydrographic surveying
- Dredging
- Oceanographic research
- Seismic surveying
- Subsea construction
- Antenna stabilisation

**Deeper understanding**

Seapath has been continually refined by Kongsberg Seatex to ensure systems that are state-of-the-art, robust and precise. The systems are tailored for use in challenging applications and environments, facilitating optimum seabed mapping by measuring heading, position, roll, pitch, heave and timing with absolute precision.

The Seapath product family marks the latest step in this evolution of accuracy.
INTEGRATED SOLUTIONS

Kongsberg Maritime is the leading manufacturer of multibeam echosounders for shallow, medium and deep water applications and has delivered systems since the mid 1980's. Several of the solutions have become the industry standard due to their unique features.

**Fully integrated**
Seapath is fully integrated in all multibeam solutions offered by Kongsberg Maritime. Spanning from shallow to deep water applications, Seapath delivers position, heading and attitude data to the multibeam solution, resulting in a uniform and dense survey pattern which leaves no gaps or holes uncharted.

**Depth compensation**
Seapath provides heave, roll, yaw an pitch movements of the vessel in real-time enabling the multibeam system to measure and log the correct depth.

KONGSBERG has deep knowledge and experience to deploy solutions on large complex (research) vessels to efficient vessels of opportunity where the need for rapid deployment is important.

**Fixed installations**
For complex survey vessels, the Seapath 300 family, our third generation of Seapath, employs the best possible combination of GNSS signals and inertial measurements for optimal results, whatever the operational demands. Seapath 300’s combination of GNSS and inertial data enables peak performance, with a high output data rate (up to 200 Hz), zero delay on output data, and data available in up to eight different measurement points. In addition, the systems offer a total of sixteen configurable serial lines and Ethernet ports.

**Portable solution**
For rapid deployment, the Seapath 130 family of products is available, specifically designed for hydrographic surveying where high precision heading, position, roll, pitch, heave and timing are critical measurements. These solutions combines state-of-the-art dual frequency GNSS receivers, inertial technology and processing algorithms in a compact and portable package.
Data from the Petermann Fjord, Northwest Greenland. Collected by using KONGSBERG echo sounders with Seapath. Vessels in operation: Icebreaker ODEN and R/V Skibladner. Water depth from 100 to over 1200 metres.
NEXT GENERATION RESULTS

There are two product ranges in the Seapath family, each tailored to meet different market needs, while delivering the same outstanding results.

Seapath 130
Seapath 130 offers a fast track solution that delivers the accuracy of the Seapath 300 family in a package that is flexible, convenient and simple to install. Utilising the same innovative technology as its sister range, Seapath 130 blends precision with portability, making it an ideal companion for a broad range of applications and surveying vessels where fast deployment and quality results are key criteria for success.

Seapath 300
Precision, reliability and performance are precursors for success when undertaking complex operations, in demanding environments. The market proven Seapath 300 series of heading, attitude and positioning sensors pinpoint and utilise the optimal combination of GNSS signals and inertial measurements to provide high quality results for applications including hydrographic surveying, dredging, oceanographic research, seismic work and offshore construction. With state-of-the-art software and processing algorithms, the Seapath 300 family provides users with the capacity to map the seafloor, and unlock opportunity, like never before.

Flexibility
With a wide range of different models to choose from, any application in need for a robust and reliable high-precision solution can take advantage of the Seapath solution.

Installation
The market proven Seapath 300 series pinpoint and utilise the optimal combination of GNSS signals and inertial measurements to provide high quality results for applications.

By incorporating the latest available GNSS infrastructure, the Seapath series delivers an unmatched availability for any application in need for a high-precision positioning solution.

With four LANs, eight serial lines and three analog channels, distribution of Seapath data to various users onboard are endless, and makes Seapath a natural choice in seafloor mapping applications.
Network Architecture
The products within the Seapath 300 family are two-module solutions consisting of a Processing Unit and an Operator Unit connected via Ethernet.

The Processing Unit, which operates in a safe mode for complete operational integrity, runs all critical computations independently from the user interface on the Operator Unit. This ensures continuous and reliable operation.

Several Operator Units can be connected to the same Processing Unit in a network, thus enhancing flexibility.

Position Determination
Seapath software is built around a state-of-the-art ‘all in one’ signal processing core, offering advanced algorithms and true parallel processing of all available signals, including Inertial Measurements and SBAS (e.g. WAAS, EGNOS, MSAS and GAGAN). DGNSS corrections from different sources are combined thanks to its unique MULTIREF™ capability.

There is no practical limitation to the number of differential corrections that can be handled by Seapath software.

Seapath systems have a built-in, autonomous, real-time quality control feature that continuously monitors the quality of the calculated position. This activates alarms and warnings if critical tolerances are exceeded, or if position quality degrades.

The lever arm compensation in the software enables the selection of several measurement points on the vessel for the output of position, velocity and heave data.

In addition, Seapath products can be operated in floating ambiguity mode, utilising standard DGPS, XP/HP/G2/G4 and RTK corrections, and determine position accuracy down to 10 cm RMS by combining a single frequency receiver and RTK corrections.

Post-processing
Seapath has the possibility for logging of raw GNSS and IMU data for post-processing in for example TerraPOS or Inertial Explorer®.

Specifications for the Seapath range

<table>
<thead>
<tr>
<th>Model</th>
<th>Roll/Pitch [deg]</th>
<th>Heading [deg]</th>
<th>Heave Real-time [cm]</th>
<th>Position (x,y) [m] with RTK corrections</th>
<th>Position (Z) [m] with RTK corrections</th>
<th>GNSS system(s) supported</th>
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<tbody>
<tr>
<td>130-3</td>
<td>0.08</td>
<td>0.2 1)</td>
<td>5</td>
<td>0.01+1ppm</td>
<td>0.02+1ppm</td>
<td>GPS/GLO</td>
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<tr>
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<td>0.2 1)</td>
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<tr>
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<td>0.2 1)</td>
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<tr>
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<tr>
<td>320-6+</td>
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<td>0.04 2)</td>
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<tr>
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<td>GPS/GLO/GAL/BDS</td>
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<tr>
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<td>5</td>
<td>0.01+1ppm</td>
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<td>GPS/GLO/GAL/BDS</td>
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<tr>
<td>380-5+</td>
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<td>0.04 2)</td>
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<td>0.02+1ppm</td>
<td>GPS/GLO/GAL/BDS</td>
</tr>
</tbody>
</table>

All accuracy data is specified as RMS. 1) With 1 meter antenna baseline 2) With 4 meter antenna baseline 3) L1 only
KONGSBERG’s unique experience of providing world-class technical solutions for marine applications permeates everything we do. Through decades of close collaboration with customers, our skilled in-house team has developed an intimate understanding of the operational challenges they face, and the technology that can help them achieve their goals.

This knowledge has informed everything we do, allowing us to build true sector expertise and provide products that meet requirements, while surpassing expectations.

In-house expertise

KONGSBERG is committed to in-house innovation – creating technology that is custom-made to deliver outstanding performance in complex operations. By developing gyros, in combination with accelerometers and GNSS receivers in-house, our team has an intimate understanding of the capabilities of these crucial system components. This allows us to exploit them to their full potential, delivering better products, with optimum performance standards, for all our customers.

Sensor fusion

Over the course of the last 20 years, KONGSBERG has been working on closely integrating MRU Inertial Navigation System (INS) and Global Navigation Satellite System (GNSS) technology. This integration, together with sensor fusion technologies, has resulted in the Seapath and the DPS series of products. In these products, the company has successfully exploited the complementary nature of INS and GNSS technologies to create products that provide optimum results for position, attitude and heading.

Modelled to meet your requirements

KONGSBERG understands that every operation, in every vessel, is unique. To ensure that we have the technical solution that is right for you, we have developed a range of solutions within this area that deliver unparalleled performance for a variety of applications. This ‘product family’ encompasses everything from units developed for dedicated applications, to those that can be used in multiple applications on the same vessel.

World-class production standards

KONGSBERG is a global technology leader in terms of innovation, but also with respect to its first-class production standards – ensuring a level of consistency and reliability that meet the most exacting industry demands. Through a continual process of improvement, and a relentless focus on quality, we provide dependable excellence, in every product produced.
Seapath’s operator software is used for performance monitoring, configuration and system trouble-shooting. Installed on the bridge-based Operator Unit, with the option of installation on further units (located in a survey room, for example), it offers users a selection of views optimised for different operations, such as DP, hydrographic surveys and hydro acoustic positioning. The operator simply chooses the view that best suits the task at hand.

The Sky View allows users to see which satellites the Seapath is tracking and using, displaying them according to satellite geometry. The grey outer field represents the elevation mask. Satellites under the set elevation mask are marked grey. The satellite azimuth angle is shown in relation to a north-south axis. In each corner of the interface, the various satellite systems are marked, and number of satellites tracked respectively are indicated.

The Position Integrity view indicates the position integrity of the system position in accordance with the IMO requirements for positioning equipment, based on the RAIM exclusion and detection algorithm implemented. The integrity indication for different position accuracy levels is expressed in three states (Safe, Caution and Unsafe) according to the requirements. The different states are indicated on a vertical bar with the colours green, yellow and red.

An error ellipse forms part of the view, describing the position quality and the geometry of the position solution. The position accuracy level is configurable from the setup file (the value is displayed as the outer circle on the axis). Default value is 10 m.

The operator software spans the configuration of the system, the distance between its components, the location of the different measurement points, and the configuration of the input and output lines. The location of the various system elements and measurement points are shown graphically to ensure an easy and problem free installation.
LIFE CYCLE SUPPORT

Designed to purpose – maintained to last
Our life cycle management service will assist our customers throughout all the phases, from design to commissioning and during the operational life time. Solid in-house competence, both in system design and user competence enables us to provide solutions that are fit to purpose and thus yield efficiency in operation.

Our common base technology provides robust designs, with few and reliable parts, an excellent foundation to maximize the output at competitive costs. The distributed and open system design employs an industry standard communication network. Standard hardware components used for various applications and the open network approach results in:

- Increased reliability
- Competitive life cycle support
- Easy up-grade solutions

Evergreen
We offer continuous hardware and software upgrade to keep your vessel at maximum efficiency. Our system is designed with consistent boundaries between individual systems and control segments. This design strategy makes it easy to add new functionality or complete new control segments, enabling us to offer step by step upgrades to keep your system evergreen.

Training
Qualified personnel are one of your major assets in efficient and safe operations. Thus, we offer modular training courses for all major subjects – from operator training to technical training - helping you to build the competence of your crews.

Supported by professionals
Our systems are easy to install and maintain – supported by professionals either on-site or through remote connectivity. They are designed for optimal operational availability and allow for favourable lifecycle expenditure
GLOBAL CUSTOMER SUPPORT

We are always there, wherever you need us. Kongsberg’s customer services organisation is designed to provide high-quality, global support, whenever and wherever it is needed. We are committed to providing easy access to support and service, and to responding promptly to your needs. Support and service activities are supervised from our headquarters in Norway, with service and support centres at strategic locations around the globe – where you are and the action is.

As part of our commitment to total customer satisfaction, we offer a wide variety of services to meet individual customers’ operational needs. Kongsberg Support 24 is a solution designed to give round-the-clock support. For mission-critical operations, Kongsberg support 24 can be extended to include remote monitoring. We can adapt the level of support needs by offering service agreements, on-site spare part stocks and quick on-site response arrangements.

Global and local support
We provide global support from local service and support facilities at strategic locations world wide. Service and support work is carried out under the supervision of your personal account manager, who will ensure that you receive high-quality service and support where and when you need it.

Your account manager will ensure continuity and work closely with your personnel to improve and optimise system availability and performance. Under the direction of your account manager, and with a local inventory of spare parts, our wellqualified field service engineers will be able to help you quickly and effectively.

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