

## INTERVIEW WITH ERIK HAMMERSTAD, KONGSBERG MARITIME AS

# Technology for Hydrographic Purposes

Hardware (and to a lesser extent software) for the hydrographic survey industry is mostly developed by technical experts not educated as hydrographic surveyors. Nevertheless, manufacturers have come up with equipment that has broadened and hugely opened up the possibilities for hydrographic and oceanographic investigations. What is the link between hydrography, which still very much depends on field experience, and technological developments? Or how is technology directed towards the invention of usable and workable equipment for hydrography? Hydro international interviewed Erik Hammerstad, Senior Principal Engineer /Hydrography Subsea of Kongsberg Maritime AS Norway.

Please tell our readers something of your professional education and how you became involved in hydrography.

I hold the Norwegian equivalent of the MSEE degree from what was then the Norwegian Institute of Technology, now NTNU, in Trondheim, graduating in 1970 with a thesis on a microwave ferrite phase shifter. Before entering university I underwent officer training while doing my military service. After graduating I joined SINTEF, an industrial research institution affiliated to the university, working in the Radio Group and doing research on microwave networks and components. I was also involved in the development of phased antenna arrays, which turned out very useful for my later experience in sonar. After about twelve years at SINTEF I wanted something new. I therefore joined a start-up company, Bentech, which was to develop a high-resolution multi-beam echosounder. The company was located in TromsÅ, which was the hometown of my wife, so in a way I was driven into hydrography for her sake.

Could you describe the history of Kongsberg and Simrad? How and when did the two meet and merge?

Kongsberg has its roots in a state-owned weapons manufacturer established in 1814. After reorganisation in 1987 the company again became a weapons manufacturer only, but after the fall of the Berlin wall in 1989 the Group devised a strategy that involved devoting more attention to civilian markets. The company was listed on the Oslo Stock Exchange in 1993 and changed its name to Kongsberg Gruppen in 1995. During the 1990s several strategic acquisitions were made in the maritime electronics and systems sector. Considerable organic growth was achieved in maritime and defence activities alike during the same years. Consolidated operating revenues expanded from NOK581 (million) in 1987 to NOK6,439 (million) in 2004. Over the same period staff increased from 2,335 to 4,017 employees. Kongsberg has two main business areas, Kongsberg Maritime and Kongsberg Defence & Aerospace. About two-thirds of the Group's operating revenues are related to maritime activities, including products designed for defence and civilian markets.

Kongsberg Maritime delivers systems and technology for merchant vessels and offshore installations. Important markets include countries with significant offshore activities, and shipyards in China and South Korea. The Group also makes instrumentation for yachts and fishing vessels, especially in Europe and the USA. Emphasis is attached to exploiting the Group's shared technology platform to meet customers' needs for new products and applications. The business area enjoys leading positions in dynamic positioning, vessel automation, navigation, hydro-acoustics, simulators, communication, and information management.

Simrad was founded in 1947 with the aim of industrialising technology developed by the Norwegian Defence Research Establishment. The hydro-acoustic activity was moved from Oslo to Horten in 1957. The company's main hydro-acoustic products were fishery sonar and echo sounders, naval sonar, acoustic positioning systems and hydrographic echo sounders, but Simrad also expanded by acquiring companies such as Albatross, Robertson and Shipmate. The first hydrographic product, the EA 200 echo sounder was introduced in 1975 and the first multi-beam echo sounder, the EM 100, in 1986. Kongsberg acquired Simrad in 1996, and together with Norcontrol and Navia became the nucleus of Kongsberg Maritime. Today the Simrad brand is used by the daughter-company of Kongsberg Maritime that targets the Yachting and Fishery market, its hydro-acoustic products still mostly being supplied by Horten. The hydro-acoustic product units targeting the professional markets, including Hydrography, are organised by the Subsea division of Kongsberg Maritime. Today the hydro-acoustic activity represents about 10% of Kongsberg business.

How does Kongsberg Maritime obtain the necessary knowledge and experience to invent and develop hydrographic equipment?

The important thing is to have good contact with the user community and listen to their viewpoints. Such contact is of course mostly gained through marketing and sales, but also through the service engineers doing installations and repairs; some customers undergo system inspections at typically yearly intervals. Development engineers also come into good contact with users through participating in sea trials of new equipment, and when they sometimes join service engineers in solving difficult problems. Very useful for interchange of information between the hydrographic professionals and the developers are the FEMME (Forum for EM Mutual Experience) user conferences that are

held at approximately eighteen-month intervals. The last FEMME was held in Dublin last April with about 160 participants.

The parent Kongsberg organisation avails of many units, involved in maritime business. What is the synergy and how do you make use of the knowledge in other Kongsberg units?

There is a lot, but since hydro-acoustics is such a special field, most of the synergy I have personal knowledge of is through marketing which is very internationally oriented. For example a significant number of the HiPAP hydroacoustic positioning systems are sold as reference systems for the dynamic positioning systems from Kongsberg. Likewise many of the multi-beam echo sounders are delivered together with motion sensors and positioning instrumentation from Kongsberg Seatex. However, there are also regular meetings and communication among technical experts within Kongsberg, and especially with respect to use of software tools there is synergy within the whole organisation. Within the hydro-acoustic field in Horten and also with our sister companies in Canada and the USA there is much technical synergy. Ideas and subsystem development is shared between the product groups, and products from one group are often adapted by others to fulfill the requirements of other markets. Also in Horten there is a common technology development group.

You are not a hydrographic surveyor by origin. How do you personally maintain and upgrade your hydrographic knowledge in order to serve the demanding hydrographic market?

Mainly through two channels, reading relevant literature and talking to hydrographic professionals. The literature includes magazines, both professional journals and trade magazines, books, and what I can find on the internet.

What, if any, have been the far-reaching and costly career developments which for you finally appeared not to be usable or workable and had to be written off?

The high-resolution sonar development I was a part of in Tromsø, resulted in a technically fully working system but no commercial product. The sonar was originally conceived as an inspection tool, funding being provided by Norske Shell (it at that time being beneficial in obtaining oil-field leases from the Norwegian government). Norske Shell brought in technical expertise from Shell International in The Hague, Jean Riemersma (then head of Topographical Services) and C.D. Green (then head of Seabed Investigations) as advisers. They restructured the development to provide a potentially useful tool for Shell, with the sonar integrated in a towfish, an inertial platform for motion and position of the fish, an acoustic position system and a radio positioning chain. The result was the Benigraph system, which was practically fully operational as a prototype in 1986, proven through a survey of about 100km<sup>2</sup> of the Draugen field off mid-Norway, and the Troll field a year later.

The Benigraph was probably technologically too far ahead of its time to have been commercially successful. As an example, only 5% of the data gathered on the Draugen field was used for post-processing; the horizontal resolution of about 30cm was simply too much to be utilised. Only quite recently, through the Hugin AUV, have Benigraph capabilities been surpassed. It should be noted, however, that the engineers involved in the project gained a lot of knowledge and experience through it (my own hydrographic knowledge is very much due to the teachings of Riemersma and Green), and hence there was an intangible gain as a result.

What in your opinion is more important for the hydrographic community, software or hardware development? Please elaborate.

I find it impossible to differentiate between the two; both are required and they are quite dependent on each other. As an example, the move to wide-band multi-beam echosounders such as in the new Kongsberg EM 710 requires new transducer and electronics hardware technology, but also the implementation of new software and algorithms. Of course, for the post-processing of the acquired data and the making of the final products, such as charts, this could be seen purely as software; but then again the general advancement in computer power is also necessary.

What has been the impact of offshore oil- and gas developments in Norway on Research and Development in the hydrographic industry? Were there any hydrographic activities, apart from nautical charting, before that period?

The development of Kongsberg products such as the EM 100 multi-beam echosounder, the HiPAP acoustic positioning system and the Hugin AUV have all been supported by the oil industry to meet their needs. Statoil has been directly involved through both funding and assistance in field testing, and in specifying use of Simrad equipment for many of its surveys. Thus the oil industry has been a major driving force for the development of new instrumentation, although it is not necessarily a major user of the results. I personally do not know of any other hydrographic activity than charting before oil exploration started in Norway.

Apart from the oil & gas industry and nautical charting, what are the other offshore activities in Norway requiring hydrographic support?

Hydrographic mapping required by the UNLOS convention to set the boundary of the Norwegian EEZ is an example, and Kongsberg EM 12 and EM 120 operated by Gardline were the multi-beams used. Academic research on seabed characterisation, fishing-ground mapping and environmental assessment are other examples involving the utilisation of hydrographic support. An interesting inshore application is inspection of hydro-electric reservoirs.

From where and how do you recruit personnel for the research and development department in Kongsberg Maritime?

As far as I know, Kongsberg recruits in a normal fashion, i.e. mostly through advertising of job openings, but also through company presentations at the relevant educational institutions. There is also some recruitment through co-operative projects undertaken by the company together with academic and research institutions.

Do you have a message for junior people considering a career in hydrography?

Depending on what level they want to reach, I would say a good education is essential. To go into my field of work, instrumentation development, signal processing is perhaps the most important expertise, in addition to a good understanding of hydro-acoustics. New signal processing algorithms will, in my opinion, be the driving force in the design of future hydrographic instruments.

