

# The 1<sup>st</sup> International Hydrography Summer Camp 2007 in Germany

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**Key words:** education, hydrography, depth measurements, IHSC

## SUMMARY

Actually in Germany exists a problem to interest young people in study programs dealing with engineering. Complementary to a decreasing number of students we find an increasing need for hydrographic surveyors. In order to go into action against this development the first International Hydrography Summer Camp 2007 was carried out at the Lake Hemmeldorf. 15 students from Spain, Austria and Germany took part in the two-week course.

The course was addressed to all students dealing with geodesy/geomatics and related disciplines, preferential students from the 2<sup>nd</sup> study year and above. The course was held in English and German.

In terms of the project the students worked with a two frequency echo sounder, multibeam echo sounder, side scan sonar, subbottom profiler, and a magnetic sensor. The positioning was carried out with RTK. After a short introduction the measurements were processed self dependent from the students in the camp with the software products Qloud, WinProfile, and ISE. In order to get the direct contact to the manufacturer one part of the Camp was supported by Innomar (subbottom profiling, side scan sonar). Archaeologists from the State Archaeological Department of Schleswig-Holstein took a brief look at the results of the project and gave some insight into their work. Actually one student invests the results of the project in terms of his bachelor thesis. All together the participants obtained a short insight into hydrographic surveying and processing.

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## 1. INTRODUCTION

Actually in Germany exists a problem to interest young people in study programs dealing with engineering. Complementary to a decreasing number of students we find an increasing need for hydrographic surveyors. Several hundred of young hydrographic surveyors or academics with similar occupational competences are searched by dredging and surveying companies: but cannot be found.

In most cases students of in the field of geomatics, surveying engineering, geodesy, or related fields don't get in contact with hydrography. There may be short lectures in Hydrography in the field of, for example, topography or marine geodesy. However today's hydrographic surveyors need to have skills in high precision real time multi sensor systems working in kinematic applications, the processing and analysis of mass data and an appreciation to marine or other water related sciences. In order to get a deeper insight one should to take part in practical trainings.

Generally hydrography for itself can be seen as cost intensive comparing to most other surveying topics. Also building up and maintaining a study program in this field needs a lot of infrastructure like ships, people which take care of the ship and various sensors which are different from "normal" surveying instruments. The maintaining of this infrastructure could be the main problem by establishing hydrography at universities. Consequently students related to disciplines like Geomatics don't know much about the fascinating and ambitious tasks in hydrography.

In order to go into action against this development the first International Hydrography Summer Camp 2007 was carried out at the Lake Hemmelsdorf. 15 students from Spain, Austria and Germany took part in the two-week course. The course was addressed to all students dealing with geodesy/geomatics and related disciplines, preferential students from the 2<sup>nd</sup> study year and above. Lectures were held in English and German.

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## **2. M.SC. HYDROGRAPHY AT THE HAFENCITY UNIVERSITY HAMBURG (HCU)**

Why Hamburg takes care of hydrographic studies? The harbor of Hamburg and the German coasts offer a lot of sophisticated tasks in the field of Hydrography. Professional education in Hydrography has a more than 20 year old tradition in Hamburg, Germany. In 2000 a new curriculum was established at the HUAS, offering studies in Geomatics with 8 semesters and a master program of 4 semesters in “Hydrography”. It was possible to combine modules from the diploma studies with the master program, so that the diploma in Geomatics and the Master of Science in Hydrography could be reached in a total of 5 years. The Master of Science Program “Hydrography” has been re-certified by the IAB of the FIG/IHO at Category-A in 2001.

In January 2006 the Department of Geomatics has been moved from the Hamburg University of Applied Sciences (HUAS) to the HafenCity University (HCU) Hamburg, founded by the Federal State of Hamburg. The HCU starts with the advantage of already well-established departments (architecture, civil engineering, geomatics, urban planning) coming from the Technical University, the University of Arts and the University of Applied Sciences, all of them located in Hamburg. With its Master of Science Programme in Hydrography, the Department of Geomatics is still the only academic institution in Germany offering a two-years postgraduate program which is certified according to the “Standards of Competence of Hydrographic Surveyors” by the IAB of FIG/IHO at category A.

For security reasons each professional training location for Hydrography has to fulfil special requirements, namely the Standards of Competence for Hydrographic Surveying of the International Federation of Surveyors (FIG) and the International Hydrographic Organization (IHO). The Standards of Competence distinguish two different levels for the quality of education, Category A and Category B. The higher Category A courses are defined as follows:

A programme which provides a comprehensive and broad-based knowledge in all aspects of the theory and practice of hydrography and allied disciplines for individuals who will practise analytical reasoning, decision making and development of solutions to non-routine problems.

Category B courses are directed to less qualified staff. The certificate has to be renewed every 10 years. In 1990 the International Advisory Board (IAB) of the FIG/IHO certified the consecutive studies “Hydrography” in Hamburg at the highest level: Category A (Academic).

From the 1<sup>st</sup> through the 4<sup>th</sup> semester in the Bachelor course Geomatics at the HCU there are courses that are compulsory. For example, all Geomatics students in Hamburg have to enrol in Hydrography I. The course (2 h) aims to give a basic understanding of and a first insight into hydrography.

The master course covers modules such as Hydrography (Basics, I, II, III), Higher Geodesy, GIS-Hydrography, Data Processing, Navigation, Marine Geology/Geophysics, Fundamental Oceanography, Marine Environment, Software Technology, Practise, Project, and ends with the Master Thesis. In total 120 credit points are possible. Normally students in the master course should absolve 24 hours a week. Details are shown in Fig. 1.

Sem.	A	CP	B	CP	C	CP	D	CP	Σ CP
M 4	<b>Project</b> Field of Marine Engineering Geomatics Project Management	9	<b>Elaboration of Master Thesis</b> 3 Months		<b>Final Examination</b>			21	30
M 3	<b>Marine Geology/Geophysics</b> Geology/Geomorphology Basics Subbottom Profiling Seismics Magnetics	8	<b>Fundamental Oceanography</b> Physical Oceanography Tides	7	<b>Marine Environment</b> Oceanography Marine Weather Legal Aspects	7	<b>Software Technology</b> Object-Oriented Programming Project: Digital Cartography	8	30
M 2	<b>GIS Hydrography</b> Desktop Mapping GIS-Projects: e.g. Coastal Zone Management	7	<b>Hydrography III</b> Sonar Systems with Area Coverage Hybrid Hydrographic Measurements Digital Terrain Model (DTM)	9	<b>Navigation</b> Nautical Science Traffic Control Systems Electronic Chart Display Integrated Navigation	7	<b>Practice</b> Supplementary Field Training (3 Weeks) Quality Management	7	30
M 1	<b>Data Processing</b> Interface Technology Data Acquisition Basics on CARIS	6	<b>Higher Geodesy</b> Mathematical Geodesy Physical Geodesy Gravimetry	7	<b>Basics Hydrography</b> Remote Sensing Applied Mathematics II Hydrography I	8	<b>Hydrography II</b> Basics Underwater Acoustics Acoustic/Parametric Systems Determination of Position and Water Depths	9	30
Sem.	A	CP	B	CP	C	CP	D	CP	120

CP: Credit Points

**Fig. 1:** Study program M.Sc. Hydrography at the HCU

Additionally, the students in Hamburg can make use of the possibilities to absolve a practical training in the near-by institutions, dealing with hydrography or bathymetry. For example, such as the Federal Maritime and Hydrographic Agency of Germany (BSH), the Alfred Wegener Institute (AWI, Bemerhaven), the Hamburg Port Authority (HPA) and various companies.

According to the IHO Special Publication S-47 (March 2006) approximately one hundred courses in Hydrography, Nautical Charting, and Marine Sciences – lasting from one week to five years – are offered worldwide. Only 41 from approximately 100 courses in Hydrography, Nautical Charting and Marine Sciences are recognized as Category A or Category B courses according to the “Standards of Competence for Hydrographic Surveyors” of the FIG/IHO/ICA International Advisory Board IAB. There are 21 Category A courses and 20 Category B courses, including the ones with a pending submission (list of July 2007). Only 10 Category A courses are English spoken.

### 3. LAKE HEMMELSDORF –SEARCHING THE DEEPEST POINT IN GERMANY?

Lake Hemmeldorf is located 15 km northwest from Luebeck and 5 km south from Timmendorfer Strand, a tourist beach at the Baltic Sea. The lake offers interesting aspects:

- the sea bottom hides the deepest natural point on the mainland of Germany;
- possibly archaeological sites (Slavonic settlement); and a
- nature reserve.

Asking surveyors for the deepest point in their country one will normally think of locations near the coast or in valleys. Only a few take the land below the water surface into consideration. Lake Hemmeldorf is not the deepest lake in Germany (40 m). But located near the Baltic Sea the water surface is near the mean sea level. Consequently the deepest point inside the lake is around 40 m below the mean sea level. For example Lake Constance is round about 250 m deep but the water surface is 400 m above mean sea level: so the deepest point of this lake is 150 m above mean sea level. To understand this relationship and to consider that there is a bottom under the water surface with quite a lot unknown and more or less not visible information was the first topic to be taught.

Lake Hemmeldorf consists of two parts: the northern part with the small creek Aarbek as a connection to the Baltic Sea holds depths up to 6 m and has a lot of rocks under shallow water. The southern part falls rapidly into a depth of 40 m. Unfortunately in summer time the sea bottom in the southern part is filled with gas. Gas is the best reflector for hydroacoustic waves, so that it was not possible to look deeply inside the sediments of the lake. Parts of the lake in the northern part are under protection as a nature reserve.

In the last century fisherman found an old log-boat inside their net. Archaeologists classified this object as a Slavonic vehicle. The island “Möweninsel” inside the lake shows an ancient settlement and relicts of wooden bridges were found. Additionally one interested private person suspected a Viking city (Reric) near this area. Napoleon planned to build a harbour in this location and his surveyors took first depth measurements. In the 2<sup>nd</sup> World War parts of the lake were used for the landing of floatplanes. Additionally it was planned to build a submarine harbor. From these points of view an investigation of the topography, sediments and magnetic signals in the lake seems to be interesting. The longer the camp stays at the lake the more theories and rumors about sunken military aircrafts and cars occurred.

Fortunately a group of Scouts in the little village Offendorf/Ratekau offered a hut direct at the lake (Seepfadfinderstamm “Dwarzlöper”, thank you very much for the warm welcome!) where some of students could sleep for a very small amount of money, with a kitchen and a place for our computers for the postprocessing. Next to the hut the participants could use natural baths with shower. Some of the students stayed in relatively cheap vacation homes.

#### 4. EQUIPMENT

The measurements were carried out onboard the survey craft LEVEL-A of the HCU: With the length of 7.5m and a draft of less than 50 cm the boat is optimized to operate in shallow water. The LEVEL-A is mainly used for education and research purposes (see fig. 2). The Northern Institute of Advanced Hydrographics GmbH (NIAH) manage the boat and the equipment. The NIAH has been founded as a public private partnership between the HCU as the owner of ship and equipment, and the companies Innomar and Vermessungsbüro Felshart.

The outstanding equipment installed onboard of LEVEL A offers best conditions for practical exercises: RESON Multibeam SeaBat 8101, INNOMAR Parametric Sub-Bottom Profiler SES-2000 fan incl. Side-Scan, IxSEA motion sensor Octans III, GNSS-Javad-Gyro-4 (GPS, GLONASS), Marine Magnetics Mini Explorer, RESON Sound Velocity Probe SVP 15 and other instruments. Software packages as PDS 2000, QPS Qinsy and Qloud, WinProfile, ISE for SES-2000, Geo++ ® GNNET-RTK and CARIS HIPS/SIPS/GIS are available for survey planning, measuring, and data analysis.

Despite the high accuracy of all used sensors (position, heading, heave, roll, pitch and sound velocity), the main problem is to integrate these complementary sensors with the sonar systems with reference to timing and their relative locations to obtain reliable Digital Terrain Models (DTM). The data delivered by the IMSS components (GNSS-Javad-Gyro-4, Motion Sensor OctansIII, IMU Inertial Measurement Unit) are integrated by the software GNNET-RTK developed by Geo++ GmbH, Garbsen.



**Fig. 2:** HCU survey craft LEVEL-A for training, research and special purposes (Photo: Prof. P. Andree)

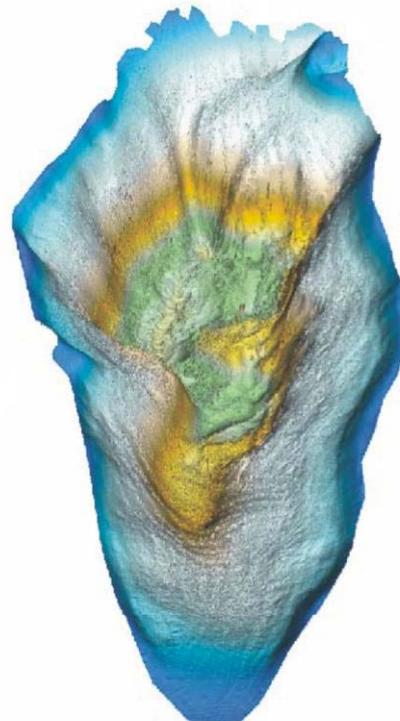
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## 5. SOME RESULTS

The deepest point was temporary marked with a buoy (see figure 3). Fig. 4 shows the interesting morphology of the southern part of the lake with the deepest point 39,60 m below MSL measured with a frequency of 240 KHz. Depending on the used measuring frequency different results can occur for the depth. Deep frequencies with maybe 13 KHz normally penetrate deeper into the sediment or suspension. One can discuss which should be the definition of the 'deepest point'.

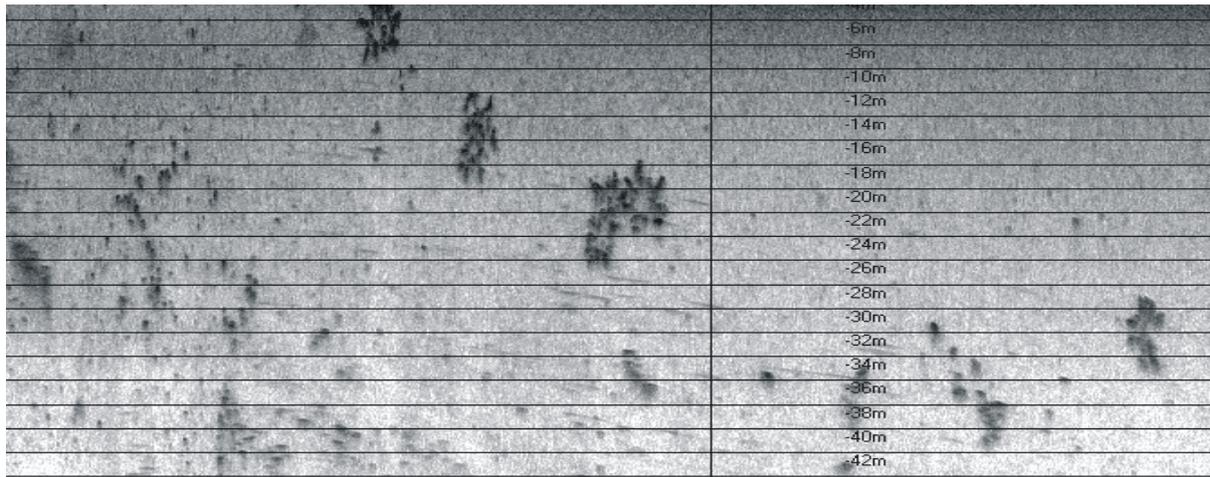


**Fig. 3:** Temporary marking the deepest natural point on the mainland of Germany.



**Fig. 4:** Southern part of Lake Hemmeldorf , measured with Reson SeaBat 8101.

Figure 5 shows some interesting structures in the depth of 1.5 m. These structures could be manmade. In this case researcher can combine the age of the structure with the height of the waterline in this period in order to find out interesting coherences.



**Fig. 5:** Possibly accumulation of stones in the lake; side scan view with Innomar SES2000.

However the best result was the outstanding success of giving an idea of hydrography to all participants.

## 6. CONCLUSIONS AND ACKNOWLEDGEMENT

I like to thank all who contributed to the success of 1<sup>st</sup> International Hydrography Summer Camp 2007: and this is a long list. The IHSC was sponsored by the German Hydrographic Society (DHyG) and the “Fördererverein der Geomatik an der HafenCity Universität Hamburg”. The company QPS gave multiple temporary version of the processing Qloud, Innomar helps with additional licenses for ISE. The Archaeologists from the State Archaeological Department of Schleswig-Holstein and other institutions in the State of Schleswig-Holstein, especially in Ratekau helped clearing the formalities and gave information about the nature of the lake. Inhabitants of the nearby villages, especially the “Dwarslöper”-Scouts, the tenant of the lake, the fisherman Liebe, and the fisherman Schierbaum helped us in many ways. The steermen Harro Lüken and Conny Lohmann, the assistants Axel Wrang and Arne Sauer and Jens Lowag from Innomar Technologies supported teaching, measuring and processing. And in particular I like to thank all participants of the summer camp, most of them can be seen in figure 6. Thanks.



**Fig. 6:** Participants of the 1<sup>st</sup> International Hydrography Summer Camp 2007

**The 2<sup>nd</sup> International Hydrography Summer Camp 2008 will take place in the very northern part of Germany from the 18<sup>th</sup> till the 30<sup>es</sup> of August 2008 in Schleswig at the Schlei. On the traces of an old Viking city Hedeby we are searching for wrecks and structures under the water surface.**

## **BIOGRAPHICAL NOTES**

**Volker Böder** graduated in geodesy from the University Hannover in 1994. His doctoral thesis from 2002 is about the precise positioning and attitude determination in marine applications. He received his Assessor Degree from the Government of the Federal State of Lower Saxonia in 2005. Since 2005 he is professor for practical geodesy and hydrography at the HafenCity University, Hamburg.

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