Hydrography and its Education

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1. Introduction

No one will deny if we say that the sea or ocean part of the earth is going more and more important in the next future.
Talking about sea or ocean we have to talk about hydrography.

According to the United Nations Group of Experts on Hydrographic Surveying and Nautical Charting, formed by the United Nations at the Second United Nations Regional Cartographic Conference for the Americas, in Mexico September 1979, has been expressed that :

> Hydrography may be defined as the science of measuring and depicting those parameters that are necessary to describe the precise nature and configuration of the seabed, its geographical relationship to the landmass, and the characteristics and dynamics of the sea.

From the history of hydrography we know that bathymetry map as a result of hydrographic surveying mostly use for navigation, and according to the development of science and technology the use of hydrography not more only for navigation but it is used also very important for the exploration and exploitation of marine resources, and other activities.

2. Relation between Hydrography and Geodesy/Surveying, Education and Accreditation.

According to the classical definition :

- Geodesy, which mean “I divide the earth”, is a science of measurement and mapping of the earth’s surface.

G.L. Hosmer in his book “Geodesy”, defined geodesy as follow :

- Geodesy is a science which treat of investigations of form and dimensions of the earth’s surface.

If we see the definition of hydrography from U.N. Expert and compare to the definition of geodesy above, we come to the conclusion that hydrography is a part of geodesy.

If we compare curriculum of hydrographic and geodesy/surveying educations in many countries we can see so many overlapping in both curriculums. David Wells figured nicely the relation between Hydrography and another scientific fields, which mainly lectured in geodetic education (See Attachment 1). At least 60 % of the hydrographic and geodesy/surveying curriculum are mostly the same. That’s why in some countries hydrographic education can be attached to the geodesy/surveying education, at least as specialisation in geodesy/surveying.
Talking about hydrography education, although there are more than 100 coastal states on the world, but less than 15 countries which already have education in hydrography and not all of them have university level.

To maintain the quality of hydrography globally, FIG and IHO formed a FIG/IHO International Advisory Board on Hydrographic Education. The Board has 8 (eight) members, which consist of 4 (four) members from FIG and 4 (four) members from IHO.
The Board meets once a year to evaluate and acreditate hydrographic education from all over the world. University Hydrographic Education can be acreditated as Academic Acreditation in Category-A.

3. Hydrographic Moduls

There are three main modules in hydrography, namely positioning, sounding and tide.
Talking about positioning one already touch the field of geodesy, because we have to talk about reference system, datum, projection, cartography, e.t.c. Modern satellite positioning system such as GPS (Global Positioning System) is widely use for positioning in hydrographic survey. As we already know if height determination using GPS, we have to take into account the undulation as the height from GPS observation refer to ellipsoid.

The objective of sounding work is to measure the depth of sea bed and operationally refer to the sea level. The problem is that sea level change continuously from time to time. That's why we have to look for a reference surface where all measuring depth to reduce to. Practically all measuring depth must be reduced to a common surface, normally Mean Sea Level (MSL); that's why we have to observe the position of sea level continuously (tidal observation). There are several methods to make tidal observations, from the simple one to the modern methods. There are two popular types of instrument normally used in practice for the tide observation, namely floating and pressure types of instrument. In practice one use MSL as geoid but we all know that MSL is not geoid. Geoid is an equipotential surface while MSL not. As MSL is not an equipotential surface, Lisitzin introduced "Sea Slope" terminology to express that two points on the MSL are located not in one equipotential surface. The distance between MSL and geoid is normally called as Sea Surface Topography (SST).

4. Geodetic Aspects on the Law of the Sea (GALOS)

In 1982 the United Nations Convention on the Law of the Sea, known as UNCLOS III, was signed in Montego Bay, Jamaica and enter into force in 1994. Actually the activity of the United Nations to produce the Law of the Sea started already in 1973; that's mean it's need 9 years to realise the UNCLOS III. In the UNCLOS III sea part of a coastal states is divided mainly into Territorial Sea (12 miles) and Economic Exclusive Zone (EEZ) (200 miles). According to the UNCOLS III, there are many countries has big sea area belong to them. In the book of "Ordering the Ocean" (See Attachment 2) there are fourteen lucky countries with the largest 200 miles zone.

Why the United Nations forced to produce the convention ?

In literature we can read that the sea area of the earth is very rich in natural resources. As technology is develop rapidly that make it possible to explore natural resources even in the offshore. As a consequence the competitive to claim sovereignty on the sea area will be very serious. That's why to order the sea/ocean is very urgent. W. Friedman in his book "The Future of the Ocean" tried to divide the ocean.

As a response to the application of UNCLOS III, in 1990 International Hydrographic Organisation (IHO) produced "A Manual on Technical Aspects of the United Nations Convention on the Law of the Sea - 1982". After he read the Manual, Petr Vanicek arranged a discussion with some geodesists who attended a conference in Miami (USA) in 1990. As the conclusion in the meeting, a geodetic conference to discuss geodetic aspects on UNCLOS III was recommended to be held in Bali 1992, called "First International Geodetic Aspects on the Law of the Sea (GALOS) Conference". Four year later (1996) the second GALOS Conference has been held in Bali again.

5. Hydrography as a science

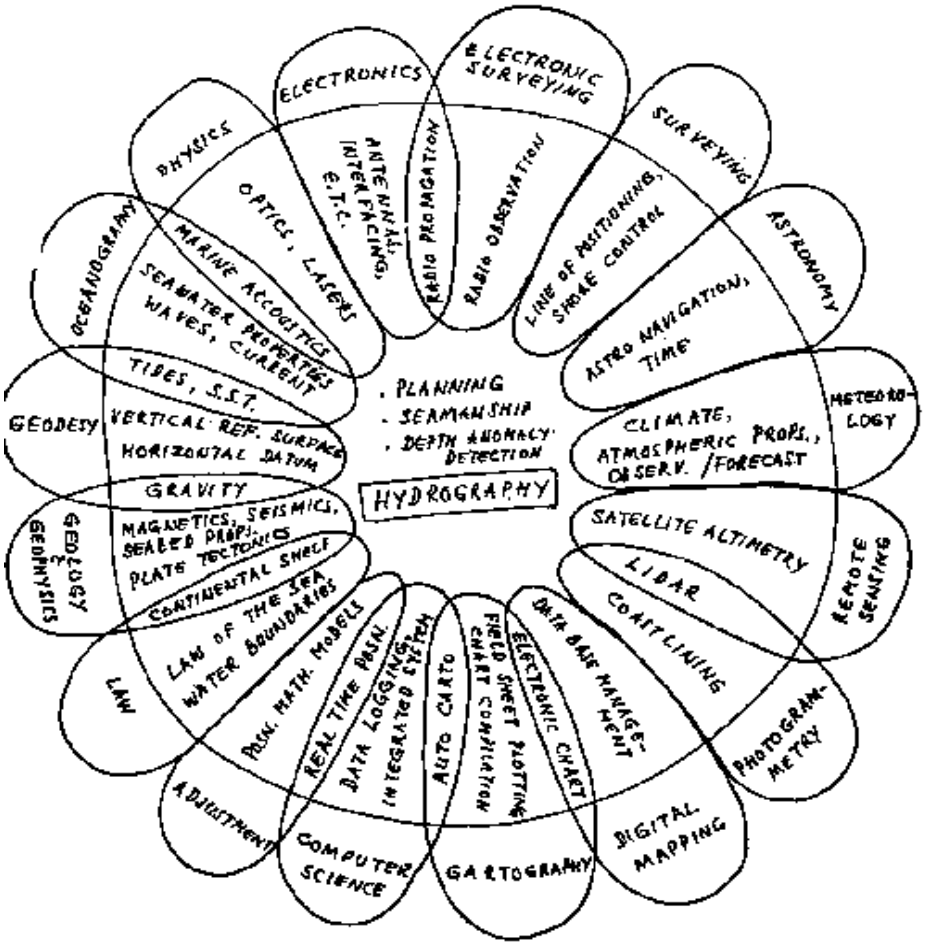
As already mentioned above hydrographic activity shows improvement every year, not only in the routine work done by Hydrographic Office in each countries, but also in the engineering works, especially because of high technology development for mining activity in the offshore.

The existence of FIG/IHO Advisory Board for Hydrographic Education, makes sure that quality of hydrographic works done by the surveyors produced by the accredited education institutions fits the international standard. There are not so many educations involved in producing man power for hydrographic works. That's why most of the hydrographic institutions such as Hydrographic Office in each countries established their education and training by themselves to fulfil their need in hydrographic surveyors.

There are people who still see hydrography as only applied science which can be studied in the form of short course and training, while hydrography actually contains many scientific aspects and problems to be studied and developed. Should we let hydrography only as a normal engineering work ? Don't we want to see hydrographic scientists create new methods and technology in the field of hydrography ? To response that matter, higher education institutions should open hydrographic study program in all level of educations such as undergraduate and postgraduate programs. Actually there are already some universities offer hydrographic programs but the amount are not enough to meet a demand.

It's necessary to change the way to see and understanding hydrography by most people, not to see the side of engineering only, but it should be balanced to see hydrography as a science. We hope in the future the development of hydrography as a science will be increasing, so it can participate in many applications. In connection to this matter, maybe FIG/IHO Advisory Board for Hydrographic Education could participate in developing the idea of hydrographic higher education in University level much more than we have seen now. Universities which have already Surveying and/or Geodesy study programs, should put their attention not only to the land dimension only, but they should pay attention also to the sea. In fact, it can be the new area for them to work on.

Could we imagine universities all over the world have hydrography study programs in all levels to graduate M.Sc. and Ph.D. in the field of hydrography. To realise the idea, it's needed to increase the contacts to the universities, so the universities have better understanding about hydrography, and eventually develop hydrography education in each their universities.



RELATIONS BETWEEN HYDROGRAPHY AND ANOTHER SCIENTIFIC FIELDS
(David Wells, 1985)

The fourteen lucky countries with the largest 200-mile zones.