A CAREER IN HYDROGRAPHY: THE INTRICACIES AND ITS MAKE-UP

A paper Presented

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ORDER OF PRESENTATION

- **Introduction**
  - -Definitions
  - -The Hydrographer
  - -Tasks of Hydrographic Surveyor
- **Scope of Hydrography**
  - -Procedure /Measurements
  - -Instrumentation
  - -Specialization
- **Training and Regulations**
  - -Education program
  - -Educational Institutions
- **Professional Organizations**
  - -International Organization
  - -National Organizations
- **Relevance/Application of Hydrography**
- **Career / Employment Opportunities**
- **Challenges**
- **Prospects**
- **Conclusion**

INTRODUCTION

The issue of career choice and specialization is usually very challenging to young school leavers and aspiring career makers in fields of broad specialization.

In surveying where core specializations co-exist with current Geoinformatics sub-fields and where the science continue to develop, there arise a need for a document that states precisely the pros and cons of Hydrography to serve as a guide to aspiring and up-coming career makers in the geomatics world.

In this presentation, the content, prerequisite, prospects and challenges of hydrography are spelt out. Besides, the basic trait for a potential hydrographer, training and educational prerequisite of the discipline are also laid out.

Definitions

-Hydrography is "the branch of applied sciences which deals with the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defense, scientific research, and environmental protection" (IHO, 2012).

- A career is the sequence and variety of occupations which one undertakes throughout a lifetime, it includes life roles, leisure activities, learning and work (Dept. of Education, Training and Employment- State of Queensland, 2004).

- A career in hydrography involves series of activities that involve measurement, description and presentation of variety of characteristics of water bodies and usually carried out in a wide range of differing marine situations and applications.

The Hydrographer

- Professionally, the hydrographer is a person who has
  - an aptitude for working with numbers
  - tenacity to cope in extreme temperatures
  - capability for working in dynamic, cramped & challenging environments
  - ability to work for long period of time

- He is expected to have
  - skills in seamanship and safety
  - potentials for good vision, detail orientation & accuracy

- Educationally, the hydrographer must

  - have broad knowledge in sciences such as physics, mathematics, geography, engineering, technological designs, electronics and computer applications

  - have a view to acquiring professional training and vocational skills in navigation, global positioning and geographic information system

"A vision of adventure and discovery 'may' attracts thousands to marine sciences {Hydrography}, so 'but' dedication is required to ensure career fulfillment."

... Richard Harrington
Marine Conservation Society

TASKS OF THE HYDROGRAPHIC SURVEYOR

The Hydrographic Surveyor:

- measures, describes and map variety of water bodies e.g. rivers, lakes & oceans, etc.
- undertakes maritime boundary delineation and delimitation
- surveys and charts waters for navigation, dredging and construction projects, submerged pipeline and cable laying
- determines water depth and measures tide and current.

The Hydrographer is responsible for producing a number of nautical publications such as:

- nautical charts
- sailing directions
- instruction to mariners
- bathymetric maps
- tide and current tables, etc.

. . . . (The Association of Ontario Land Surveyors)

PROCEDURES / MEASUREMENTS

Measurements in Hydrography ranges from depth measurement and position fixing to maritime delimitation and delineation viz a viz:

- **Depth measurement and position fixing**

Sounding; determination of positions of points, aids and structures such as hills, lights and towers, etc.; bathymetric surveys for depiction of coastal configuration.

- **Geophysical Survey**

Determination of the geologic properties of the ocean constituents and sea bottom composition for anchoring, undersea construction.

- **Measurement of water current, tides and waves**

… current metering - determination of rate and direction of flow of water current.

….tide and wave observations - measurement of water level fluctuations for determination of heights and water levels e.g. MSL.

- **Maritime delimitation and delineation**

Determination and description of the extents, boundaries, and limits of maritime zones/spaces for purpose of exercising rights in maritime space and resource exploitation and development e.g. EEZ

- **Marine Cartography**

….representation of measurement results as graphs, tables, chart (electronic and manual), thematic maps and manuals.

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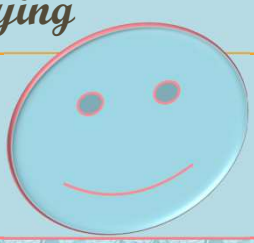
Hydrographic Surveying



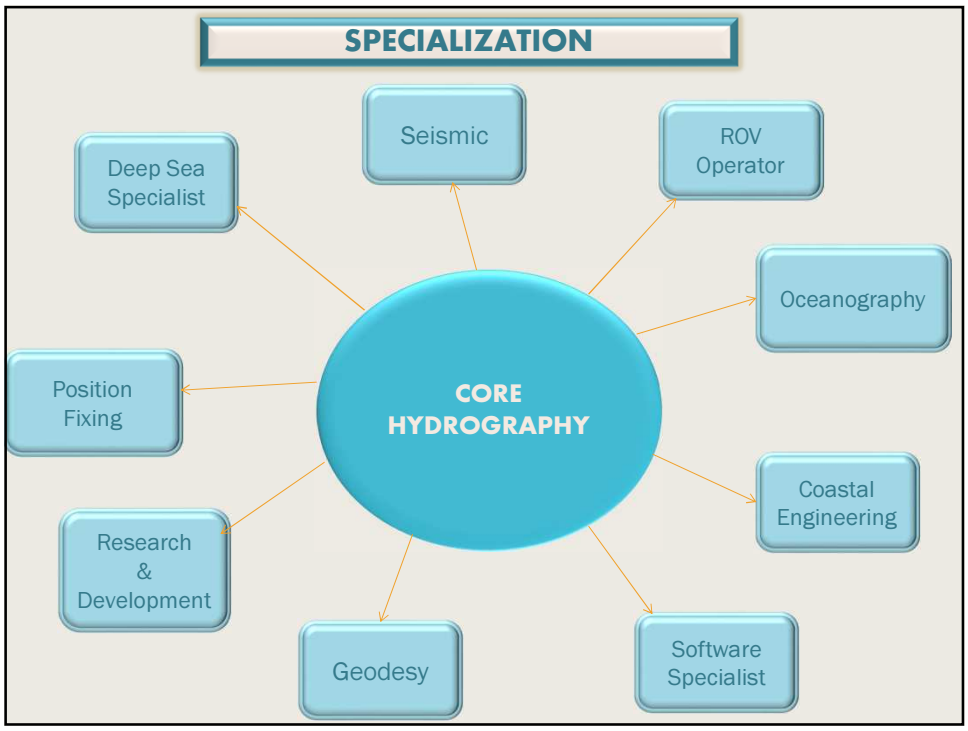
"looks" into the ocean to see & depict what it looks like

United States Office of Coast Survey

INSTRUMENTATION

- **Sounding** - sounding poles, lead lines, multi-beam and swath sounding systems, multi-beam and angle-discriminating sonar, speed of sound profiler, echo sounder, bathymetric LIDAR instrument, etc.
- **Positioning/Direction** - sextant, theodolite, total station, EDM and GPS instruments
- **Time** – Stopwatch, Mechanical Chronometer, Electronic Chronometer GPS/GNSS,
- **Tides** - tide pole, tide staff, tidal gauge, etc.
- **Currents** - current meter, Acoustic Doppler Current Profiler (ADCP), rotary/ electromagnetic ultrasonic flow gauge, etc.

- **Samples** - Autonomous Underwater Vehicles (AUV), Remotely Operated Vehicles (ROV), grabs, barges, drogues, sediment sampler, corer, high resolution boomer, dredgers, pressure actuated meter , etc.
- **Surface/ Sub-surface Temperatures** - can be measured from space by satellites that record infrared radiation received, thermometer
- **Gravity -** gravity corer, magnetometer
- **Survey Vessels / Survey Boats**
- **Software** – specialized and 'instrument based' e.g HydroCAD, HYPACK, etc. for data collection, application of removal of outliers, plotting of field sheets, creating of mosaics, charts and exporting and presentation of data.



BENEFITS/APPLICATIONS OF HYDROGRAPHY

- **Marine Resource Exploration and Exploitation**
  - water .. water volume, depth, direction of flow and discharge are used in conservation and taping for domestic, agricultural and generation of hydropower.
  - mineral oil and gas, sands, gravels…location, quantity, seabed configuration, characteristics of regimes are used for siting of oil well , positioning of drilling rig & location of access route
  - fishes…location of wrecks ,maritime limits, forbidden zones & ocean regimes are harnessed in fishing expeditions.
- **National Spatial Infrastructure -** Bathymetric survey data and other marine related spatial data serve as vital data in national spatial database.

- **Marine Science**
  -bathymetric information for: deployment of scientific instrument; seabed classification, habitat mapping, environmental impact assessment.

  -deep sea explorations/seismic data provide information on: geographical shifts and seafloor spreading, prediction of geologic activity e.g underwater volcanoes
- **Maritime Delimitation and Delineation**
  - territorial sea baseline .. boundary definitions of Territorial Seas, Exclusive Economic Zone (EEZ),and the continental shelf
  - thalweg ..maritime boundaries between countries.

- **Coastal Zone Management and Engineering**
  - bathymetric chart, - nautical chart, - acoustic pictures, - seabed profiles and - sonar pictures are used in dredging and marine construction, environmental monitoring and protection.
- **Defence and National Security**
  - baseline information such as point coordinates, marine zones and boundaries are used in submarine mines and amphibious operations by the Navy against terrorism, piracy, in decision making that ensure national and international security.

- **Tourism** - Hydrographic measurements provide data for navigational direction, boating restriction, location of channel, coral reefs and area with scenic characteristics
- **Recreational Boating-** Hydrographic surveys provide data on shore lines, soundings characteristics of bottoms, areas subjected to Suring and silting, depth available for navigation and velocity as well as characteristics of flow of water, location of lights rocks, sand ball and buoys, etc.
- **Maritime Transport/Navigation**
  - nautical/navigational charts…show dangers and aids to navigation used to define courses and locate channels

EDUCATION & TRAINING

The FIG/IHO/ICA International Advisory Board on Standards of Competence (IBSC) for Hydrographic Surveyors categories training programmes in hydrography into:

Category "A" Programme

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

Category "B" Programme

a practical comprehension of hydrographic surveying for individuals with the skill to carry out the various hydrographic surveying tasks.

Unclassified Programmes

a training program for support personnel employed in hydrographic operations. – defined according to local requirements and are not intended for international recognition (S-5, 2011).

Scheme

system of review, assessment and recognition of an individual to ensure that he/she possess the relevant and up to date competencies to perform the role of a Surveyor at the appropriate level.

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EDUCATIONAL INSTITUTIONS

At the international level, institutions offering hydrography recognized and accredited by IHO include amongst others;

- RAN Hydrographic School, Balmoral Australia
- Royal Naval Hydrographic School, Plymouth UK
- National Institute of Hydrography GAO, India
- L'ecole des Hydrographes, France
- University of New Brunswick, Canada
- US Naval Post Graduate School Montery, USA
- The Hydrographer SA Navy, Republic of South Africa, etc.

At national levels, countries establish institutions and also set the entry requirements/standards and educational levels of the respective institutions and countries.

In Nigeria, Surveying and related courses that lead to specialization in Hydrography are offered at three levels of institutions (Fajemirokun et. al. 2002). The institutions are:

University
- University of Uyo, Uyo
- University of Lagos, Lagos
- Ahmadu Bello University, Zaria
- Federal University of Technology, Minna

College of Technology/Polytechnic
- Nigerian Institute for Oceanography and Marine Research
- Rivers State Polytechnic, Bori

Technical College
- Federal School of Surveying, Oyo
- Maritime Academy, Oron

At post graduate level, institutions offering hydrography include:-
- University of Lagos, Lagos
- University of Nigeria, Nsukka
- Nnamdi Azikiwe University, Awka

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PROFESSIONAL /REGULATORY ORGANIZATIONS

IFHS

is an international umbrella organization for both individual and corporate hydrographic communities that foster the establishment and growth of new national societies.
The IFHS provides a global platform for promoting free exchange of information between members and related disciplines.

IHO

an inter-governmental consultative and technical forum with the objective of coordinating the activities of national hydrographic offices and fostering exchange of technical and nautical information among nations

FIG Commission 4

is a commission of the FIG involve with hydrography. The commission promotes the aims and objectives of FIG to Hydrographers,
Foster closer links with all sister organizations.
Disseminate information relevant to the profession.

Terms of reference includes ; hydrographic surveying;
Hydrographic education, training & CPD;
Nautical charting & bathymetric maps…; etc.

At the national level several national hydrographic organizations exits. Some include:

- Nigerian Hydrographic Society (NHS)
- Australian Hydrographers Association (AHA),
- Canadian Hydrographic Association,
- The Hydrographic Society of America (THSoA)
- German Hydrographic Society (DHYG), etc.

National organizations that embodies specialist across the surveying profession including hydrography include amongst others:

- Nigerian Institution of Surveyors - Nigeria
- Royal Institute of Chartered Surveyors - London
- The Institution of Surveyors - Australia

CAREER / EMPLOYMENT OPPORTUNITIES

Oil and Gas Industry: In oil and gas exploration, the hydrographic surveyor is employed to undertake deep seismic research, drilling rig survey and emplacement, pipeline survey and construction.

Boundary Commissions: National and International maritime boundary delineation and delimitation,

Military : Hydrographers have relevance in the Military

Educational/Research Institutes: equipment and software development, academic research and studies

Freelance surveying and consultancy is also a sector of high career prospect

Utility & telecommunications Companies, surveyors map the peaks, valleys, and obstructions on seafloors for laying of communications lines.

Environmental Monitoring & Protection. EEZ and coastal zone management, environmental studies, dredging projects and shipwreck recovery, nautical and navigational charting.

Public Sector

- National Hydrographic offices
- Port Authorities

Private Sector

- surveys for marine exploration and mining
- offshore dredging/ constructions
- sensor and software technology
- nautical charting

CHALLENGES

The hydrographic profession is faced with challenges ranging from work environment, instrumentation, expertise as well as the optimum means of upholding high standards on practices, education and training.

Work Environment: It is pertinent to state here that the environment in which hydrographic measurements are carried out is a dynamic one and this usually leads to repeated measurements, observations.

Inadequate Personnel: Despite the expansion in data usage and applications, there has not been a parallel increase in trained personnel thus making the profession under staffed.

Educational Institutions: Low number of educational institutions training in hydrography, number of students applying for the course, high cost of training and education (Armstrong et al, 2012).

Financial Constraints: Although hydrographic equipment and survey vessels are witnessing a tremendous development and advancements in recent times, they have high capital and operating cost thus posing a major financial challenge to the growth of the profession.

PROSPECTS

- Despite the challenges, developments in hydrography is far from complete as prospects abounds in different areas.
- **Review of Standards:** International Advisory Board on Standards of Competence for Hydrographic Surveyors is in the process of reviewing the S-5 to cater for challenges in hydrography and nautical cartography. The review is expected to be completed by 2014 (Armstrong et al, 2012).

  The IHO is undertaking the release of new Hydrographic Geospatial Standard for Marine Data and Information (S-100). This together with its supporting geospatial information infrastructure (GII) is to take care of the ENC and any subsequent IHO data transfer standard (Ward, et al 2009).

➢**Advancements in data acquisition and processing:** Advancements in instrumentation and measurement technology such as multi beam, multi channel acoustic and laser systems augmented with the availability of satellite positioning systems makes data acquisition and processing less rigorous.

The convergence of technologies of digital data collection, processing, and dissemination with sophisticated computers enhance the integration of activities on a single platform. The amalgamation of topographic and hydrographic databases will lead to global standardization of hydrographic data and e-hydrography.

➢**Remuneration:** The US Bureau of Labor Statistics in its publication declared that job prospect in Hydrography is good especially for those with extensive experience and that employment of Hydrographic Surveyors is expected to increase by 18% by 2018. As of 2012, the Bureau publication placed the average annual salary for hydrographic surveyors at $52,000. This varies on location, employer, education, experience and benefits.

CONCLUSION

The work of hydrography involves the mapping of varieties of bodies of water and determining the topography of the bed, water depth, limits and other characteristics.

Hydrography has various methodologies, instrumentation and specialism.

Its products have diverse uses and applications in different sectors of the economy including maritime boundary delimitation, marine resource exploration and exploitation, marine transport and navigation, coastal zone management, defense and national security.

• • • CONCLUSION

Challenges to efficient and effective career accomplishment exist that require utmost attention.

For entry and a successful career, skills and information can be acquired through training in appropriate institutions of learning, technical and scientific publications and also through participation in programs of the regulatory and professional bodies both at the national and international levels.

On the whole, the hydrography profession is a rewarding profession and commands high prospects among other surveying specialism.

Thank you all for your attention.