



Training Course on

Hydrographic Surveying and Introduction to Chart Production Course

For

Island States in the South West Pacific Hydrographic Commission Region

Course Completion Report

October 22rd 2010

Submitted to

International Hydrographic Bureau

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Report Prepared by

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National Hydrographer



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Introduction

The International Hydrographic Organization through the Capacity Building program has promoted Regional Capacity Building program by funding 2 weeks Hydrographic Surveying and Introduction to Chart Production for Regional Hydrographic Commission project.

The training was conducted in the South West Pacific region from 11th October to 22nd October 2010, in Port Moresby, Papua New Guinea for the small island states within the region. The course was hosted by the National Maritime safety Authority of Papua New Guinea. The course was run as an action item for the 09th SWPHC conference held in Port Moresby.

The course participants were coming from Cook Island (1), Federation State of Micronesia (1), Fiji (2), Palau (1), Papua New Guinea (4) Tonga (1) and Solomon Islands (1), and to develop the Hydrographic and Cartographic Capacity within small Island States.

This course gave the participating countries a head start on the Hydrographic Capability in their respective countries. The participants have various backgrounds in cartography, land Surveying, naval operations and Marine Pilot. The word "hydrography" was not new to them as most of them had some exposure from their respective background.

Course Methodology/Goals and Objectives/Evaluation

Under the theme "Hydrographic Surveying and Introduction to Chart Production", the course was structured around understanding the fundamentals of surveying, conducting a basic survey to a desired accuracy and produce a report detailing the conduct.

The syllabus was design by AHS instructor Lieutenant Matthew Templeton and SHOM instructor Lieutenant Commander Ronan Pronost. The syllabus was presented through series of lectures, particle demonstration and activities and through engaging discussion.

The goal of IHB was to contribute to capacity building for the regional development, with the focus on the ability to deal with hydrographic data acquisition in a correct manner, achieving a desired accuracy and produce a fair sheet of that work.

The lectures observed the students performance throughout the course and provide feedback each day. Through this constant assessment process the instructors were able to adjust the program to address the weaknesses of the student and provide individual attention to achieve the objectives and goals of the course each day.



The course Syllabus designed by two instructors for the 2 weeks course are outline as follows to achieve the objectives and goals;

The Principles of Hydrographic Surveying

- General Introduction
- Course Objectives and goals
- Hydrographic Surveying General Aspect
- Theory of Errors
- Survey Standards
- Framework of Hydrographic Survey
- Basic Trigonometry

Positioning

- Geoid/Spheroid/Ellipsoid
- WGS 84 Description
- Projections and Grids
- Datum Shifts and Conversion
- Positioning GPS
- Tidal Theory
- Tide Levels and Datum
- Tidal Observation

Depth Determination

- Sound Velocity
- Acoustic
- Depth Measurements
- SBES Calibration
- SSS
- SBES and SSS Survey

Hydrographic practice

- Survey Planning and Reconnaissance
- Horizontal Control
- Conducting levels

Cartography

- Nautical Cartography
- Nautical Charts planning
- Nautical Charts Production
- Digital Nautical Charts
- Hydrographic Note

Reference used

- C13-Hydrographic Manual
- Cartography Symbols
- S4- Chart Specifications
- S11- Maintenance of Charts



- S32- Hydrography Dictionary
- S44 – Hydrography Survey Standards

The course syllabus is available for future development within Hydrographic Offices. Judging from the results of the course evaluation questionnaires, the majority of the participants were in agreement that all of the goals and objectives were achieved, as indicated in the participants' summary of evaluation

Course Contents and Knowledge/Skills acquired

The Principle of Hydrographic Surveying

Provide students with what they are expected to learn throughout the course and what is expected of them as the students. It gives the student an insight to assess themselves in the past and what they will be doing in the future. The content provides the objective and goal of the 2 week course and what they are expected to acquire throughout the course. The general hydrographic aspect provides the definition of Hydrography and fundamental of why it is needed and its importance to the coastal states. The content also looks at the types of hydrographic surveys. The course provides the on the contrary that without hydrography there would not be any offshore infrastructure development. Also in this content, the types of errors were covered and how errors can be treated and managed to provide confidence in the data. The standard used in survey was also covered to provide the participants the S44 – Standards for Hydrographic Surveys and the IHO Hydrographic manual. The objective of the framework of hydrographic surveys provide participants the definition of hydrographic survey and describes the five fundamental parts of hydrographic survey and provide 5 main areas of information that are produced in a survey. The most important part of this content is rendering the report of survey which is covered in the framework of survey. The fundamental of computation is based on the Trigonometry which this outline basically reviewed and emphasis the importance of trigonometry in surveying and how it could be used to calculate the UTM grid.

Positioning

In relation to the earth, geodesy was explained to the participants and its use in hydrographic survey, especially the Geoid and the Spheroid in reference to the Reference Frame. The World Geodetic System 1984 was considered most preferable datum for position, the content describe the WGS84 and why it was important to as most preferable datum. General properties of the projections and the grids where discussed. The participants acquire fair knowledge of the 3 types of projections and distortion and the grid system used by mariners. Datum shift and datum conversion were covered to provide students a review of geodesy and grid. The outline provide what a datum shift achieved and how to conduct a shift and also the participants where taught how to do datum conversion. GPS positioning was covered with the outline of the Global Navigational Satellite System the means of obtaining position with 3 significant segments of the system related to the signals. Tidal data was also emphasis as an important component of position especially vertical position. Tide theory was discussed with the objective to identify the 3 types of tide, and the definition of the tide and the main causes



of tides. Tide levels and datum were related to the measured level, as heights related to mean sea level and depths related to chart datum which approximates to lowest astronomical tides (LAT). The participants discussed the Tide pole and Gauge observation relationship, especially tide pole locality and the factors complicating tide gauge tidal measurements.

Depth Determination

Sound velocity variables were discussed on how they affect the speed of sound depending on the seasons and times of the day. The sound velocity probes were looked in relation to correlate of the precise measurement. The acoustic explains the propagation sound in the water, the participants appreciate the reflection and refraction of sound in the water column and how an echo sounder work. Calibration and method of determining sound velocity was discussed as well as describing the method of bar check. Side Scan Sonar principles were discussed brief with its applications. The SBES and SSS were used together in the practical session to appreciate the data coming through.

Hydrographic Practice

The purpose of survey planning and reconnaissance was stated and discuss during this session, with the steps involve in the survey planning and reconnaissance. Why it was necessary for reconnaissance and the 3 phases in the survey reconnaissance were discussed and looked into. The horizontal control was discussed as the fundamental for the survey and why it was necessary and important, the locality of the control was very important to the survey. The establishment and it's extend was discussed with the different types of equipment used to established the horizontal control. In relation to that the vertical control was also discussed as well as conducting level runs. Why level was necessary for the survey and how to connect the level from Bench marks to datum and to the tide gauge in relation to the chart datum or the lowest Astronomical tide.

Cartography

The participants were lead to the history of IHO and the SOLAS V (9) reference to the official charts which prompt the introduction of nautical cartography. Brief history of IHO was discussed to provide participants with the background understanding of the objective of IHO. The nautical chart is seen as a thematic chart, which connects the cartographic communication model which is real world, charts and the end user, which the participant appreciate in nautical cartography. The participants looked at the general rules in planning chart portfolio and it guidelines in reference the S11, the IHO publication and a little bit of history in chart preparation to what it is. The regional hydrographic Commission was looked into. The students appreciate the amount of work put by the IHO in its progress over the number of years and its continuing member state. The evolution of navigation and the increase of the vessels with an area compared to the time and efficient of paper charts the digital nautical charts emerge. It is timely as the world is unified with World Datum and introduction of e-navigation to provide effectiveness and efficiency. The form of data and image were discussed for the participant to appreciate the Raster and Vector images and the also the emerged of ENC which is comply with S57 and Validate by IHO. The ECDIS was discussed as when it will be become mandatory. The whole IHO working group connected to IMO was discussed to provide knowledge for the participants. The Hydro Note was explaining as the means to update nautical publications and nautical charts. The format and what information is required on the Hydro Note were all part of the subject as well how to write a Hydro Note and how to submit a Hydro Note.



Training Evaluation in Summary

The amount of information gain was a lot and it was relevant to the relevant position the participants held back in the respective country. The course met its objectives and goals with high standard of tuition and the high standard of lecture documentation. The time spend to attend the course was worthwhile and it was a good investment to the respective participants. The pace of the tuition and lecture was average, it was easy to understand with the level of communication each instructors had to the participants. The amount of time spend in theory and practical was sufficient and it was easy to under the theory a related to the practical. The course as help a most of the participants to understand Hydrography and charting more as before, it also realize the safety of navigation is paramount in the respective countries. Most participants will apply the training directly but some will use it where necessary and if they change the jobs maybe in future. Most participants want to course and it should not stop as will help them elevate their country capacity.

Technical Support

Bruttour International Pty. Ltd. Provided technical support through the SWPHC to the National Maritime Safety Authority, Papua New Guinea

Technical support consisted of:

- 1 x CEETIDE acoustic tide gauge, range 0.5 to 12 meters
- 1 x CEEDUCER Pro with Hemisphere L1/L2 GPS receiver activated to receive Omni STAR HP correction signals
- 1 x CEEDUCER Pro with Hemisphere L1/L2 GPS receiver activated to receive OmniSTAR HP correction signals plus 200KHz. 8° transducer
- 1 x Odom Digibar Pro acoustic velocity meter
- 1 x Triton STARFISH side scan sonar c/w 20 metre cable, and hull mount
- 1 x Panasonic Tough book field computer
- 2 x ASUS Laptop computers 5 x Program Hardware lock for HYPACK hydrographic software
- 1 x Set of transducer mounting hardware for vessels of opportunity
- The NMSA provided level and leveling staff plus bar plate for echo sounder bar check
- The PNG Navy provided one small dinghy powered by outboard motor.

Class room support

This being product introduction to the supplied data acquisition equipment, and use HYPACK hydrographic data management software for setting up geodesy, interfacing and connection of equipment with input of 'offsets' between different sensor, survey planning, creation of track guidance lines; editing and processing of field acquired data. Editing & processing illustrated the process of eliminating false echo anomalies, reduction of soundings to m local datum, production of a TIN model and from that extracting 'binned' XYZ data at User defined spacing; and contoured plans of surveyed area in DXF format. Preparation of fair sheet with border and appropriate legend of relevant survey information, plus inclusion of contoured area with overlay of binned depths. Output of DXF files to printing PDF file was done to provide the print for participants to assess the images. Side scan records were studied and principles of SSS mosaic discussed with SSS mosaic of the survey area produced.



Field support:

Practical support was being deployment of CEETIDE and set-up to local Port datum. Wharf TG benchmark was re-levelled using two other known Bench Marks in the vicinity of the tide gauge location. Naval of CEEDUCER Pro was done on the known mark as check to validate GPS Horizontal positioning. Installation of CEEDUCER Pro in small boat, setting of transducer draft, selection of Auto or Manual sound velocity for depth correction, check of CEEDUCER Pro auto velocity value at surface and at depth of 5 metres when compared to velocity values determined by use of Odom Digibar Pro. The independent echosounder bar check procedure was demonstrated. Data acquisition using CEEDUCER as a stand alone unit (visual navigation) and use of CEEDUCER with real time output to Tough book running HYPACK software with background TIF of Aus. 622 Chart for real time track guidance and data acquisition were demonstrated. Deployment of outboard mounted side scan sonar running simultaneously with CEEDUCER Pro single beam echo sounder was demonstrated.

Summary:

It was considered that the 13 students had a very good command of English language, good computer skills and knowledge. They were enthusiastic to learn and I believe and appreciated the opportunity given to them by their own organisations; the IHO; their hosts NMSA, PNG; the Hydrographic Office, RAN; and SHOM to attend the course. Sincere thanks to the Bruttour International to provide the technical support. Most indicated that they would like to attend a higher level course in the foreseeable future, i.e. within one or two years. Maybe SWPHC would look at it as a project to carry the training to another level for the students in future.



Graduation Night, each participants ware award with the certificate after the course.