Report of

On Board Multi Beam Survey Training Course

12\textsuperscript{th} – 22\textsuperscript{nd} Dec: 2010 at India

Sponsored by: IOC/UNESCO
Organised by: COAST MAP IO Program
Conducted by: NHO/NAVY of INDIA

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Part I  General Report

Introduction of the country

Sri Lanka is located in the Indian Ocean, its called the "Pearl" of the Indian Ocean. Sri Lanka coast line stretches over 1340 Km with a total land area 64740 sq Km and total population of +20 million and Sri Lanka has 36% population centers within 08km of the coastal area.

The ancient small fishing hamlets located at the mouth of rivers, lagoons and bays in Sri Lanka. These are original harbour towns were entering ports on the maritime Silk route from at least the 2nd Century CE. Basically our natural ports were developed for international merchant purposes and used its facilities as a fortress for Portuguese, Dutch and British invaders.

By this time, Silk routes at Indian Ocean developed and extended through the Strait of Malacca and obtain due to their harbor facilities. This Malacca ships routes and ancient Silk route are on Sri Lanka Exclusive Economic Zone (EEZ) waters and very closely to our coastal areas. Hence, Sri Lanka land is very important who are on Strait of Malacca or Silk routes.

The strait is the main shipping channel between the Indian Ocean and the Pacific Ocean, linking major Asian economies such as India, China, Japan and South Korea. Over 50,000 vessels pass through the strait per year, carrying about one-quarter of the world's traded goods including oil, Chinese, Indian manufactures, and Indonesian coffee.

After the civil war all the Sri Lankans and as well as government agencies and officers try to make a wonderful Sri Lanka by respecting the major development vision of 'Mahinda Chintana’ Vision for the future - Presidents Election 2010. It’s mentioned about navel, as follows;

"The objective of our next massive leap forward is to transform Sri Lanka into a strategically important economic centre of the world. My determination therefore, is to transform Sri Lanka to be the Pearl of the Asian Silk Route once again, in modern terms. Using our strategic, geographical, location effectively I will develop our Motherland as a Naval, Aviation, Commercial, Energy and Knowledge hub, serving as a key link between the East and West”

Background of the Institute

National Aquatic Resources Research and Development Agency (NARA) is the principal National Institute charged with the responsibility of carrying out and coordinating research, development and management activities on the subject of Aquatic Resources in Sri Lanka under the Ministry of Fisheries and Aquatic Resources Development. It is accredited to the International Hydrographic Organization (IHO) and Intergovernmental Oceanographic Commission (IOC) as the focal points for hydrographic and Oceanographic surveys in Sri Lanka
National Hydrographic Office of Sri Lanka is functioning under the NARA and it has the power and responsible to establish standards and procedures for gathering, processing and presenting of Hydrographic data and nautical information for the safety navigation in our waters on NARA Act - Amendment No 32 of 1996. NHO - Sri Lanka is carrying out hydrographic surveys through systematic data collection of inshore, offshore and inland water bodies. This information is support of maritime safety of navigation and marine environment preservation, defense, exploration, and research & management plans as well as Production of Nautical charts on IHO standard.

**Importance of trainings**

National Hydrographic Office had lost all survey equipments and the survey vessel (S/V SAYURI) we had unfortunately was damaged due to Indian Ocean Tsunami disaster in 2004. The NHO is presently having state of art equipments (Hydrographic and Oceanographic) which are not utilized up to optimal efficiency level because of lack of survey vessels and human resources. Therefore we couldn’t provide information to the stakeholder in efficiency manner. In this situation we are carrying out surveys by using our small boats on short distance and short period with light instruments. We wish and already called a new survey vessel for efficiency level surveys in near future.

According to this situation currently we couldn’t upgrade and improve our on board surveying experience, skills and knowledge as a Hydrographic Surveyors as well as professional job upgrade and improvement with modern techniques and practice in the subject.

**Benefits from the Training**

After year 2000, the world used Multi beam echo sounders for the hydrographic surveys. Some countries already changed their hydrographic surveys to the multi beam survey system increasing their data equation speed and sea floor covering rate. Sri Lanka is planning to start multi beam survey in near future to obtain IHO standard and provide information to the stake holders in efficiency manner.

Benefits through the on Job on Board training of COAST MAP, I acquired the knowledge and practical skill on Multi beam survey for Hydrographic Surveys such as on board surveying instruments setting up and calibration system, Survey planning and requirements, data acquire and quality assurance technique, data processing and map projection knowledge and skills with related software and instruments. Also got experience on how to manage and prepare on board activities and needed requirements and safety of maritime.

The content of the training highly relevant and useful for the day to day routine works and will be most valuable for me to improve and develop on board knowledge and skills for beginning to multi beam surveys. Therefore, it would be helpful for whenever we get a new survey vessel, as just start surveys with multi beam. So I can give out utmost service to my institute and country for the production of Hydrographic information the
IHO standard and coastal developments such as fishery harbour and industry, inundation map. As well as to extend our services in the resettlement areas in north and east parts of Sri Lanka in future for their development activities

**Conclusion and Recommendation**

I achieved the knowledge and skill of existing system and techniques for multi beam surveys at India. We can directly apply the gained knowledge and skill with our available system as one model. Hence, we can apply only basic and requirements of theory and practical in survey before, during and post configuration. Therefore, different type of instruments, data acquisition and processing programs was used compare with our available system. Such as existed Indian SEABEAM echo sounder with HYDAS for deep water data acquisition and Caries software for data process and in Sri Lanka SEABAT echo sounder with PDS 2000 and Caries for it in order.

The DGPS correction for the survey in used Indian system was known point with HF communication beckon system. It is very economical system than we used satellite DGPS correction communication system. Also it is more economical use to long term and use few number of DGPS loggers.

High resolution with multi beam data using can be produce 3D views of sea floor maps. It is very useful for fishery industry, which can be found sea mounts and rocks on sea bed for catch fish shoals. High resolution with multi beam raw data very helpful for Oceanographic research and for ocean disaster management model.

These opportunities will be helpful to the vision of Mahinda Chintana for the development of our Motherland as a Naval hub on wonderful of Sri Lanka.

Finally I would like to recommend that we need to change with multi beam surveys for very accurate and can be sea floor full coverage surveys (order of SP- 44) and increase the production rate of information and 3D views.
Acknowledgement

I would like to pay my obligation to acknowledge the wisdom and consent of generous people who have helped me to upgrade my Multi beam survey knowledge and skills in order to hydrographic survey and responsibilities with to compiled my tour on successfully.

Thanks for the arrangements and financial support for this training course and giving a chance to Sri Lanka, COAST MAP IO program, UNESCO/IOC and specially Dr. Dmitri Travin - Coast-Map-IO Project Manager. Also thanks to the Indian National Hydrographic office, Indian NAVY and government of India provide training and guest facilities and also offering me a chance to visit India.

My special thanks for The Captain of INS SARVASHAKE Ship, Captain Adhir Arora and all the officers and sailors, for building us a studying and living friendly environment on your ship. Also thanks the Lecturer from Indian Hydrographic School, Lt Cdr Tribuwan sin, Lt Cdr S.K. Sajan ī Senior Hydrographic Surveyor and hydrographic survey team in survey chart room for your valuable knowledge and practical exercises of Multi beam survey presented to us.

Thanks for my colleagues from Myanmar, Thailand, Mozambique and Sri Lanka for your corporative and friendly relations.
Part II  Technical Report

Introduction

Training program of on board Multi beam Survey on bathymetric data acquisition, processing and management in Indian Ocean, offered by COAST MAP IO program held by the Intergovernmental Oceanographic Commission under the UNESCO. The training course conducted by Indian National Hydrographic Office under the Indian NAVY on 12-22 December 2010.

Multi beam training course curriculum with lectures, training material, vessel and instruments, coordinated and linked by Indian National Hydrographic Office, and needed travel, accommodation expenses provided by UNESCO/IOC to the participants from in government hydrographic related agencies at around Indian Ocean.

This training program will be very helpful and benefited for when who in seeking start multi beam surveys or who exist multi beam surveying in countries at Indian Ocean. Therefore grade opportunity for full search their own sea floor and become an already covered at Indian Ocean sea floor search to safety navigation, ocean activities and other developments like Tsunami modeling and storm surge modeling and Fishery industry.

Survey vessel

Survey vessel name is इंस यात्री कार्यालय its means is Surveyor, she also commissioned on year of 2002 She belongs to the Indian National Hydrographic Office under the Indian NAVY. It is well planned vessel for especially deep water hydrographic surveys and adequately equipped to undertake Oceanographic surveys. As a mother vessel, she has four in numbers dedicated survey motor boats for operate coastal water hydrographic surveys. She is also carrying an integral flight for support to surveys and as well as safety purpose. The ship length is 85.77m, maximum speed is 18 knots, has a compliment of 14 officers and 190 sailors for endurance is 45 days with her designed to provide limited local navel defense and rapid conversion into a hospital too.

INS SARVEKSHAK survey ship
The captain, officers and other crew members of all of them in INS SARVEKSHAK ship was created a working and onboard living friendly environment for us. Time to time gave attraction presentations during the survey by lecture from Indian National Hydrographic School at Goa and also hydrographic survey team at on board was given maximum knowledge and practical skill creating to studies cooperative environment to us. The Senior Hydrographic surveyor guided us for providing all the facilities to training, practices living and administration assigned to the ship.

I am very happy and lucky for being here at INS SARVEKSHAK and to study in India about multi beam hydrographic surveys and to cooperate all of you. This opportunity will be cooperating to build up international cooperation among the hydrographic and Oceanographic surveyors at Indian Ocean and search to own waters.

**Used Survey Instruments and Software**

Frequency of 12 kHz with SEABEAM 2100 multi beam echo sounder and its support with HYDAS software used for bathymetric data acquisition. Out build at Gyro compass and Motion sensor instrument is coupled with multi beam echo sounder processing unit for gaining quality of data. GPS positions correction as DGPS, communicated way of HF from known point at land on Mangalore it’s setting up before the start survey.

Tide was not applied to the data because our survey area is so far about 100 nm from the land and depth is around 1000 - 2000m. Day by day before the survey we collected sound velocity data by using SVP instrument and also applied data for test and actual surveys. Vessel offset, GPS offset, and Motion sensor off values measured from multi beam sensor head and it’s applied to HYDAS program as a vessel configuration file. In manually planed Patch test line file observing on chart at suitable sea bed and direction. Doing the patch test we collected bathymetric data using we defended roll and pitch errors values as mounting errors its find by using ‘Caries Hips and Sips’ program. Latency, Yow test errors were not required to this survey because depth is very high at surveyed area.
For the survey needed lines amount and length defended by using area scale, depth and multi beam swath food angle. Ship is straightly stirred on prepared survey lines in HYDAS screen collecting multi beam row data line one by one.

The row data is processed using CARISS HIPS and Sips program on line by line and also as cubes. Finally we made fair sheet exporting to CAREIS GIS program as a bathymetric fair chart and seabed topology in 3D view. It monitored by the captain, senior hydrographic surveyor and lecturer.

**Survey lectures and Practical of Training**

Selecting suitable sea areas and continually surveyed was done catching maximum experience and knowledge to the participants practically. The lectures and practices with all activities done as scheduled as follows.

*Lecturing in chart room at SARVEKSHAK ship*

11-12 Dec 2010 - Arrival to Kochi Air port and reach to ship  
13 Dec 2010 - Familiarization of ship  
14 Dec 2010- Theory of Multi beam and surveys and Departure from Kochi harbor / Southern Navel Base Command  
15 Dec 2010- Setting up of DGPS at Mangalore  
16 Dec 2010- Survey planning and Departure from Mangalore to Survey area  
17 Dec 2010- Sound Velocity Observation & Calibration, and HYDAS programming for Data acquisition to patch test  
18 Dec 2010- Data acquisition in HYDAS practices on CARIS HIPS and SIPS  
19 Dec 2010- Data acquisition and practices in Data processing on CARIS HIPS and SHIPS  
20 Dec 2010- Data processing on CARIS GIS and reach to Mangalore and INS SARVEKSHAK ship night (Cultural and entertainment program) on ship organized by onboard medical doctor  
21 Dec 2010- Recovery of Camp at Mangalore  
22 Dec 2010- Arrive to Kochi harbor / Southern Navel Base Command  
22-23 Dec 2010- Departure from Kochi Air port
Participators and Participants

Vice Admiral B R Rao AVSM, NM, VSM, Chief Hydrographer to the Govt. of India visited the survey ship at time of recovering of survey camp in Mangalore. He inspected our progress and printed charts. He also invited all countries, to request needed trainings and surveys through inter government such as capability developments.

On time to time gave attractive presentations of multi beam survey theories and practices during the survey by visiting lecturer from Indian National Hydrographic School Goa - Lt Cdr Tribuwan sin.

Participants from various countries at Indian Ocean as trainees, who engaged at their hydrographic and Oceanographic surveys under the government agencies of civil or NAVY basement. The nine participants offered a training program by four countries. They had various level subject knowledge, practices and education background but they haven't multi beam surveying practices. The participants had subject knowledge and skills exchanged among other participants. Participants and crew members had different type of cultural and languages, but we could make friendly and enjoyment environment within together.

Every participant is seeking to begin multi beam surveys offering maximum support to their countries, because of the achievements and knowledge gained. List of participants as follows

Lt.Cdr. Wanchai Chana-iad Hydrographic Department Royal Thai Navy
a. Lt.JG. Panlert Boonchuay Hydrographic Department Royal Thai Navy
b. SubLt. Saluk Hydrographic Department Royal Thai Navy
c. Mr. DLP Hewage Sri Lanka National Hydrographic Office- Sri Lanka
d. Mr. P Jayasooriya Sri Lanka National Hydrographic Office - Sri Lanka
e. Mr. Ricardo Constantino Mozambic Surveyor from INAHINA
f. Mr. Carlos Mariano Mugaua Mozambic Surveyor from INAHINA
g. Lt.Cdr. Naing Oo National Hydrographic Center Myanmar
h. Lt(SG) Lwin Ko Ko Maung National Hydrographic Center Myanmar

From left
Lt.JG. Panlert
Boonchuay, Mr. DLP Hewage, Lt.Cdr. Naing Oo, Lt.Cdr. Wanchai Chana-iad, Captain Adhir Arora, Lt Cdr Tribuwan sing, Lt(SG) Lwin Ko Ko Maung, Mr. Ricardo Constantino, Mr. P Jayasooriya, Mr. Carlos Mariano Mugaua, Sub Lt. Saluk.