

Chapter 3 PROGRESS SITUATION OF TECHNOLOGY TRANSFER

Operations to meet the goal of technology transfer are as followed.

- (1) The hydrographic survey and Nautical charting capability in MPWT/WD of Cambodia should be strengthened by carrying out technology transfer, then producing and updating C & ENC can be carried out by themselves.
- (2) Moreover, contribute to the strengthening of institutional building to produce an environment to be a member country of IHO, which will be able to publish officially ENCs.

As the result of discussion reached with MPWT/WD, prescription for digital hydrographic survey on the basis of S-44, IHO international standard for hydrographic survey, and ENC production manual based on S-57, standard specification of ENC production, were made to be performed along the technology transfer shown in Table 3 - 1 below:

Table 3 - 1 Outlines of Technology Transfer

No.	Technology transfer	Work descriptions of Technology Transfer	Methods
1	(6) A) Carrying out Geodetic Control Point Survey and Leveling	<ul style="list-style-type: none"> - Ground control point location determination - GNSS survey - Pricking - Geo-Reference method of Satellite Imagery - Extracting coastline method from Satellite Imagery 	Obtainment of each process through OJT
2	(6) B) Processing of Satellite Imagery (delineating shoreline, dried lines and dangerous rock)	<ul style="list-style-type: none"> - Ground control point location determination - GNSS survey - Pricking - Geo-Reference method of Satellite Imagery - Extracting coastline method from Satellite Imagery 	Obtainment of each process through OJT
3	(6) C) Acquisition of Hydrographic survey data	<ul style="list-style-type: none"> - Digital Hydrographic Survey Date Acquisition - Digital Hydrographic Survey Date Processing - Quality control (accuracy) management - Creation of Vector Fair Sheet - Creation of Operating and Working Manual 	Obtainment of each process through OJT
4	(6) D) Tide observation and tidal measurement	<ul style="list-style-type: none"> - Oceanographic Observation Method (Tidal Level and Current data Acquisition) - Tidal Harmonic Analysis technique - Determination technique for Chart Datum - Quality control management 	Obtainment of each process through OJT
5	(6) E) Data Processing of DHS data	<ul style="list-style-type: none"> - Digital Hydrographic Survey Date Processing - Analog Hydrographic Survey Date Processing - Quality control (accuracy) management - Vector Fair Sheet production 	Obtainment of each process through OJT
6	(7) Production of Chart and ENC	<ul style="list-style-type: none"> - Nautical Charting Method - ENC Compilation Method - Quality control (accuracy) management - Creation of Operating and Working Manual 	Obtain process through training in Japan and OJT

3 - 1 Detail of Carrying out Technology transfer

3 - 1 - 1 (6) A) Carrying out Geodetic Control Point Survey and Leveling

(1) September - October 2013

This site work was carried out together with 3 C/P and 2 support staff of PAS. Simultaneously the technology transfer for Geodetic Control Point and Leveling also had been carried out.



Photo 3 - 1 C/Ps and Pilots of PAS who conducted the Control Point Survey

Photo of Geodetic survey and Leveling was carried out at SHV on September - October 2013



Photo 3 - 2 Control Point Survey by means of GNSS

GNSS control point survey was carried out under the guidance of the study team by divided in the 3 parties. To realize the technical transfer in OJT smoothly, procedures on the operation of GNSS was prepared in advance. Last GNSS survey session was requested to carry out by C/Ps team themselves. Study team considers that the C/Ps fully understood the GNSS observation technology.

Study team requested for the C/Ps to prepare the GCP station record, which described the selection of GCP and GNSS observation. Following example shows the GCP station record of GCP11, describing the geological relationship with the lighthouse and the access to the point.

GCP 11 N 10° 36' 31.55" E 103° 25' 55.65" (by Stand Alone Observation) **20131017**



This Photo is taken from the rooftop of Light House
(White point is Pilot ship)
It is necessary to use small boat for landing and accessing
to Light House



Top of light house and GCP 11 and
Casino Hotel (Red roof) at Orchid road
are on a same constant line

The Light House was established at 2004.3
Height of the Light house: 10m

Light house
Position: N 10° 36' 31.7" E 103° 25' 55.3" (Standalone)

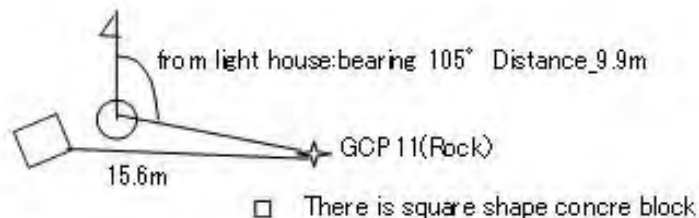


Figure 3 - 1 GNSS Ground Control Point Survey of Observation at GCP11 point



Photo 3 - 3 A Prior Consultation and Ex Post Facto Meeting between Study Team and C/Ps

Photo 3 - 3 shown the baseline analysis carried out by C/Ps after the lecture of GNSS observation given by Mr. Takanashi, Geodetic Survey Expert of the study team, at the room of Chief Security of PAS.



Photo 3 - 4 Leveling Survey



Photo 3 - 5 L: PAS leveling Point and R: Newly installed B.M. PAS Tide Station

Photo 3 - 4, Photo 3 - 5 and Figure 3 - 2 shown observed leveling documents.

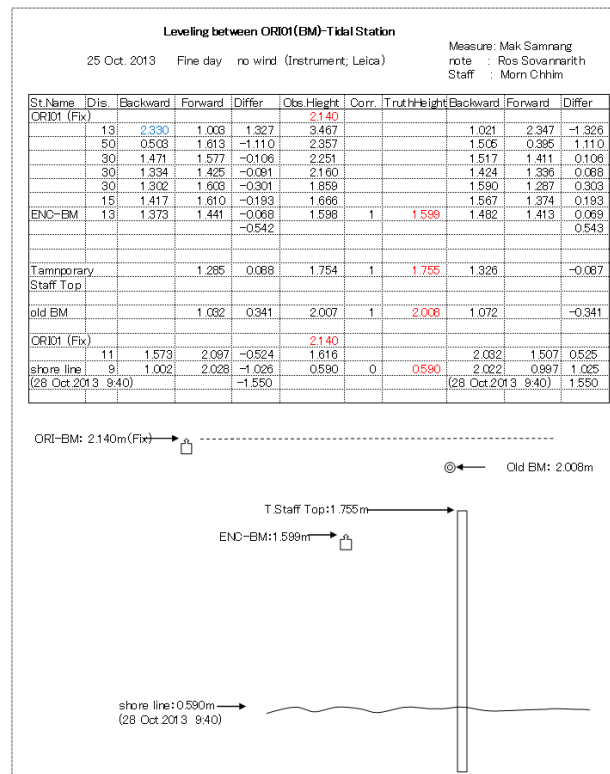


Figure 3 - 2 Field Notebook of Leveling Survey

(2) December 2014

The supplementary survey in order to fix the position and height of navigational marks such as light house was carried out in December 2014. This survey was carried out by the following C/Ps (Shown in Photo 3 - 6) led by Mr. LONG BUNLONG, leader of C/Ps. For the handling and instruction of GNSS equipment, study team prepared the operational manual in advance for them to be used in OJT. It is considered that they understood the methodology of GNSS observation through OJT.



Photo 3 - 6 C/Ps who had the Training of GNSS

In Photo 3 – 7 Left : GNSS observation carried out on the bridge way to KAOH POAH. To find the position of Navigational Aid : Red lamp and Green lamp. Basically for Navigation Aid information, the study team gathered information from PAS, but there are not the sufficient information about these bridge lamps, so GNSS had been carried out.



Photo 3 - 7 GNSS Observation and Leveling Survey

In Photo 3 – 7 Right : Leveling survey was carried out again between BM of PAS and the newly installed BM of PAS tide station after 2013 leveling. C/P carried out this survey was well versed in knowledge and experience through the road maintenance project. Therefore, study team asked C/P to conduct leveling survey by themselves after lecture and support while carried out from the study team.

3 - 1 - 2 (6) B) Processing of Satellite Imagery

During the extension project, the training of extraction of shoreline data out of the satellite imagery was carried out using ArcGIS.

Technology Transfer on the accuracy check of satellite imagery and the extraction of shoreline data out of the satellite imagery were made by means of using ArcGIS manufactured by ESRI USA, which was procured for this project. ArcGIS is the comprehensive GIS software used worldwide enabling the processing of vector data and raster data in an advanced technology. C/Ps only knew its name of the software but did not have any experience to use it for their services, so far. Technology Transfer was aimed at contributing not only to use it to this project but also to apply it to their upcoming own services.

(1) Period:

Technology Transfer was divided into two terms, 1st - term, from 19th Apr. 2016 to 1st Jun. 2016, and 2nd - term, from 8th Aug. 2016 to 19th Aug. 2016, and executed simultaneously with the bathymetric survey on the sea. C/Ps were divided into 2 teams, 4 personnel each, and the same training was scheduled individually, proceeding along the manual prepared in advance by the study team.

(2) Contents Execute:

[1st Training]

1) Basic Operation of ArcGIS:

Basic knowledge was explained, e.g. Shape file and Outline of ArcMap, to C/Ps as all the members were their first time to operate the software.

2) Basic Process on Satellite Imagery:

This project adopted several different types of satellite imageries. Satellite imageries are different with each other in terms of process level, terrestrial resolution, number of band, order of band and product configuration. At the initial step to understand the process, it is necessary to understand these parameters. Study team explained on its minimum knowledge to display the image designated on the ArcGIS as shown below, as it's difficult to understand the whole function of the system and also believed that it's already beyond the knowledge of C/Ps at this moment:

- a) Terrestrial Resolution: to be adjusted to the objective,
- b) Band Number and Order: to allocate the band number that imagery has to respective channels, Red, Green and Blue that ArcGIS has,
- c) Product Configuration: Pan-Sharpened imagery or not. If not, fix the setting of Pan-Sharpened,
- d) Information on Geo-Reference: whether the imagery has Geo-Referenced information.

3) Accuracy Check and Geometry Correction:

Study team explained the methodology on the accuracy check of their locations and trained as to the coordinates measured on site, which were developed on the ArcGIS. Study team also explained the C/Ps on the adjustment technology, Geometry Correction, followed by its training, if the imagery did not have relevant accuracy.

4) Setting of Feature Templates:

Explanation on the technology for adopting the Feature Template to obtain the shoreline data on each attribute was made and executed its training.

There are several methods to manage the line data, which has its attribute, in the operation with ArcGIS. For example, there is the method to store one attribute in one Shape files, or the method to use the File Geodatabase instead of Shape files.

Once the File Geodatabase is adopted in our operation, it enables to manage all the ENC data, not limited to the shoreline data. Setting of Feature Template also allocates the Symbology, i.e. colour, width, size, pattern, etc., on each attribute in the ArcMAP. In this training, for the purpose of

acquiring the basic skills on ArcGIS, the training on the methodology of distinguishing the type of shoreline, charting and its management using attribute table of one Shape files.

5) Delineation of Shoreline and its Editing:

Training was made on the method of shoreline delineation deciphering the terrestrial objects using the Editor toolbar. At the same time, training of editing method of delineation data, editing of figures and attribute change, was also conducted. Further, The explanation on a package processing method by the Geoprocessing Tools was made to the C/Ps.

6) Conversion to CAD:

Since ArcGIS has high performance of compatibility to work with CAD software, e.g. AutoCAD, it will be important to use it with other CAD software for the efficient work and working on the same software with the data of different format collected separately. Therefore, training on interchangeability was made to C/Ps.

7) Other Effective Tools:

Following tools were explained to C/Ps as supplemental information:

a) Utilization of LANDSAT imagery:

LANDSAT imagery has a maximum resolution of 15 m, i.e. 15 m in panchromatic imagery and 30 m in multi-spectrum imagery, and has various frequency band in addition to RGB and also plenty of archive operated by the U.S. and available to everyone for download freely once one make an user registration with free of charge. Hence, there will be any possibility to utilize it on various opportunities for C/Ps activity. C/Ps also showed their keen interests on it. Study team explained on the methodologies to download and of display on ArcGIS, creations of RGB imagery, Pan- Sharpened imagery, and etc.,

b) Methodology on Shapefile creation using the location of Geotagged Photographs, developing of photograph on ArcMAP:

Photographs taken by digital camera or smartphone with GNSS receiver will be recorded its shooting location coordinates with the images. ArcGIS enables to create Point Shapefile to combine multiple images as an Input File. The data base of Shapefile created will be shown the storage address, and the map and the photo will be connected by a hyperlink. Study team explained this how to operate this process to C/Ps.

c) Import of GPX and KML Files:

Study team explained on the methodologies of importing standard GPX file that stores the track plots and waypoints of portable handy GPS, and/or KML file that is used for “Google Earth”, to C/Ps.

[2nd Training]

During the 2nd - term training, reviews and training on setting the coordinate system and adding of location information, geometry correction on raster data without location information, and the explanation on the file interchange between ENC data file and the data set of the File-Geodatabase of ArcGIS mentioned above. Major training conducted is shown as follows:

1) Setting of Coordinate System and Adding of Location Information:

- a) Read out the coordinates and collect coordinate system information out of the existing map,
- b) Setting of corresponding coordinate system on ArcMAP,
- c) Geometry correction on to the scanned data of the existing map,
- d) Determination of the necessity for coordinate conversion on the ArcMAP display,
- e) Coordinate conversion by the geo-processing process.

2) File-Geodatabase:

- a) Outline of File-Geodatabase structure,
- b) Methodology on the operation of File-Geodatabase,
- c) Methodology on setting the domain, methodology to limit the input value on to the specific attribute field.

Since the File-Geodatabase is truly the sophisticated and also complicated software, the explanation was made up to the processing that the ENC data file can be interchangeable with File-Geodatabase by way of FME keeping almost all the attribute data as it was, in addition to the contents mentioned above. This suggests that the ArcGIS would be able to manage, update and edit the ENC data produced in this project. For example, the ENC data will be updated using of ArcGIS effectively in case the Shapefile of updated terrestrial object is available.

[Evaluation]

After the 1st -term training, study tem asked each trainee to give an evaluation by themselves. Following Table 3 - 2 shows its results. There might be some different evaluations from the study team’s appraisal because the evaluations were made by themselves. In addition, there were times when some trainees could not participate in the trainings due to the other engagements. However, it seemed that almost all the trainees achieved to a certain degree on the Technology Transfer. Therefore, study team hopes that each trainee would drive their motivation to review the technology where they could not fully understand, and deepen their knowledge referring to the operational manual the study team prepared.

Table 3 - 2 Summary of Self- Evaluation after the Technology Transfer

Technology Transfer Topic			Understanding Level (Please put check mark)			
			Excellent	Good	Fair	Poor
Vector data processing	Basis of ArcGIS	Minimum components of shapefile to open in ArcMAP	0	6	1	0
		Setting the coordinate system	0	7	0	0
		Creating New Shapefile	0	7	0	0
		Basic operation of Geoprocessing tools such as Dissolve	0	5	2	0
		Basic operation of drawing and editing tool	0	7	0	0
		Importing AutoCAD .dwg file into Map document	1	5	2	0
	Drawing Coastlines for ENC	Creating feature template in order to draw features with attribute	1	4	2	0
		Drawing coastline and 0m contour (low tide) line by interpreting satellite images	1	5	1	0
		Importing Shapefile to AutoCAD and separating layers by attribute value	0	5	2	0
Raster data processing	Satellite Image Processing	Adding Satellite images in Map document	1	4	2	0
		Assigning band number to RGB channel in ArcMAP	1	4	2	0
		Pansharpener satellite image	1	3	3	0
	Accuracy Inspection	Adding XY ascii data such as .csv file into Map document and converting it to shapefile	0	5	2	0
		Checking accuracy of georeferenced raster data such as satellite image using ground control points(GCPs)	0	4	3	0
	Geometric Correction	Geometric correction of raster image	0	4	2	1
		Saving modified raster image to another file or dataformat	0	4	2	1

It should be important to understand the significance of setting the coordinate system and the geometry correction, allocating the coordinate information on to the imagery in raster format, which should not be avoided to use the ArcGIS in their job. Based on the key points raised in the Technology Transfer, the practical training of setting the coordinate system and the coordinate conversion were carried out at the 2nd - term Technology Transfer. And, study team also explained that the File-Geodatabase has the capability of managing the ENC data. Study team believes that it’s not enough to simply learn the operation of the File-Geodatabase, actually, as it is the highly sophisticated and too much complicated software. Therefore, in a way, sustainability of the Technology Transfer should totally be dependent upon their motivation to learn more in-depth knowledge and the strong will to achieve the objectives. However, each trainee is believed to acquire another measures in hand to approach to the issues, and expected to tackle them in different methodology for the solution. Study team hopes that each trainee would work more hard and try again and again to commit their responsibility.

3 - 1 - 3 (6) C) Acquisition of Hydrographic survey data

Refer to shown at Chapter 2 - 6 - 4 following technology transfer held by OJT.

(1) Preparing MBES survey project with HYPACK

1) Creation of New project and setup following geodetic coordinates to the HYPACK

Geodetic System: UTM North Zone 48 (All Cambodia's territory located inside)

Ellipsoid: WGS-84

2) Creating Survey Plan line

After inserted Satellite Imagery as the background in HYPACK. To handle and gain rough information of depth and seafloor topology first, so it was decided to create 200m sounding interval line in East-West direction which also using for navigation in HYPACK Survey. After finished 200m interval, continued to do 100m interval between surveyed 200m interval line and also for 50m interval (Shown in Figure 3 - 3) orderly to fill out data in the study area.

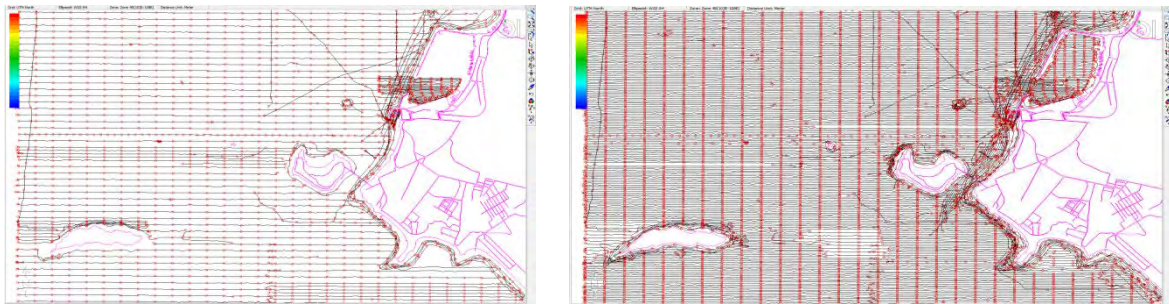


Figure 3 - 3 Survey Line Design (Left: line 200 m interval, Right: line 50 m interval)

(2) Installing equipment in survey boat

1) Equipment installation

With the support from PAS's mechanics, the customized attachments and modified patrol boat to install equipment were made and carried out (shown in Photo 3 - 8).

The outfitting/installation of DHSDAS to survey boat are affected on accuracy of Multi-Beam sounding as discussed below. Therefore, the OJT training of the outfitting/installation and its release were done respectively by C/Ps divided into two groups because the sustainable technology transfer is very important too, after closing the supplementary survey at the second Hydrographic survey.



Photo 3 - 8 Survey Boat, PAS Patrol Boat; “KOH DEKKOL”, and Installation of Transducer to the Side Frame of Hull

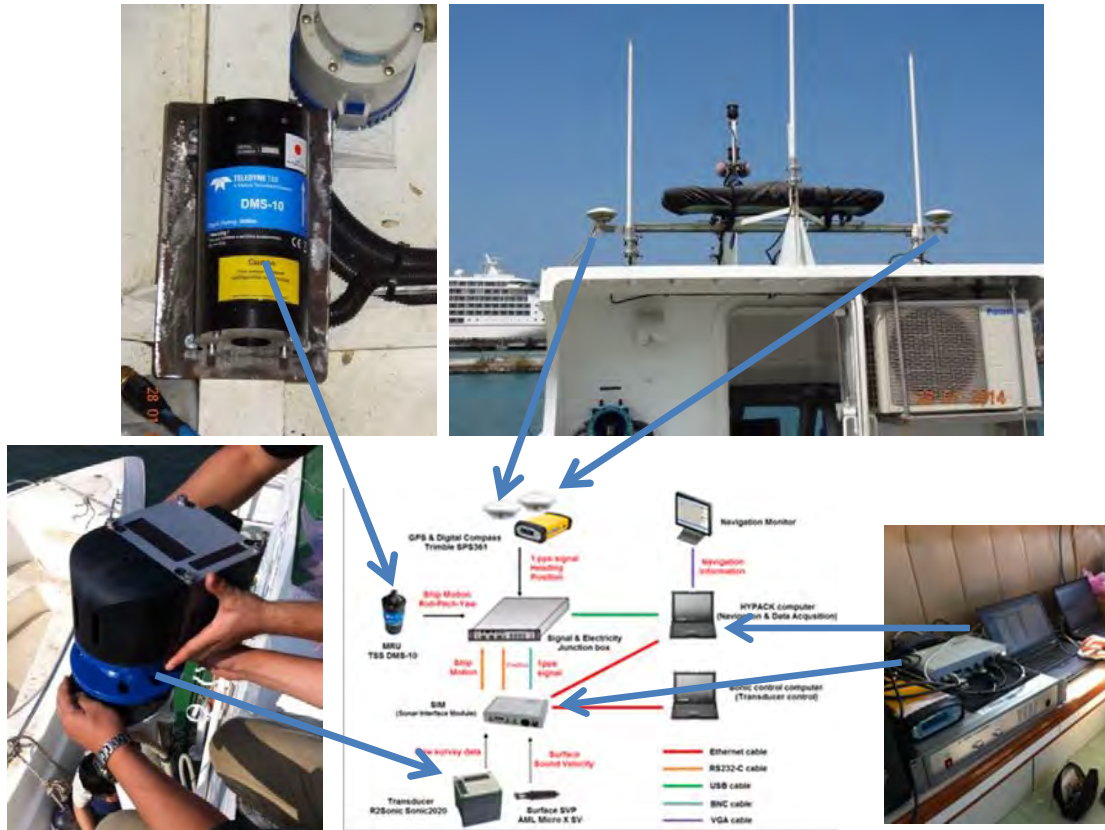


Figure 3 - 4 Outline Diagram of DHSDAS, and Installation of respective Equipment on to the Survey Boat

2) Measure distance between equipment with origin point

Measuring from origin point 0,0 (center of motion sensor) to installed equipment at the survey boat to find out equipment offset, then input to HYPACK. Figure 3 - 5 shown the setting diagram of offsets:

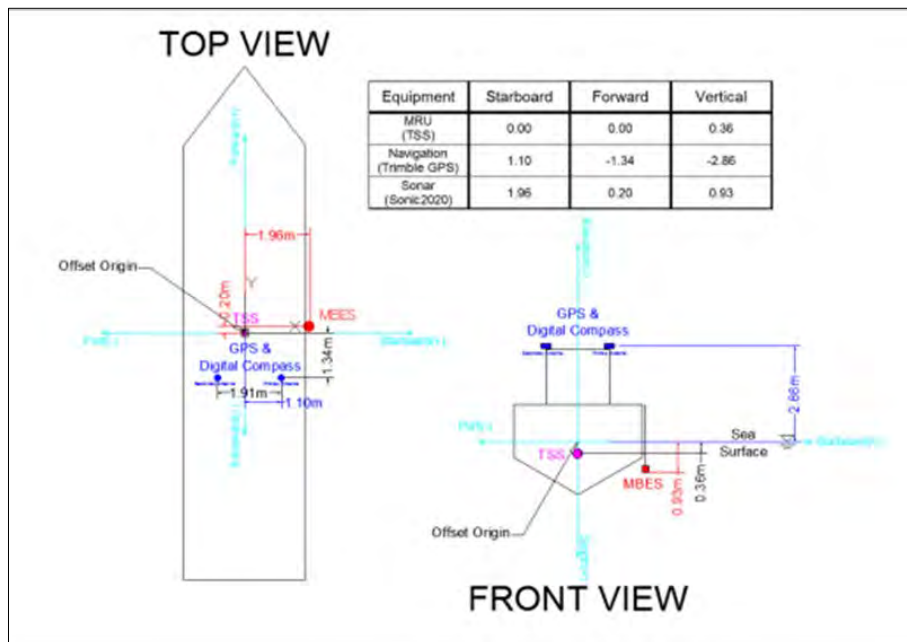


Figure 3 - 5 Offset Equipment Install

3) Setting for HYPACK hardware and HYWEEP hardware to recognize equipment installed with HYPACK and input equipment's offset value.

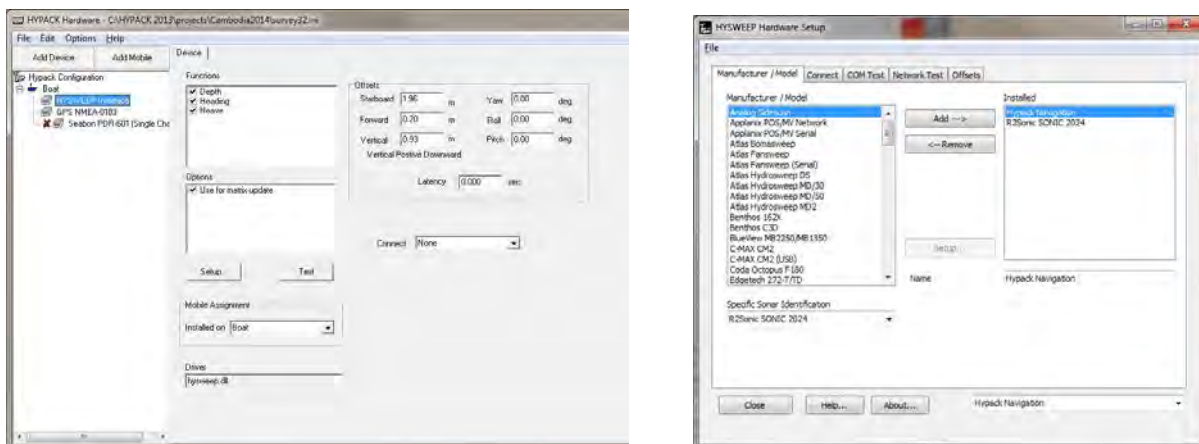


Figure 3 - 6 Navigation Setting in the right panel, and MBES Setting in the left panel, in the HYPACK

(3) Data Acquisition process in Digital Hydrographic Survey

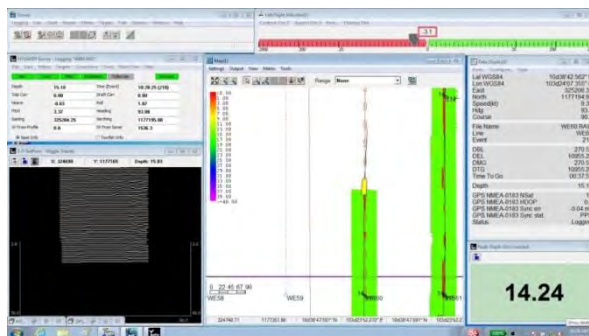


Figure 3 - 7 Display of HYPACK SURVEY for Bathymetric Operation and Navigation

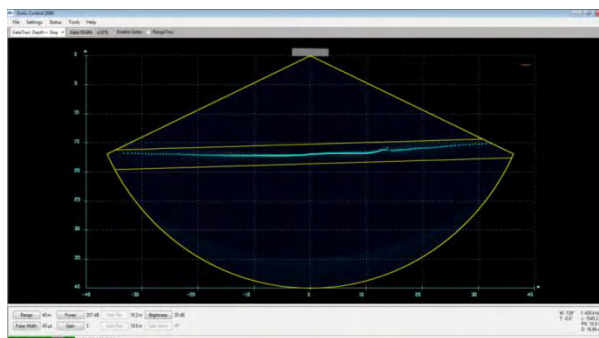


Figure 3 - 8 Display of Sonic 2000 Controlling Transmitting Signals (Power, Gain, Pulse width etc.) of SONIC2020

Sound velocity measure was carried out by sound velocity profiler (AML Minos X) to correct sound velocity and reflection for the raw data of DHSDAS in each day of survey. The survey boat has been navigated and surveyed by captain/operator to insure for safety of ship, crews, operator, and maximize efficiency in time and fuel for data acquisition and a crew has been assigned for observing any possible dangers, contacting with other ships for safety. These knowledge, technique, mechanism including boat maneuvering, mechanism, important watch of survey-navigation and maintenance of equipment etc. are transferred with OJT.



Photo 3 - 9 Survey Boat's Navigation, Lookout and SVP Operation

(4) Technology transfer for data acquisition

There existed some differences on hydrographic survey capabilities of each trainee, especially in multi-beam sounding capability, even with their completion of JICA group training on Hydrographic survey. In order to keep the hydrographic survey to proceed smoothly, following measures and steps have been established as a technology transfer to make it effectively, discussing with C/Ps.

1) Lectures on DHSDAS:

Training on DHSDAS was so planned that C/Ps could memorize important things using whiteboard, and tried to have them take memo in their notebook, as there were not any reference materials for training from the very beginning. The time for Q&A were held for the trainees in order not to leave any uncertainties after the training



Photo 3 - 10 Lectures on DHSDAS by using Whiteboard

2) Lecture Methodology:

The trainings on operations of equipment and software were lectured by the study team, in addition to the review work. After the lecture given by the study team, a series of operation of each items using equipment and software were also requested for each trainee to operate individually, and confirmed their understanding. Study team requested to the well versed trainee to give necessary explanation and operation to the trainees, who were not yet understood the operation.



Photo 3 - 11 Training on DHSDAS

3) OJT on Operation and Maintenance of Survey Equipment guided by Study Team:



Photo 3 - 12 Training of System Operation and Maintenance guided by the Study Team

4) Gain the experience form OJT with the support from the study team member



Photo 3 - 13 OJT on MBES on board the Survey Boat

5) Proficiency Rating by Each Trainee:

Following Figure shows the proficiency rating by each trainee to evaluate their own operational knowledge on the DHSDAS, which would be helpful for study team to frame a Technology Transfer

Cambodia ENC 2014 - Sihanoukville harbor and surroundings						
Understanding Level Questionnaires in Technology Transfer						
Name: <u>LONG DUNLONG</u> Team: <u>2</u> Rotation Time: <u>01</u> Date: <u>10 Feb 2014 - 23 Feb 2014</u>						
Technology Transfer Topic	Understanding Level (Please put check mark)				Comments	
	Excellent	Good	Fair	Poor		
Hydrographic Survey	Digital Hydrographic Survey Data Acquisition	MB Equipment installation		✓		
		HYPACK setting for MB data acquisition (Coastline, HYPACK HARDWARE, HYDROGRAPHIC HARDWARE)		✓		Relation between depth by survey & SD-Data (MB) survey. Geo. reference setting.
		Navigation preparation (Coastline, MTX, Plan line)		✓		
		MB Data acquisition/Data logging/Target creating		✓		
		Survey ship navigation		✓		
		MB Patch test		✓		
		Sound velocity profiling		✓		
		Data backup from ship		✓		
		MB Equipment maintenance		✓		
		Safety issues for hydrographic survey		✓		
Digital Hydrographic Survey Data Processing	Create Tide corrections file		✓		Need more trained about AutoCAD	
	Create Sound Velocity corrections file		✓			
	Calculate Patch correction			✓	SD Map HYPACK HARDWARE & HYDROGRAPHIC HARDWARE SETTING	
	Convert Raw to Corrected - Phrase 1		✓			
	Noise deletion (Line survey base editing) - Phrase 2		✓			
	Save in H52 file format		✓			
	Create MTX files		✓			
	Create tracklines			✓		
	Create line reports			✓		
	Create plot sheet by HYPLLOT			✓		

Figure 3 - 9 Proficiency Rating made by Trainee on the Questionnaire

6) Operational Manuals on DHSDAS:

In order for trainees to facilitate the hydrographic services, the label of each equipment was translated into Cambodian language, and created operational manuals of DHSDAS.



Figure 3 - 10 Operations Manuals in English, and labels in Cambodian Language

Study team requested C/Ps to evaluate by themselves giving their proficiency rating on the right columns Figure 3 - 9 every month. Individual trainee was trained separately referring to their evaluation. The C/Ps were divided into 2 parties that each of them could operate different operations, e.g. when one party worked on 1st - term hydrographic data processing, the other party devoted reviews on the hydrographic data acquisition.

Specific hydrographic survey was designed in the northern offshore of the project area, in front of the power plant where the water depth was 8 m and some light buoys were installed, at which the bulk ore carrier operated berthing and deberthing only when its high tide. The objective was to improve their skills in digital hydrographic data acquisition, which was operated for 1 week, alternately. And, This was the request from MPWT. It was operated on Dec. 2014, and the digital acquisition was carried out accordingly following to the procedures stated in the above. (Shown in Figure 3 - 11)

The above DHSDA was conducted only by C/Ps except ship operation according to the procedure described above 3 - 1 - 3 (1), (2) and (3). The technology transfer of DHSDAS thought by the study team did not proceed at the first hydrographic survey period in reason of all C/Ps being seasick because of first experience of sea work, rough sea, and the effect of cross-cultural for this mission, however it is considered that C/Ps have learned knowhow with a certain level of DHSDAS including installation work by the additional MB sounding at the second hydrographic survey period. The following Power Point screen is presented by C/P at the 4th Task force Meeting.

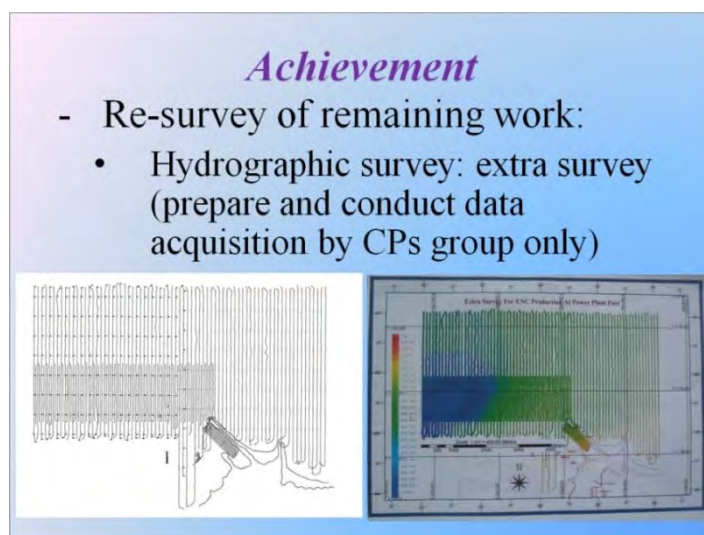


Figure 3 - 11 PPT of Hydrographic Survey conducted by C/Ps alone presented on JCC Meeting

Supplemental knowledge and skills were replenished on the uncertainty operations and etc. by the study team during the extension project, although the basic operations were almost the same.

During the extension project, the C/Ps undertook a series of operations from the survey designing, rigging of equipment, bathymetric survey, de-rigging and maintenance of survey equipment. Study team also accompanied each operation and advised if necessary and induced trainees to be able to reach an appropriate solution by themselves once the operational issues and/or problems occurred even after the project.

3 - 1 - 4 (6) D) Tide observation and tidal measurement

The Tide observation point for the determination of the chart datum on sea area around SHV port and for correction of sounding raw data, and the current observation method for acquiring current information described in the nautical Chart and ENC were guided by OJT. Items of technology transfer are as follows.

(1) Theory of Tide and Tidal Current Observation

(2) Operation and Maintenance for Short and Long Term Observation for Tide Gauges

1) Installation of Short Term Type-Tide Gauge

Short Term Type-Tide Gauge was installed at the same station in order to compare the tidal records of tide gauge (RMD5225WL-B), hence the comparative observation of tides was carried out simultaneously.



Photo 3 - 14 Comparative Observation of Tides between “RMD5225WL-B” and “RT710”, Simultaneously

(3) Method of Simultaneous Tide Observation and Reduce-ratio Calculation

(4) Method of Tide and Tidal Current Harmonic Analysis

(5) Determination Method of Chart Datum (Lowest Low-water)

3 - 1 - 5 (6) E) Data Processing of DHS data

After finished data acquisition, DHSD and technology transfer have been carried out as the following step.

(1) Tidal correction and sound velocity correction have been done by the function of HYPACK with DHSDPS.

- 1) Creation of Tide Correction File
- 2) Creation of Sound Velocity Correction File
- 3) Creation of Patch Correction Data

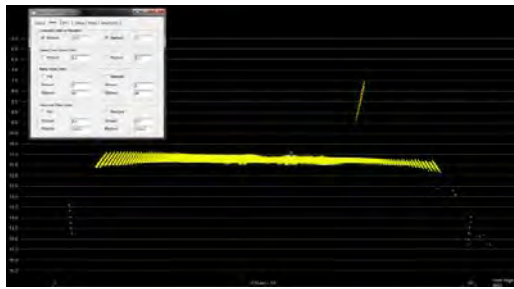
C/Ps had experienced and finished these series of corrections above by themselves from the data acquisition to the respective processes using HYPACK.

(2) Noise Reduction Processing

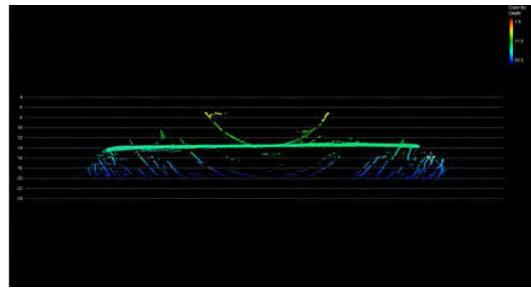
Processing of noise reduction, which took much time, was carried out as OJT in Cambodia and Japan by the following steps.

Applying automatic filter to delete noise/false data quickly and efficiently.

- 1) Manual editing using interactive processing to delete noise and false bottom was carried out by means of HYSWEEP EDITOR,
- 2) During the manual editing, as the trainees did not have enough knowledge and experience yet to identify noise and false bottom, study team made the noise sample sheet by using the screen capture for C/P.



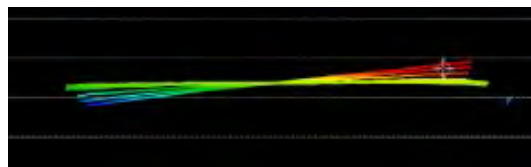
Normal noise



Fishnet tangled up in transducer



Fishing net or floating debris in water column



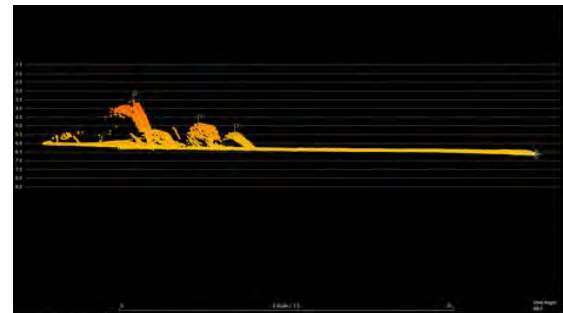
Errors of motion sensor due to rough sea

Figure 3 - 12 Samples of the noise data in the noise sample sheet

3) As the chart's important information, critical seafloor topology of outcropped rocky bottom or EO (Extraneous Object) were put the flag at the top to determine the minimum depths.



Underwater rocky surface: View from above



Underwater rocky surface: Side view

Figure 3 - 13 Samples of underwater rock data from HYPACK at data processing step

(3) Area Based Data Processing

After finishing the noise deletion in all of each survey line, area-based noise deletion was made by uniting the survey line data. Processing time can be reduced to some extent by applying the automatic filter used in the noise reduction on survey line. And then, manual deleting of noise/false data was undertaken considering the harmonization of depths with adjoining sounding lines and cross lines. C/Ps worked on the deletion of noise and false data processing on all the area-based profiles of each adjoining survey line.

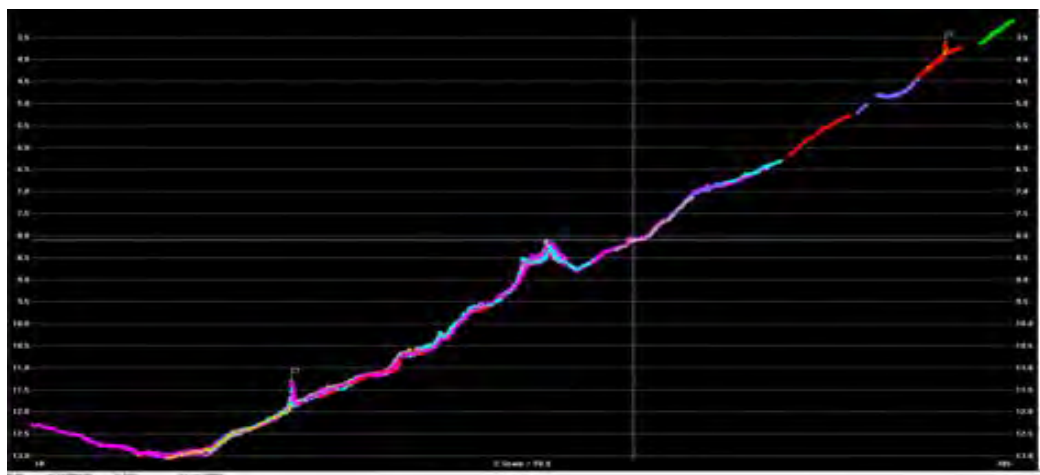


Figure 3 - 14 Noise Reduction on Area-Based Operation

(4) Data Processing Management

During data processing, data obtained on different dates should be well managed to parcel out for the noise deletion to all the trainees and the study team member. Accordingly, the management sheet (file) for data processing was created as shown in the following Block, as technology transfer. Study team asked C/Ps to manage and control the data processing based on the Block sheet by them. Each Block was divided into 500 m x 500 m in order for HYPACK to process the enormous data.

(5) OJT and Feedback

On the data analysis, especially on depth data analysis, it was likely to waste the processing time during the OJT. C/Ps made the inspection mutually within the process of work. Feedback lecture was also made to C/Ps after they completed the inspection. Thanks to the mutual cooperation, OJT was complete as scheduled, whereas some of the member could not participate the training from time to time due to the other engagement and conferences.

An intensive training was scheduled to the younger generation of trainees, especially Mr. Sok Vannak, as the expert for data processing, considering the future project.

Attention for this intensive training was to aim at the development of his skills to other trainees in the Echo-Training. The assigned trainee for intensive training also participated in the JICA Collective Training, Hydrography for Charting and Disaster Management, for 6 months, from Jun. 2016 to Dec. 2016.

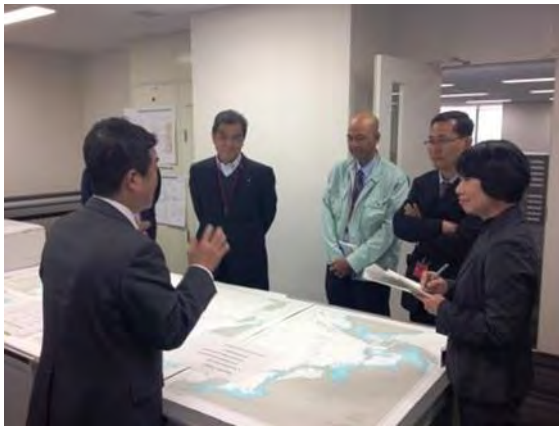
3 - 1 - 6 (7) Production of Chart and ENC

(1) The 1st ENC Training; Basic Knowledge

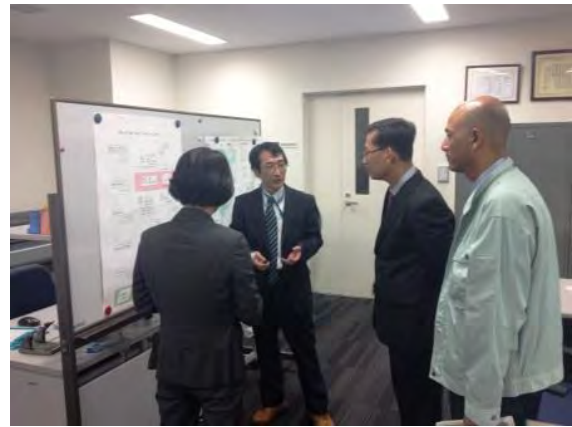
The 1st ENC training has been conducted to the 2 C/P as to the ENC contents, the method and the schedule at JICA Tokyo, for 27 days from 1st Dec. to 27th Dec. 2013. Following Table 3 - 3 shows the summary of the 1st ENC training:

Table 3 - 3 Schedule of 1st ENC Training in Japan

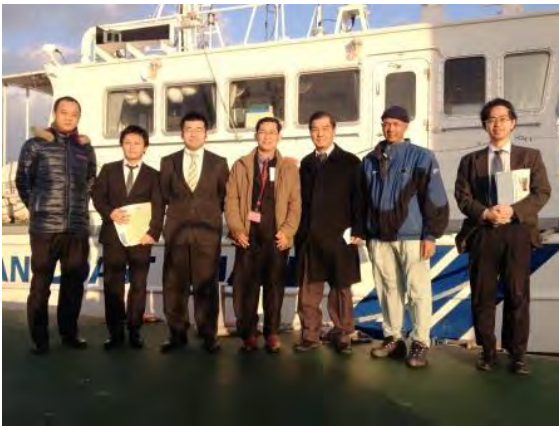
Date		Contents	Method	Instructor
		Shoichi Kokuta: Aero Asahi Corporation (AAC) Ichiro Nakagawa: Terra Corporation Katsutoshi Najoh: Japan Hydrographic Association (JHA)		
30-Nov-13	Sat.	Two trainees travelled to Japan		
1-Dec-13	Sun.	Trainees arrived at Narita		
2-Dec-13	Mon.	Briefing / Skill Check /visit JCG	Lecture	S. Kokuta and I. Nakagawa
3-Dec-13	Tue.	Training ENC/Chart Knowledge (1)	Lecture	S. Kokuta and others
4-Dec-13	Wed.	Technical training of ENC	Lecture	S Kokuta and I. Nakagawa
5-Dec-13	Thu.	Training on S-57 standard	Lecture/Practice	I. Nakagawa
6-Dec-13	Fri.	Outline of ENC Designer / visited JHA	Practice/Visitation	I. Nakagawa/ S. Kokuta
7-Dec-13	Sat.	Day off		
8-Dec-13	Sun.	Day off		
9-Dec-13	Mon.	Training on ENC Reference	Lecture/Practice	I. Nakagawa
10-Dec-13	Tue.	Chart Knowledge (2) (3) (4), Datum Level	Lecture	K. Najoh
11-Dec-13	Wed.	Cell and meta / convert Geo- Datum	Lecture/Practice	I. Nakagawa
12-Dec-13	Thu.	Feature and topology	Lecture/Practice	I. Nakagawa
13-Dec-13	Fri.	International ENC / Visit AAC	Lecture/Visitation	S. Kokuta
14-Dec-13	Sat.	Day off		
15-Dec-13	Sun.	Day off		
16-Dec-13	Mon.	How to digitize using ENC Designer	Lecture/Practice	I. Nakagawa
17-Dec-13	Tue.	How to digitize using ENC Designer	Practice	S. Kokuta and others
18-Dec-13	Wed.	How to create feature objects	Lecture/Practice	I. Nakagawa
19-Dec-13	Thu.	Quality management/use -Inspector	Lecture/Practice	I. Nakagawa
20-Dec-13	Fri.	6th JCG Headquarters(Hiroshima)	Visitation	S. Kokuta
21-Dec-13	Sat.	Training Tour (Kyoto)	Tour	S. Kokuta
22-Dec-13	Sun.	Return to Tokyo		
23-Dec-13	Mon.	Day off		
24-Dec-13	Tue.	How to update/distribute ENCs	Lecture	S. Kokuta
25-Dec-13	Wed.	Making exchange set / Install ENC	Lecture/Practice	I. Nakagawa
26-Dec-13	Thu.	Skill Check / Evaluation Meeting	Questionnaire	S. Kokuta and I. Nakagawa
27-Dec-13	Fri.	Trainees travelled back to Cambodia		



Lectures on ENC at JHOD on 2nd Dec. 2013



Lectures on ENC at JHOD on 2nd Dec. 2013



Visit 6th Regional HQ of JCG on 20th Dec. 2013



Lecture about ENC on 10th Dec. 2013



ENC Training at Terra Corp. on 25th Dec. 2013



Evaluation Meeting at JICA on 26th Dec. 2013

Photo 3 - 15 ENC Training on December 2013 in Japan

There were some uncertainties on the result of training for ENC at the beginning. But Mr. Long Bunlong, (one of the trainees) was familiar with diversified technologies of IT and GIS. He was expected to be an ENC expert and the chief of C/Ps to train the other C/Ps.

(2) The 2nd ENC Training; In-service Training

The 2nd ENC training has been carried out in Japan and the Philippines as to the following contents and schedule from 27th Jul. 2014 to 23rd Aug. 2014. At the beginning, the trainee had lectures on ENC in Japan for 1 week. Then, the training in the Philippines has been carried out under the “Third-Country-Training” at the National Mapping Resource Information Authority (NAMRIA), which had already obtained the high evaluation among the JICA technical cooperation projects that achieved the objective of “The project for supporting ENC Production of the Philippines”, implemented in 2000 - 2004 (For more detailed information refer to Interim Report). Following Table 3 - 4 shows the summary of training in Japan and the Philippines:

Table 3 - 4 Schedule of Training in Japan and the Philippines

2 nd ENC Training Schedule; in Japan and the Philippines				
Year/Month/Date		Summary of Activity	Training Contents	Lecturer
2014			Shoichi KOKUTA, AAC Ichiro NAKAGAWA, Terra Corp. Kittisak WANGKIWORAKUL, AAC Dante, ENC staff in NAMRIA	
27 th Jul.	Sun	Arrival of Trainee in Narita		
28 th Jul.	Mon	Briefing, Visit JHOD	Courtesy call /Lecture	S. Kokuta
29 th Jul.	Tue	Review on ENC knowledge	Lecture	S. Nakagawa
30 th Jul.	Wed	Review on ENC knowledge	Lecture	S. Nakagawa
31 st Jul.	Thu	Training on vectorization technique of digital data	Lecture/Training	S. Nakagawa W. Kittisak
1 st Aug.	Fri	Training on ENC production adopting vectorized data	Training/Field trip	S. Kokuta S. Nakagawa
2 nd Aug.	Sat	Travel from Narita to Philippines		
3 rd Aug.	Sun	Day off		
4 th Aug	Mon	Visit NAMRIA	Courtesy call/ Discussion	S. Kokuta
5 th Aug.	Tue	Trial production of ENC near SHV	Training	S. Kokuta W. Kittisak Dante
6 th Aug.	Wed	Lectures on ENC production using hydrographic survey results at NAMRIA	Lecture/Training	-ditto-
7 th Aug.	Thu		Lecture/Training	-ditto-
8 th Aug.	Fri		Field trip	-ditto-
9 th Aug.	Sat	Day off		
10 th Aug	Sun	Day off		
11 th Aug	Mon	Visit NAMRIA Head Quarters. Trial production of ENC	Training	S. Kokuta W. Kittisak Dante
12 th Aug	Tue	using part of the existing	-ditto-	-ditto-

13 th Aug	Wed	chart under the instruction of lecturers of NAMRIA.	-ditto-	-ditto-
14 th Aug	Thu		-ditto-	-ditto-
15 th Aug	Fri		Visit NAMRIA's survey vessel	S. Kokuta W. Kittisak
16 th Aug	Sat	Day off		
17 th Aug	Sun	Day off		
18 th Aug	Mon	Evaluation of trial ENC produced in the previous week	Lecture/Training	S. Kokuta W. Kittisak Dante
19 th Aug	Tue	Re-produce of trial ENC based on the review	-ditto-	W. Kittisak Dante
20 th Aug	Wed	Preparation of ENC in SHV	-ditto-	W. Kittisak Dante
21 st Aug	Thu	Discussion on ENC production with ENC staff of NAMRIA	Qs & As	S. Kokuta W. Kittisak Dante
22 nd Aug	Fri	Evaluation Meeting Presentation of diplomas	Evaluation meeting	S. Kokuta JICA Philippines
23 rd Aug	Sat	Trainees traveled from Manila to Phnom Penh		



ENC Training at NAMRIA



MPWT's executives visiting



Presentation of Diplomas by JICA Philippines; Lecturers of the Third-Country Training
Photo 3 - 16 Third-Country-Training on August 2014

What was worthwhile for the successful completion of the Third-Country-Training was the preliminary visit to NAMRIA by the Study Team Leader of JICA, and he requested the cooperation for ENC training to Deputy Director of NAMRIA and discussed on the arrangement with the technical staff of ENC. It was considered that it was effective to have them the Third-Country-Training given by the ex-trainees in the previous Technical Assistance Project of JICA. Following maps show the paper chart and ENC produced as the products of Third-Country-Training.

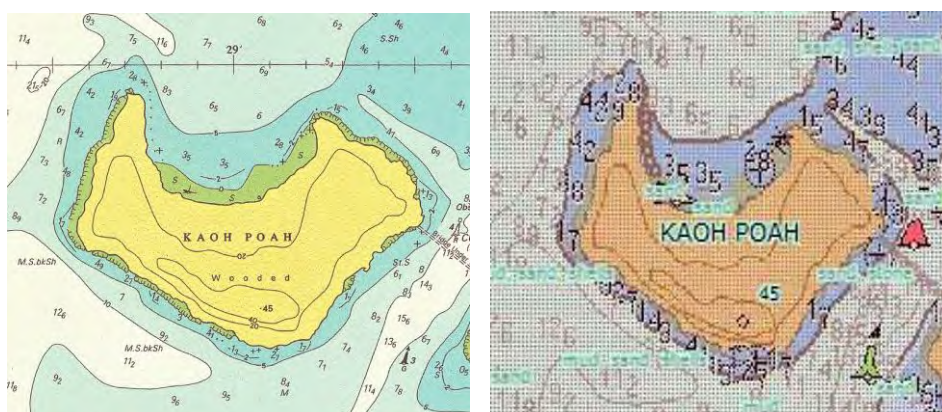


Figure 3 - 15 Paper Chart in left and ENC in right produced in the Third-Country-Training in Aug. 2014

(3) Implementation of Technical Visit and Leader Training

Technical Visit, recognizing the importance of institutional capacity building, aimed at being a member of IHO has been implemented by the visits of NAMRIA of Philippines and MSA of Singapore from 3rd Aug. 2014 to 8th Aug. 2014. H.E. Mr. LENG THUN YUTHEA; Under Secretary of States, Mr. ROS SOPHORNNA: Director of Waterways Department and Mr. MAK SIDETH, MSc; Director of Merchant Marine Department of MPWT have joined respectively in order to obtain know-how on management of ENC produced and build a cooperative relationship with the member countries of EAHC. The Philippines is the Chair country of EAHC and has published ENCs in the technical cooperation of JICA. Singapore is one of the leading countries to enlighten the importance of ENC (For more detailed information refer to Interim Report).

Leaders participated for the training from Cambodia made a courtesy call to NAMRIA and thanked their cooperation to the ENC training and exchanged the views on the ENC with the Director and Deputy Director of NAMRIA.

They also visited MPA in Singapore and made a tour of ENC production. Team Leader S. Kokuta and Project Coordinator K. Takashita accompanied their visit to Singapore.



Exchange of Views with the Leader of NAMRIA,
4th Aug. 2014



Visit ENC Training Room of NAMRIA, 4th Aug.
2014



Exchanging Views with Director and the Leaders
of NAMRIA, 5th Aug. 2014



Exchange of Friendship Token between Director
of NAMRIA and Under Secretary of MPWT, 5th
Aug. 2014



Visit ENC room of MPA, 7th Aug. 2014



Courtesy Call to MPA Hydrographic Office,
Under Secretary Yuthea, left, JICA Study Team
Leader S. Kokuta, center, Director of MPA
Hydrographic office Dr. Parry Oei, right, 7th Aug.
2014

Photo 3 - 17 Leader Training on August 2014

(4) ENC Administrative Training

After the production of C & ENC, it is desired to be effectively used as the sailing purpose. However, it is difficult to distribute them for actual users because Cambodia is not a member of the IHO, which is required for the publication of the international chart. Therefore, MPWT's executives as described above visited the Hydrographic Department of Philippines and Singapore and exchanged views on international environment surrounding the C & ENC. Supporting assertion for the publication of charts produced in this project has been voiced of opinions from EAHC at the field of this exchange. There is a request of training for administrative ENC training as capacity building to build the publication and maintenance system of C & ENC for a week at Hydrographic and Oceanographic Department of JCG, where is EAHC permanent secretariat, from the Chief Hydrographer, Director of MPWT/WD, who is real responsible for C / P organization according to publishing C & ENC. Then the training was implemented in September 2015 when the trial version of ENC in this project had been completed. JHOD of JCG is the permanent secretariat of the EAHC required in the publication of the chart, including Cambodia in order to provide the necessary information to maintain the latest chart for Mariners in the Southeast Asia, East Asia together with an adjustment countries of the region (NAVAREA XI region).

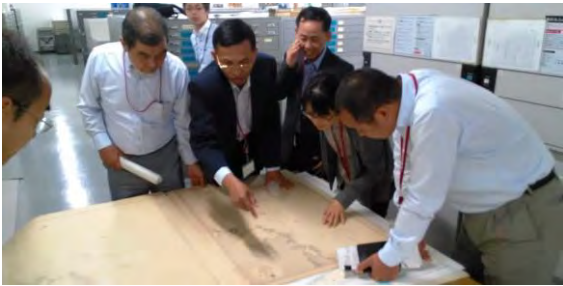
Therefore, the most effective training was considered to be in the JHOD, Japan. ENC Administrative training was held in Japan for one week from 6th Sep. 2015 as shown below:

Table 3 - 5 Schedule of ENC Administrative Training in September 2015

ENC Management Training Schedule in Japan						
D/ M / Y		Contents	Method	Place	Lecturer & Explanation	
13.Sep 2015	Sun	Arrival at NARITA				
14.Sep	Mon	Before noon	Briefing	Visitation	Aero Asahi Corporation	Person in charge of JICA
		Afternoon	International situation about ENC	Lecture		Kokuta / Nakagawa
15.Sep	Tue	Before noon	Courtesy call to the Director General of HOD Introduce Activities of Hydrographic and Oceanographic Department	Lecture & Explanation	JHOD	JHOD's officer / Kokuta
		Afternoon	Visit Cartographic Office: Charting ENC Visit Notices to Mariners Office Visit Environmental and Oceanographic Research Division Visit Oceanographic Data and Information Division Visit Marine Pollution Research Laboratory Visit Pavilion of HOD			
16.Sep	Wed	Before noon	Chart and Navigational Information Division : Outline of International Standard of ENC Production and International framework according to the distribution/update	Lecture	JHOD	JHOD's officer / Kokuta
		Afternoon	Chart and Navigational Information Division : Series of challenges according to ENC Production Technology Planning and International Affairs Division : Hydrographic and Oceanographic Services related laws in Japan			
17.Sep	Thu	Before noon	Presentation of Marine Information Services in Cambodia The role of the IHO and EAHC	Presentation & Discussion	JHOD	JHOD's officer / Kokuta
		Afternoon	Exchange of views opinions relating to future cooperation Vistation in Tokyo Bay			
18.Sep	Fri	Before noon	Suggestion about ENC of Cambodia	Discussion	Aero Asahi Corporation	Kokuta /Takashita
		Afternoon	Evaluation			
19.Sep	Sat	Trainees leave to Phnom Penh				



Explanation of Chart Management and Mechanism of IHO at JHOD of JCG



Explanation of the oldest BA chart of Cambodian Jurisdiction water

Courtesy Visit to AAC

Photo 3 - 18 ENC Administrative Training in Japan

(5) Trainee's Level on the Data Processing Technique

As to the publication of ENC actually, it should be desirable to own the publication technology of a paper chart. The computer science and operation should be the minimum requirements and the knowledge of the vector graphics and of the geographic coordinate systems should also be needed for the smooth implementation of the technology transfer. It was found that the comprehension varied apparently from each other despite the same contents of training. In order to acquire the ENC production technology for a short period of time, it might be essential that the trainees should be well prepared for it along with having a high level of techniques on computer science, of course.

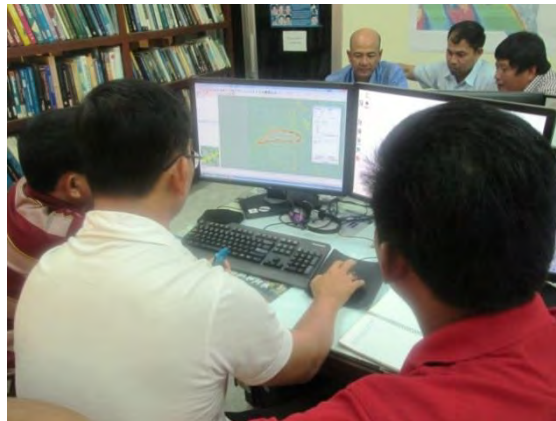


Photo 3 - 19 Production ENC trainees C/P

Following Table 3 - 6 shows the rating of technical proficiency on ENC of trainees at 6 grades in terms of before and after the trainings as of Dec. 2016:

- 1: 0 ~ 10 % State of being having neither knowledge nor practical experience.
- 2: 10 ~ 20 % State of being having a basic theory and knowledge only.
- 3: 30 ~ 40 % State of being an initial stage of technical learning and skills based on basic theory.
- 4: 50 ~ 60 % State of being an intermediate stage of technical learning based on practical skills and theory.
- 5: 70 ~ 90 % State of being the advanced stage of technical learning based on practical skills and theory.
- 6: 90 ~ 100 % State of being proficient in practical skills and theory and possible for the further sustainable development by oneself.

Table 3 - 6 Rating of Technical Proficiency on ENC Production

	Before Training	After training
1 Creating ENC Dataset		
Initial Set up of country Code and Cell Naming.	1	5
Datum Conversion	1	5
2 Topology Correction		
Correct the topology before encoding ENC, understanding of Chain Node	1	4
Digitize isolated node, connected node, and edge, digitizing Methodology	1	4
Remove redundant topology, Understanding of Redundancy	1	3
3 ENC Encoding		
Understanding feature objects in S-57	1	4
Understanding attributes in S-57	1	3
Relationship between paper chart and symbolization and ENC symbolization	1	4
Mandatory objects in ENC	1	3
Mandatory attributes for each objects.	1	4
Understanding the concept of Mask and Data limit	1	3
Understanding the concept of Group-1	1	5
Examine the use of object catalogue while encoding ENC	1	4
4 Quality Assurance		
Understanding errors/warnings message by ENC Analyzer	1	4
Correct errors/warnings	1	4
5 Computer Engineering		
Operate the hardware	5	5
Operate Operating System	5	5

In the original project, ENC production by way of the hydrographic survey of all the project area followed by the production of vector fair sheet was executed, and at the same time, the technical training for ENC production was also carried out during the project period. In the extension project, ENC/Paper Chart productions were carried out following to the rasterizing process of existing paper chart scanned. And, the technology to update the ENC based on the limited data acquired by the hydrographic survey was technically transferred by the study team.

3 - 2 Issues Raised during Technology Transference and its Challenges in the Future

Initially, during the 1st phase of hydrographic survey period, from October 2013 to May 2014, most of the C/Ps were suffered by the seasickness since they did not have any experience at all to get on board the survey boat for hydrographic survey activity. Although they got to know the hydrographic survey and basic technologies of operation/maintenance of DHSDAS somehow, it was difficult for them to manage the “Echo-Training” originally planned. However, the trial for phase 1 ended up to failure, “Echo-Training” system came to be established gradually because the hydrographic activity was favored by rather a good weather condition at the latter part of the 2nd term hydrographic survey. In addition, they could have the opportunity of using DHSDAS by themselves for one week.

Having the Extension Project shifting toward further offshore, more severe weather condition was anticipated in advance. Half of the C/Ps already became unconcerned about the seasickness at the beginning of Extension Project. And, the C/Ps were entrusted rigging and data acquisition process as much as possible by themselves. Among them, one C/P already became independent operator using data acquisition system. Therefore, it should be believed that “Echo-Training” system within their office has almost established having the completion of fieldwork of the Extension Project, June 2016.

As for the technical transfer on the knowledge and methodology of data processing of digital hydrographic survey and compilation of Navigational chart and ENC, it was realized through the “Echo-Training” system operated by the 8 C/Ps divided by 2 parties on the data processing over the total number of 53 months data derived by the initial project.

Further, on the Extension Project, personnel that have not involved for the ENC training so far also emerged in the ENC production, as a result that the training policy was taken to establish sustainable system for nurturing human resources letting them to recognize the importance on the collection of reference materials for the charting project, especially on the accumulation of empirical knowledge for bathymetric data acquisition in digital format.

OJT on the rigging and installation was performed to C/Ps as in the following manner:

- To show a good example of rigging and installation of each equipment,
- To repeat its operation to each trainee,
- To point out mistakes and advised its remedies, if necessary, and to further repeat its method for them to memorize in the future.

However, unexpected incident of poor connection occurred in the connector of SVP, Sound Velocity Profiler, which was to be lowered in the water for measurement, because the plug was connected and disconnected every time the measurement of sound profiling was performed.

Which was the major defective portion of the instrument though, the connector for plugging was so tight that the operator moved it back and forth to widen its connector, which was inferred to cause the poor connection of the plug.



Photo 3 - 20 Sound Velocity Profiler Plug and Connector

Following countermeasures were taken:

- To practice pulling out the connector vertically,
- To use fresh water for washing the instrument after its use,
- To use the dummy plug during the wash so that the connector should not be affected by water,
- To make it dried and stored avoiding the direct sunlight,
- To add the warning in the operational manual,
- To enlighten the importance of maintenance of the survey equipment, which was scheduled to transfer to WD for their management and maintenance after the project.

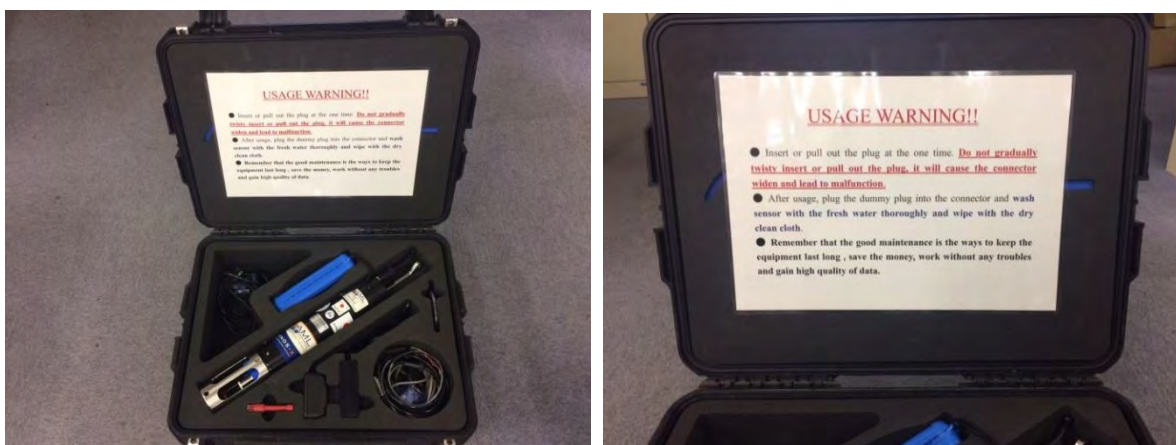


Photo 3 - 21 Operational Warning attached back of the Instrument Box of SVP

Summary:

The C/P got to know and acquired its technology gradually by the repeated trainings even for the complicated operations in the hydrographic related activities, varying from hydrographic survey to editing and compiling of navigational chart. Actually, the C/P had already become the ENC expert, but they might require some technical advice, after the 3-year training accumulating various technologies and skills for the production of paper chart and ENC, which was the initial major objective of the project, by the Technology Transfer including OJT, and now they already have relevant capability of producing ENC by their own effort. And, it was also considered that C/P had relevant responsibility and already prepared to update the ENC by them in the future.

After the project, C/P would work on the ENC training of younger generation in accordance with the respective job assignment and with relevant budget by having more accumulation of empirical knowledge of hydrographic survey and ENC production.

Chapter 4 REPORTING

4 - 1 (2) Preparation of Inception Report, (3) Explanation and Discussion

Inception Report had been prepared for summarizing the basic execution policy, methodology including technology transfer, individual tasks and its contents, implementing organization and plan of work. Study Team submitted it to JICA for comments and approval. After the approval of the Inception Report by JICA, the report had been presented to the 1st Joint Coordination Committee, hereinafter referred to as JCC, held at MPWT. Study Team explained its basic execution policy and overall survey framework and discussed with MPWT representatives. Record of Discussion was summarized in the Minutes of Meeting and approved by the personnel concerned. Minutes of Meeting of Meeting was submitted to JICA on 20th Nov. 2013.

4 - 2 (8) Preparation of Progress Report, Explanation and Discussion

Survey activities and the results were summarized in the Progress Report on the geodetic and leveling surveys carried out in Oct. 2013 and the 1st hydrographic survey commenced from the end of Feb. 2014 together with the evaluation results of 1st ENC training. Approved by JICA, the Progress Report had been submitted to the 2nd JCC Meeting and study team explained about its data acquired and the progress. Then, the study team discussed on the framework of the 2nd-term hydrographic survey after the explanation about the scope of work and its policy for the upcoming survey activity. Discussion was summarized in the Record of Discussion and approved by the personnel concerned. Minutes of Meeting including its R/D was submitted to JICA at the completion of the 1st-term hydrographic survey, i.e. 23rd July 2014.

4 - 3 (8) Preparation of Interim Report, Explanation and Discussion

Interim Report was prepared by summarizing the progress of survey work, evaluation of achievements and the procedures for upcoming project work inclusive of survey activities on the 1st-term hydrographic survey and the 2nd-term hydrographic survey as well as the 2nd ENC training undertaken in Aug. 2014.

Interim Report was submitted to JICA for approval. Then, the contents were explained at the 3rd JCC Meeting held in 22nd Apr. 2015. During the Meeting, the scope of work designed to produce ENC of Navigational Purpose 5, Harbour, by the end of Aug. 2015 was explained and discussed on the upcoming procedures and methodology.

Further, on the occasion, a request for the production of ENC for Navigational Purpose 3, Coastal navigation, in and around SHV port was proposed extending the present project for another 1 year by the MPWT. R/D was summarized in the M/M and approved by the personnel concerned. Also, the M/M was submitted to JICA at the completion of 2nd-term hydrographic survey, 21st May 2015, for approval.

4 - 4 (8) Preparation of Interim Report 2, Explanation and Discussion

Interim Report 2 was compiled, as to the progress, results and evaluation, summarizing the following tasks as shown below:

- Survey activities executed from Sep. 2013 to end of 2015,
- Scope of work for the Extension Project, for another 1 year up to the end of 2016, officially approved in the M/M, based on the revised R/D held in 10th Nov. 2015, between the Minister of MPWT and the Chief Representative of JICA Cambodia Office.

Following to the approval by JICA, a reporting of outputs of original project and an explanation on the framework and its executing policy was made at the 4th JCC Meeting held on 11th Mar. 2016. During the discussion on the Meeting, necessary procedures, expected to complete its production by the end of Aug. 2016, for the ENC of Navigational Purpose 3 near the SHV were explained and further discussed on the survey activity. R/D was summarized in the M/M and approved by the attendees. The M/M was submitted to JICA at the completion of the Extension Project, 18th May 2016.

4 - 5 (9) Preparation of Draft Final Report, Explanation and Discussion

Overall project activities, inclusive of the original project and the extension project, and results as well as the evaluation were summarized in the draft final report, and it will be submitted to JICA for approval. It will also be presented to the 5th JCC Meeting to be held on the 13th Dec. 2016, and discussion will be held on the outputs of original and extension projects and on the proposal of the future development of ENC process in Cambodia. Discussion will also be made on the “Workshop on ENC Enlightenment” by the personnel concerned. Following to the mutual agreement on the R/D, M/M will be submitted to JICA for comments and approval.

4 - 6 (10) Preparation of Final Report

Draft final report will be revised based on the results of 5th JCC Meeting. Also, together with the results of Workshop on ENC Enlightenment as well as the provision of equipment that used in the project will be added to the Draft Final Report. Final Report will be compiled that includes the CD-ROM or DVD-ROM containing the files of large and medium scales ENCs scaled at 1/20,000 and 1/150,000, which are accessible on the PC.

Chapter 5 OTHER ACTIVITES

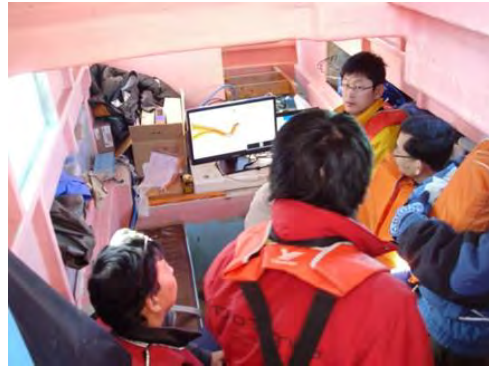
5 - 1 Procurement of Survey Equipment

Survey equipment used in this project was procured both by the open tender by JICA Headquarters and the tender performed by the Consultant contracted. Following photographs show the equipment required essentially to execute this project such as DHSDAS and DHSDPS as well as the hardware and software necessary to produce ENC.

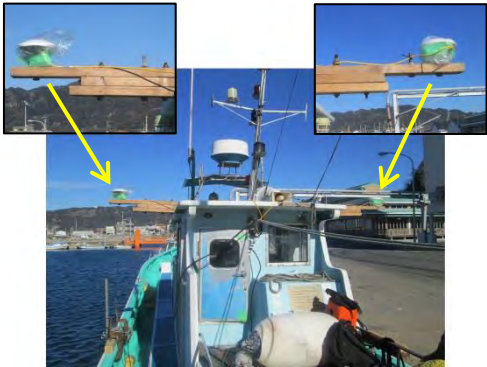
Survey equipment was provided for wet-test before the equipment was transported to Cambodia from Japan. JICA study team witnessed the wet-test about the function and its performance carried out at Hota port in Chiba pref. on 16th Dec., 2013, refer to Figure 5 - 1. The 2 Cambodian C/P trainees participated to the 1st ENC Training of JHOD witnessed this wet-test for the future project in Cambodia. Although a part of the equipment, SIM; synchronizing function of data acquisition timing, showed an improper performance, hardware and software comprising DHSDAS and DHSDPS worked properly. A defective SIM was replaced by the supplier and checked its function by the dispatched technician. Equipment provided by JICA Headquarters is shown in the following Figure 5 - 2 when arrived at SHV and all of them at Figure 5 - 3 and Table 5 - 1



Boat chartered for Wet-Test



Explanation of function and performance by supplier



GNSS antenna for positioning and heading



Upper left: Sonar controller modem,
Center: GNSS receiver,
Lower left: Power and signal convergence system



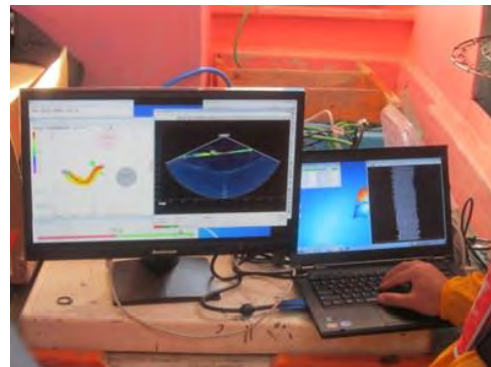
SBES and MBES Transducer



SBES data Acquisition System



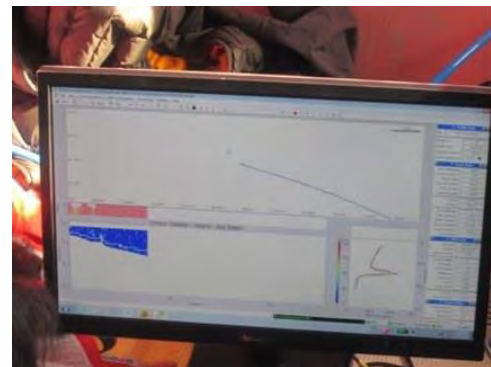
DHSDAS; Motion Sensor



DHSDAS; Control, Navigation, Data Acquisition



ADCP Transducer



ADCP Data Acquisition View

Photo 5 - 1 Equipment Procured by JICA HQ and Wet-Test in Japan at Hota port, 16th Dec. 2013



Equipment Procured by JICA Headquarters



Equipment Procured by JICA Headquarters



Containerized Equipment Airfreighted, Procured by JICA HQ



Labels Airfreighted



Equipment Airfreighted, Procured by JICA HQ



Labels Airfreighted



Open of Containerized Equipment



Open of Containerized Equipment

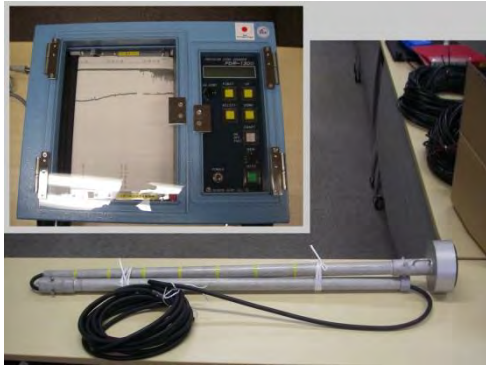


Open of Containerized Equipment



Open of Containerized Equipment

Photo 5 - 2 Equipment Procured by JICA Headquarters Airfreighted to Cambodia



SBES; PDR-1300



MBES; SONIC2020



GNSS for Positioning and Heading; SPS361



Surface SVP; Micro X SV



GNSS; SPS351, for Positioning and ADCP,500kHz



Motion Sensor; DMS-10



SVP; Minos X SV-P



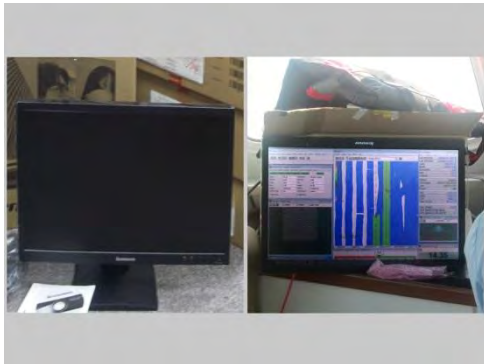
Comprehensive Hydrographic Software;
HYPACK Max and HYSWEEP



Laptop Computer: ThinkPad T430



Desktop P.C: ThinkPad M72E
Display: LENOVO LS2223



Navigation Monitor: LENOVO LS2223



External HDD: HD-PCTITU3



USB-Serial Port Exchange Box: E-dgeport/8



Power and Signal Convergence: J-BOX-1G(200)



CAD Mapping System; AUTOCAD MAP 3D2014



GIS Mapping System; ArcGIS for Desktop



Photo 5 - 3 Equipment Procured by JICA Headquarters

Table 5 - 1 List of Equipment Procured By JICA Headquarters

JICA No.	Equipment	Equipment Model	Acquisition Date	Storage Place	Remark
13-3-002206	Single Beam Echo sounding System	PDR-1300	2014/1/20	MPWT/WD	For Shallow area survey
13-3-002207	Multi-Beam Echo sounding System	SONIC2020	2014/1/20	MPWT/WD	Including spare parts
13-3-002208	GNSS positioning System	SPS361	2014/1/20	MPWT/WD	Including spare parts
13-3-002209	Surface SVP Profiler	Micro·X SV	2014/1/20	MPWT/WD	Including spare parts
13-3-002210	ADCP System	ADP 500khz, SPS351	2014/1/20	MPWT/WD	Including spare parts
13-3-002211	Motion Sensor	DMS-10	2014/1/20	MPWT/WD	Including spare parts
13-3-002212	SVP Profiler	Minos·X SV·P	2014/1/20	MPWT/WD	Including spare parts
13-3-002213	Hydrographic Survey Software	HYPACK MAX and HYSWEEP	2014/1/20	MPWT/WD	
13-3-002214	Hydrographic Survey Software	HYPACK MAX and HYSWEEP	2014/1/20	MPWT/WD	
13-3-002215	Note computer	ThinkPad T430	2014/1/20	MPWT/WD	For Data Acquisition
13-3-002216	Note computer	ThinkPad T430	2014/1/20	MPWT/WD	For Data Acquisition
13-3-002217	Note computer	ThinkPad T430	2014/1/20	MPWT/WD	For Data Acquisition
13-3-002218	Desktop computer	ThinkPad M72E	2014/1/20	MPWT/WD	For Data Acquisition
13-3-002219	Desktop computer	ThinkPad M72E	2014/1/20	MPWT/WD	For Data Processing
13-3-002220	Desktop computer monitor	LENOVO LS2223	2014/1/20	MPWT/WD	For Data Processing
13-3-002221	Desktop computer monitor	LENOVO LS2223	2014/1/20	MPWT/WD	For Data Processing
13-3-002222	Desktop computer monitor	LENOVO LS2223	2014/1/20	MPWT/WD	For Data Processing
13-3-002223	Desktop computer monitor	LENOVO LS2223	2014/1/20	MPWT/WD	For Data Processing
13-3-002224	Survey Navigation monitor	LENOVO LS2223	2014/1/20	MPWT/WD	For Survey Navigation
13-3-002225	Survey Navigation monitor	LENOVO LS2223	2014/1/20	MPWT/WD	For Survey Navigation
13-3-002226	External HDD	HD-PCT1TU3	2014/1/20	MPWT/WD	For Data Backup
13-3-002227	External HDD	HD-PCT1TU3	2014/1/20	MPWT/WD	For Data Backup
13-3-002228	USB-Serial port convertor	Edgeport/8	2014/1/20	MPWT/WD	For Data Converting
13-3-002229	USB-Serial port convertor	Edgeport/8	2014/1/20	MPWT/WD	For Data Converting
13-3-002230	Junction Box	J-BOX-1G(200)	2014/1/20	MPWT/WD	For Data Synchronization
13-3-002231	CAD Software	AutoCAD MAP2014	2014/1/20	MPWT/WD	For DTM editing
13-3-002232	GIS Software	ArcGIS Desktop Basic	2014/1/20	MPWT/WD	For GIS
13-3-002233	GIS Software	ArcGIS Desktop Basic	2014/1/20	MPWT/WD	For GIS
13-3-002234	A0 Plotter	DesignJet T920	2014/1/20	MPWT/WD	For Map Plotting
13-3-002237	CAD Software	AutoCAD MAP 2014	2014/1/20	MPWT/WD	For DTM editing

5 - 2 Equipment Procured by Study Team

As of Dec. 2016, all the equipment procured at the commencement of the project is working properly with no problems. Other than the equipment procured, consumables, such as generator, battery, air-conditioner for the survey boat and etc., were procured on site by the study team. Following Figure 5 - 4 and Table 5 - 2 shown the equipment the study team procured:

 <p>Tide Gauge; RMD5225WLB-2</p>	 <p>Portable Tide Gauge; RT710-W</p>
 <p>Uninterruptible Power Supply UPS; GXT-2000MTPLUS230</p>	 <p>Uninterruptible Power Supply UPS; GXT-2000MTPLUS230</p>
 <p>Desktop PC for ENC Editing; DELL PRECISION T1700</p>	 <p>NAS System; D-Link Desktop PC for NAS Server; DELL OPTIPLEX 9020</p>



ENC Software; SevenCs, FME

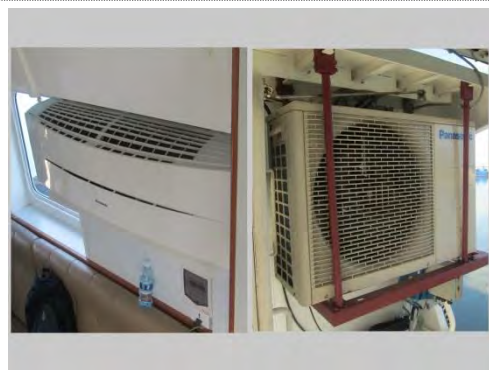


Unmanned Aerial Vehicle; PHANTOM3

Photo 5 - 4 Equipment Procured by Study Team



Generator for Survey Boat



Air-Conditioner for Survey Boat



Battery



DC-AC Inverter



Generator

Photo 5 - 5 Consumables Procured by Study Team

Table 5 - 2 List of Equipment Procured by Study Team

JICA No.	Equipment	Equipment Model	Acquisition Date	Storage Place	Remark
13-3-002235	Tide Gauge	5225WLB-2	2013/9/11	PAS; SHV Port	Purchased in Japan For Tide Station
13-3-002236	Tide Gauge	RT710-W	2013/8/23	MPWT/WD	Purchased in Japan For Temporary site
13-3-002238	UPS	GXT-2000MTPLUS230	2014/1/23	MPWT/WD	Purchased in Cambodia For Hydrographic Survey
13-3-002239	UPS	GXT-2000MTPLUS230	2014/1/23	MPWT/WD	Purchased in Cambodia For Data Processing
14-3-002739	ENC Production Desktop computer	DELL PRECISION T1700	2014/5/16	MPWT/WD	Purchased in Cambodia For ENC Production
14-3-002740	UPS	GXT-2000MTPLUS230	2014/5/16	MPWT/WD	Purchased in Cambodia For Data Processing
14-3-002741	NAS Desktop computer	DELL OPTIPLEX 9020	2015/2/11	MPWT/WD	Purchased in Cambodia For NAS Server
14-3-002742	NAS HDD	D-Link ShareCenter	2014/6/9	MPWT/WD	Purchased in Cambodia For Data Backup
15-3-002128	Tide Gauge	RT710-W	2016/2/23	MPWT/WD	Purchased in Japan For Temporary site
15-3-002129	ENC Production Software	SevenCs, FME	2016/2/23	MPWT/WD	Purchased in Cambodia For ENC Production
15-3-002130	Unmanned Aerial Vehicle	PHANTOM3	2016/3/10	MPWT/WD	Purchased in Cambodia For Remote Photo Taking

5 - 3 Site Visits

(1) Site Visit by the Chief Representative of JICA Cambodia Office



Photo 5 - 6 Site Visit by the Chief Representative of JICA Cambodia Office and his Party

The Chief Representative of the JICA Cambodia office, Mr. IZAKI and Mr. YOKOI visited the Project site on 8th Apr. 2014. The site visit was made having the introduction of C/Ps and the inspection of the patrol boat of PAS, which was to be used as a survey boat, and the seafarer room, which was to be used as the data processing room. The systems of the DHSDA equipped in the survey boat and the DHSDP were also explained, respectively. The chief representative encouraged C/Ps to learn the hydrography and advised the survey team of good taking care of the health. The duration of site visit was for about one hour.

(2) Site Visit by the Minister of Embassy of Japan in Cambodia and Member of the Legation Staff



Photo 5 - 7 Site Visit by the Minister of Embassy of Japan in Cambodia and Member of the Legation Staff

The Minister of Embassy of Japan in Cambodia, Mr. HIGUCHI and Second Secretary, Mr. IIZUKA visited the project site on 10th Dec. 2014. The site visit was made having the introduction of C/Ps and the inspection of the patrol boat of PAS, which was to be used as a survey boat, and the seafarer room, which was to be used as the data processing room. The systems of the DHSD equipped in the survey boat and the DHSDPS were also explained, respectively. The Minister encouraged C/Ps to learn the hydrography and advised the survey team of good taking care of the health. He had an interest to operate the boat.

(3) Site Visit by the Deputy Representative of JICA Cambodia Office



Photo 5 - 8 Site Visit by the Deputy Representative of JICA Cambodia Office

The Deputy Representative of JICA Cambodia office, Mr. ITO and Mr. WATANABE were visited at the project site on 11th Dec. 2014. The site visit was made having the introduction of C/Ps and the inspection of the patrol boat of PAS, which was to be used as a survey boat, and the seafarer room, which was to be used as the data processing room. The systems of the DHSDA equipped in the survey boat and the DHSD were also explained, respectively. The deputy representative encouraged C/Ps to learn the hydrography and advised the survey team of good taking care of the health. The duration of site visit was for about one hour.

(4) Courtesy call to “SHIRAYUKI”, the Escort Ship of Squadron of Maritime Self-Defense Force of Japan.



Photo 5 - 9 Escort Ship “SHIRAYUKI” anchored off SHV Port

The squadron of the Maritime Self-Defense Force of Japan consisting of 3 escort ships sailed into the SHV port on the mid-February 2014. The leader of the Study team made a courtesy call to “SHIRAYUKI”, one of the three escort ships, in order to get the information on the navigation route leading to the SHV port on 17th Feb. 2014, and met with the chief mate at the bridge. He said that the position of one Navigational Aids on the way to the port was different compared with the existing chart (BA2103). ENC had not been used at “SHIRAYUKI” at that time.

(5) Courtesy call to “KOUYO-MARU”, Training Ship of National Fisheries University of Japan



Photo 5 - 10 Courtesy call to “KOUYO-MARU”, Training Ship of National Fisheries University of Japan

Training ship “KOUYO-MARU” belonging to the Fishery Academy sailed into the SHV port at the beginning of December 2014. The leader and member of the Study team visited “KOUYO-MARU”, in order to obtain the information on the navigation route to SHV port on 3 December, and met the captain Mr. SIMOJOU and the chief navigation officers Mr. FUGAMI at the bridge. Their objectives were both on investigation of the fish catch and for the navigational training for about 50 trainees. They pointed out that the positions of isolated islands located in the Thailand Bay were different compared with the chart (BA2103 and 3967). They said that the difference in its location ranged half miles from the chart information. ENC had not been used in “KOUYO-MARU” at that time. The following scan overlapped with radar imagery on Electric Chart System (ECS) of TRANSAS shows two isolated islands named “KOH POULO WAI” (N 9°55'13" E120°54'39": the position is in-between two islands) located in the southern edge of the Cambodian territorial water. It can easily be seen the difference on the imagery.

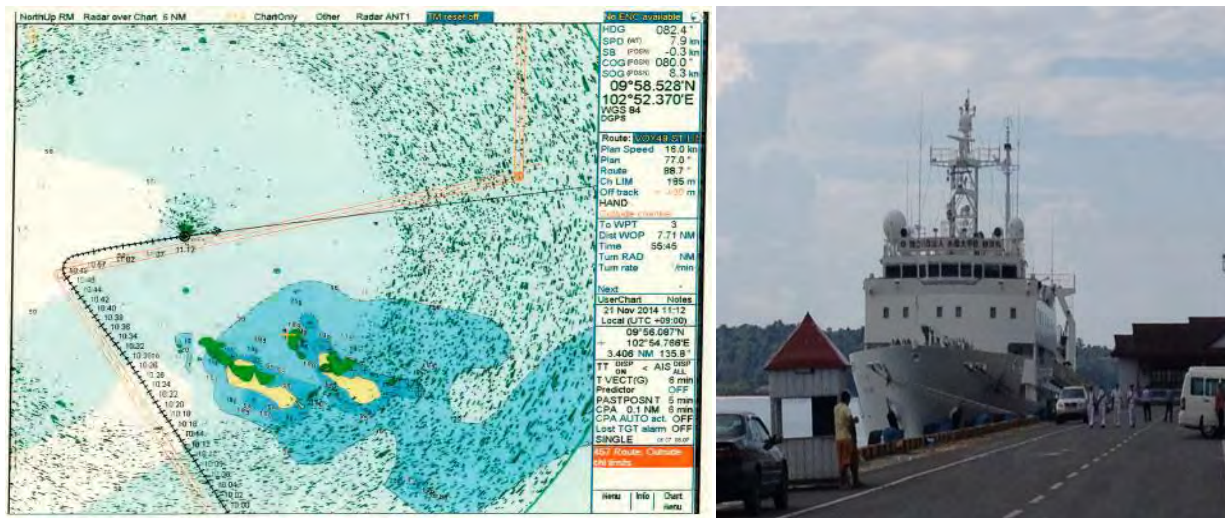


Photo 5 - 11 ECS Display, manufactured by TRANSAS, overlapped by Radar Image on the left, and Courtesy Call to “KOUYO-MARU” on the right

(6) Visiting to Koh Poulo Wai and Kas Tang, Maritime Defense Party Base

Study Team visited the Maritime Defense Party Base in Koh Poulo Wai and Kas Tang on 23rd Mar. 2016. Because the study team had a planning to operate the hydrographic survey activities in and around the Koh Poulo Wai and advanced information should be necessary for the Party. Study member lead by the Team Leader together with C/Ps guided by the PAS pilot visited the base to salute the Party and explained the hydrographic survey information.



Figure 5 - 1 Satellite Imagery of Koh Poulo Wai



Figure 5 - 2 Satellite Imagery of Kas Tang

(7) Exchange of view with PAS pilot team after ENC Workshop

Prior to the ENC Workshop held at the PAS of SHV, The briefing and exchange view regarding the ENC WORKSHOP was carried out for PAS pilot officers (16 people joined) at 19th Dec. 2015. After explain how to create the ENC in the Study team, was exchanged views in order to confirm whether the ENC produced fits the needs of end-users for the future issues. Their opinion will be reflected in the extension project. We also have committed for good cooperation and feedback to the extension project as well. Further, a detailed depths map was provided in response to the request made by the Pilot Team of PAS.



Photo 5 – 12 Meeting on Hydrographic Survey Results by Pilot Team of PAS and Study Team

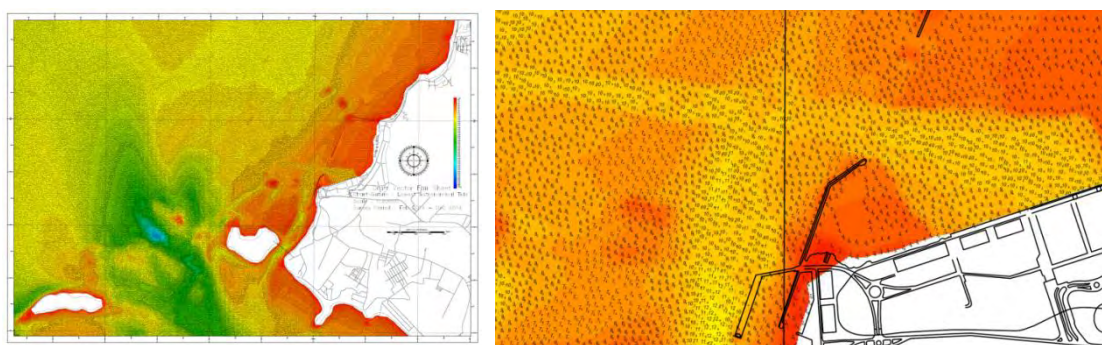


Figure 5 – 3 Depths Chart Requested by PAS Pilot Team and Map locally enlarged

(8) Exchange of view and Practical Usage with PAS pilot team after ENC Seminar

After finished ENC Seminar, Study team was carried out the explanation of completed Chart and ENC for PAS officer (PAS Harbour Master, PAS Pilot Team Members 15 people and PAS information Technology Staff)

The explanation main content was caution from completed Chart and ENC As request from PAS, to utilize (install and maintenance) new completed ENC data with the existing equipment in PAS (VTMS AIS and ECDIS in the new tug boat).

By the way, the AIS of The Vessel Traffic Management System: VTMS room could not compatible with completed new ENC data. Study team suggested to use ENC viewer in another PC together with AIS computer. For the tug boat “KOH TAKIEV” , Study team showed how to install, utilize the new completed ENC data in tug boat’s ECDIS to tug boat crew and PAS information technology staff. And hoped that new completed ENC data will be useful to for PAS functions.



Photo 5 - 13 Explanation on completed C & ENC to Pilot Team of PAS from Study Team



Photo 5 - 14 New completed ENC data usage at PAS VTMS room



Photo 5 - 15 New completed ENC data installation and usage at PAS's Tag boat "KOH TAKIEV"

5 - 4 Joint Coordination Committee

1st Joint Coordination Committee:

- Date and Time: 08:30, 22nd Sep. 2013
- Venue: Conference Room in 2nd Fl., MPWT
- Chair: JCC Joint Chairs: H.E. TRAM IV TEK, Minister, Ministry of Public Works and Transport
Hiroshi IZAKI, Chief Representative, JICA Cambodia Office
- Attendees: Officials of MPWT, JICA personnel, Study Team

The Inception Report was distributed to all the attendees and presentation was made on the principal policy of study work and its methodology by the study team. Minutes of Meeting was prepared summarizing the result of the meeting, and it was approved by the chair, H.E. TRAM IV TEK.



Photo 5 - 16 1st JCC Meeting

2nd Joint Coordination Committee

- Date and Time: 08:30, 22nd May 2014
- Venue: Conference Room in 2nd Fl., MPWT
- Chair: JCC Joint Chairs: H.E. TRAM IV TEK, Minister, Ministry of Public Works and Transport
Hiroshi IZAKI, Chief Representative, JICA Cambodia Office
- Attendees: Officials of MPWT, JICA personnel, Study Team

The Progress Report, summarizing the 1st -term hydrographic survey including geodetic and leveling surveys the 2nd -term hydrographic survey as well as 1st ENC training, was distributed and a presentation was made on the progress of study work and its results by the study team. Minutes of Meeting was prepared summarizing the result of the meeting, and it was approved by the chair, H.E. TRAM IV TEK.



Photo 5 - 17 2nd JCC Meeting

3rd Joint Coordination Committee

- Date and Time: 08:30, 22nd Apr. 2015
- Venue: Conference Room in 2nd Fl., MPWT
- Chair: JCC Joint Chairs: H.E. TRAM IV TEK, Minister, Ministry of Public Works and Transport
Itsu ADACHI, Chief Representative, JICA Cambodia Office
- Attendees: Officials of MPWT, JICA personnel, Study Team

The Interim Report, summarizing the 1st -term hydrographic survey and the 2nd -term hydrographic survey including the progress of large-scale ENC production, was distributed and a presentation was made on the progress of study work and its results by the study team. Minutes of Meeting was prepared summarizing the result of the meeting, and it was approved by the chair, H.E. TRAM IV TEK.

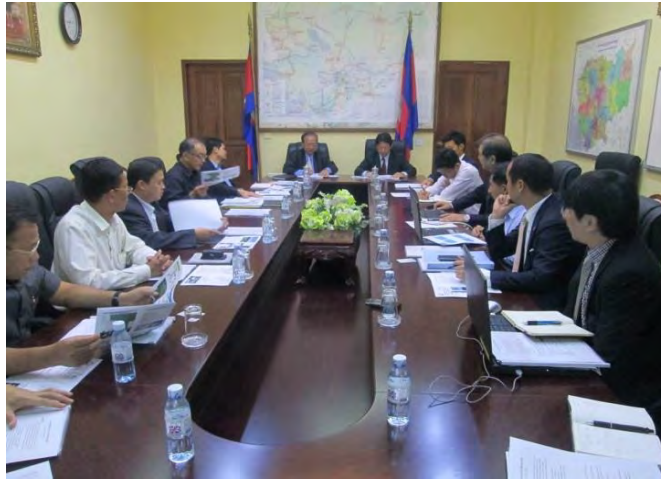


Photo 5 - 18 3rd JCC Meeting

4th Joint Coordination Committee

- Date and Time: 08:30, 11th Mar. 2016
- Venue: Conference Room in 2nd Fl., MPWT
- Chair: JCC Joint Chairs: H.E. TRAM IV TEK, Minister, Ministry of Public Works and Transport
Itsu ADACHI, Chief Representative, JICA Cambodia Office
- Attendees: Officials of MPWT, JICA personnel, Study Team

The Interim Report-2, summarizing the 1st -term hydrographic survey and the 2nd -term hydrographic survey including the final output of large-scale ENC production, the progress for 1st ENC Workshop and the principal policy of Extension Project and its methodology, was distributed and a presentation was made on the progress of study work and its results by the study team. Minutes of Meeting was prepared summarizing the result of the meeting, and it was approved by the chair, H.E. TRAM IV TEK.

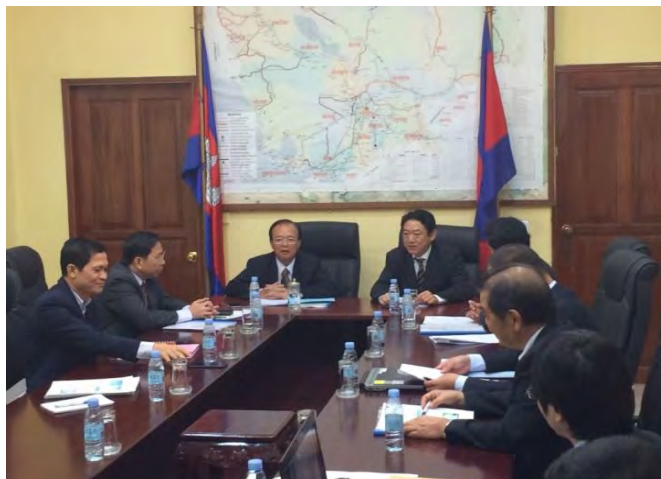


Photo 5 - 19 4th JCC Meeting

5th Joint Coordination Committee

- Date and Time: 14:30, 8th Dec. 2016
- Venue: Conference Room in 2nd Fl., MPWT
- Chair: JCC Joint Chairs: H.E. TAUCH CHAN KOSAL, Secretary of State,
Ministry of Public Works and Transport
Itsu ADACHI, Chief Representative, JICA Cambodia Office
- Attendees: Officials of MPWT, JICA personnel, Study Team

The Draft Final Report, summarizing the final output of Original Project and Extension Project and its all methodology for producing C & ENC, was distributed and a presentation was made on the progress of study work and its results by the study team and C/D discussed about future vision of WD tasks and responsibilities of maritime management in Cambodia. Briefed about preparation for holding ENC Seminar in 13th Dec. 2016 and its schedule. Minutes of Meeting was prepared summarizing the result of the meeting, and it was approved by the chair, H.E. TAUCH CHAN KOSAL.



Photo 5 - 20 5th JCC Meeting

5 - 5 Taskforce Meeting

1st Taskforce Meeting:

- Date and Time: 08:30, 8th Oct. 2013
- Venue: Conference Room in 2nd Fl., MPWT
- Chair: H.E. LENG THUN YUTHEA, Under Secretary of State, Ministry of Public Works and Transport
- Attendees: Member of Taskforce Meeting and Study Team



Photo 5 - 21 1st Taskforce Meeting

2nd Taskforce Meeting:

- Date and Time: 08:30, 13th Jan. 2014
- Venue: Conference Room in 2nd Fl., MPWT
- Chair: H.E. LENG THUN YUTHEA, Under Secretary of State, Ministry of Public Works and Transport
- Attendees: Member of Taskforce Meeting and Study Team



Photo 5 - 22 2nd Taskforce Meeting

3rd Taskforce Meeting:

- Date and Time: 09:00, 13th Nov. 2014
- Venue: Conference Room in 2nd Fl., Waterways Department, MPWT
- Chair: ROS Sophornna, Director, Waterways Department, Ministry of Public Works and Transport
- Attendees: Member of Taskforce Meeting and Study Team



Photo 5 - 23 3rd Taskforce Meeting

4th Taskforce Meeting:

- Date and Time: 14:30, 2nd Dec. 2015
- Venue: New Beach Hotel, SHV
- Chair: ROS Sophornna, Director, Waterways Department, Ministry of Public Works and Transport
- Attendees: Member of Taskforce Meeting and Study Team



Photo 5 - 24 4th Taskforce Meeting

5th Taskforce Meeting:

- Date and Time: 09:00, 5th Aug. 2015
- Venue: Conference Room, 2nd Fl., Waterways Department, MPWT
- Chair: ROS Sophornna, Director, Waterways Department, Ministry of Public Works and Transport
- Attendees: Member of Taskforce Meeting and Study Team



Photo 5 - 25 5th Taskforce Meeting

6th Taskforce Meeting:

- Date and Time: 09:30, 15th Dec. 2015
- Venue: Conference Room, 2nd Fl., Waterways Department, MPWT
- Chair: ROS Sophornna, Director, Waterways Department, Ministry of Public Works and Transport
- Attendees: Member of Taskforce Meeting and Study Team



Photo 5 - 26 6th Taskforce Meeting

7th Taskforce Meeting:

- Date and Time: 09:00, 16th Aug. 2016
- Venue: Conference Room, 2nd Fl., Waterways Department, MPWT
- Chair: H.E. LENG THUN YUTHEA, Under Secretary of State, Ministry of Public Works and Transport
- Attendees: Member of Taskforce Meeting and Study Team



Photo 5 - 27 7th Taskforce Meeting

8th Taskforce Meeting:

- Date and Time: 09:30, 5th Dec. 2016
- Venue: Conference Room, 2nd Fl., Waterways Department, MPWT
- Chair: ROS Sophornna, Director, Waterways Department, Ministry of Public Works and Transport
- Attendees: Member of Taskforce Meeting and Study Team



Photo 5 - 28 8th Taskforce Meeting

5 - 6 ENC Workshop

ENC Workshop was held at the conference room of PAS on 21st Dec. 2015. Cambodia Domestic Maritime For specialty.

- Date: 21st Dec. 2015
- Place: PAS Conference Room
- Participant: PAS's pilot team, Domestic Maritime Organization, Shipping Company
- Content : Present about ENC basic information from C/Ps and Study team. After presentation had Q&A section about ENC usage and WD introduction. Due to Domestic attendee, ENC Workshop mainly used Cambodian language for presentation and discussion.



Photo 5 - 29 ENC Workshop at PAS



Photo 5 - 30 Attendees to the ENC Workshop

5 - 7 ENC Seminar

The objectives for the Seminar were to enlighten on ENC information to the public and enhance the application of ENC effectively in many fields. Having invited the International Organization; IHO, UKHO and other related maritime organization, held the ENC Seminar in SHV. ENC Seminar was held under the auspices of MPWT/WD as shown below:

- Date: 13rd Dec. 2016: 8:30-15:00
- Place: Sokha Beach Resort Hotel, Sokha Beach Conference Center, Function Room I
- Participant: Total around 75 people from Cambodia Government and Private port, Private shipping companies, and around others 20 organizations including International Organization (IHO, UKHO, JHOD).
These result showed the high interest on ENC in Cambodia.



Photo 5 - 31 ENC Seminar

Content:

1) Opening Ceremony and Opening Address

- Opening Address by JICA Cambodia Office Chief Representative: Itsu ADACHI
- Opening Address by First Secretary, Embassy of Japan in Cambodia: Naoki MITORI
- Opening Address by Senior Secretary of State, MPWT: H.E. TAUCH CHAN KOSAL



Photo 5 - 32 Opening Address by JICA Cambodia Office Chief Representative: Itsu ADACHI



Photo 5 - 33 Opening Address by First Secretary, Embassy of Japan in Cambodia: Naoki MITORI



Photo 5 - 34 Secretary of State, MPWT: H.E.TAUCH CHAN KOSAL

2) Organizer Presentation

- Project Introduction and Briefing Presentation by Under Secretary of State, MPWT: H.E.LENG THUN YUTHEA



Photo 5 - 35 Under Secretary of State, MPWT: H.E.LENG THUN YUTHEA

3) Invitation Guest Presentation

- Presentation by IHO Representative: Commander Azrul Nezam bin Asri (EAHC)
- Presentation by UKHO Representative: Rob WHEELER (ENC Expert)
- Presentation by Japan Coast Guard, Hydrographic and Oceanographic Department, Chart and Navigational Information Division, Chart Quality Assurance Office Chief: Toru KAJIMURA



Photo 5 - 36 IHO Representative Commander Azrul Nezam bin Asri



Photo 5 - 37 UKHO representative Rob WHEELER



Photo 5 - 38 Japan Coast Guard, Hydrographic and Oceanographic Department, Chart and Navigational Information Division, Chart Quality Assurance Office Chief : Toru KAJIMURA

4) Study Team Progress Presentation

- Study Team Member from Aero Asahi Corporation: Kittisak WANGKIJWORAKUL
- MPWT/WD: Huon RATH



Photo 5 - 39 Study Team's Project Process Presentation

5) ENC Exhibition and ENC Cruising

ENC Seminar aims to promote the importance of ENC for the maritime safety, international trading, fishery, tourism and the other related section.

After the presentation and dissemination activity on ENC in the morning, and in the afternoon, the ENC cruising was scheduled to demonstrate using the ENC data on board.

By importing the created ENC data to AIS and displayed into the monitor on board the vessel. While sailing, AIS showed information from ENC data (depth and nearby obstruction and etc.) and also alerted by sound if there were any approaches to the danger or obstruction. As each of the attendee knew the practical ENC usage, participants could widely exchange the points of views with each other on ENC.

It was considered that all the attendees understood the usefulness of ENC application and were encouraged to use ENC for their navigational safety and preservation of natural environment.

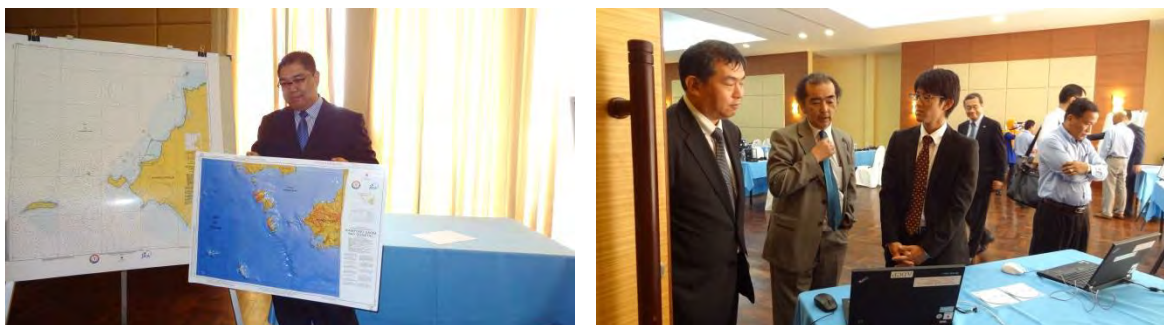


Photo 5 – 40 ENC Seminar's exhibition



Photo 5 - 41 ENC data usage demonstration on ENC Cruising



Photo 5 - 42 Attendees to the ENC Seminar

Chapter 6 SURVEY RESULTS

6 - 1 Survey Report

Reports submitted at various milestones are shown as in the following Table 6 - 1.

Table 6 - 1 List of Reports

No.	Report	Japanese	English	No. of Reports addressed to Cambodian government
1	Inception Report	5	15	10 including in 15
	Date submitted	On the commencement of Project Work		
2	Progress Report	5	15	10 including in 15
	Date submitted	On the completion of 1 st -term hydrographic survey; 12 months after the commencement of the study		
3	Interim Report	5	15	10 including in 15
	Date submitted	On the completion of 2 nd -term hydrographic survey; 20 months after the commencement of the study		
4	Interim Report 2	5	15	10 including in 15
	Date submitted	March 2016		
5	Draft Final Report	5	15	10 including in 15
	Summary of Report	5	15	10 including in 15
	Date submitted	December 2016		
6	Final Report	5	15	10 including in 15
	Summary	5	15	10 including in 15
	Date submitted	March 2017		

6 - 2 Survey Results

Following outputs are the survey results as shown in Table 6 - 2:

Table 6 - 2 List of Survey Results

No.	Survey Results			
	Result	Unit	Q'ty	Remarks
1	Vector Fair Sheet	set	1	
2	Paper Chart	set	1	
3	ENC in CD-ROM	set	1	

Chapter 7 RECOMMENDATIONS

7 - 1 Maintenance Work of ENC

7 - 1 - 1 Importance of Update on ENC Information

SOLAS, 1974, hereinafter referred to as “the Convention”, requests on all merchant ships to install Nautical Charts and Nautical Publications in the sailing vessels. The Convention shall recognize that meets the requirement is to install the ECDIS in addition to the conventional Paper Chart and Nautical Publications. The system that displays the information of Nautical Chart is called ENC. ENC is the vector electronic navigational chart published by the respective governments or officially recognized organizations complying to S-57 and S-63, standard displaying format, specified by IHO.

ENC produced in this project will be entrusted to UKHO, which has the international sale market, to publish since there is not any effective mechanism in Cambodia to provide ENC to the vessels in service internationally, at this moment. ENC should provide the users with the latest information in terms of the safety at sea. Therefore MPWT/WD has the mandatory obligation to update the information of the ENC produced in this project. Hence, it will be important to carry out the updating hydrographic survey at an appropriate timing on the updated shoreline lineation of multi-purpose wharf and water depth changes along the passage due to dredging work in the PAS, and to send the necessary information to renew the ENC to UKHO.

7 - 1 - 2 Public Relations and Application of ENC

In this project, finished ENC data , SHV Port management relative in SHV port to enlighten the usage by applying to VTMS. And installed to use in Tug boat’s ECDIS. After that PAS’s Pilot will schedule to install into the other PAS boat.

For International vessel, when C&ENC start to has been publishing by UKHO, the international vessel which berthing and deberting need to install as duty.

For the enhancement of sustainability for ENC management in Cambodia, “ENC Workshop” (Dec. 2015) and “ENC Seminar”(Dec. 2016) was guided to be held. By inviting stakeholders of ENC users and the representatives from IMO, IHO and the officers of overseas Hydrographic Offices were asked to make presentation on the international maritime relation and significance of ENC.

7 - 1 - 3 Recommendations and Promotion of ENC Application

ENC and Navigational Chart is expected to be effectively used for vessel sailing and secured for safety at sea. However, Cambodian government has not the member country of IHO, International Hydrographic Organization. Therefore, in order to let them aware the ENC arena in the world, 2 leaders of Taskforce Team were dispatched to the hydrographic offices of Philippines, which is the Chair country of EAHC, East Asia Hydrographic Commission, and Singapore, which is one of the most developed countries in terms of ENC.

On Aug. 2015, ENC training was implemented at JHOD, which is the Permanent Secretariat of EAHC, in order for MPWT officials to have management training on the publication and maintenance of ENC for about 1 week. JHOD itself is working as the coordinating country in order to provide updated navigational information as the Notices to Mariners in Southeast Asian Countries and East Asian Countries, corresponding to NAVAREA XI Area, including Cambodia, and at the same time, acting as a coordinator for Cambodia to entrust the publication of ENC to UKHO, which is working to assist the publication of ENC of other countries.

Study Team hereby strongly recommends joining IHO as early as possible having good coordination with and necessary advice from JHOD in order to facilitate the application of ENC. Also recommended is for the MPWT, which is the observer country to EAHC, to attend various committees of EAHC and recognize the significance of involvement in IHO.

7 - 2 Issues on Technology Transfer and Recommendations

7 - 2 - 1 Issues on Technology Transfer

C/P organization MPWT/WD assumes the responsibility of hydrographic activity in Cambodian waters. It seems that the Cambodian government was groping for systematizing of hydrographic activity and nurturing human resources in the 1970's because 2 ex-MPWT/WD personnel were dispatched to Japan to have the Collective Training of Hydrographic Survey Course organized by JICA. Since then, the systematization had been at a deadlock together with a loss of human resources due to a national crisis.

In the latter half of 1990's, it is considered that the present organization of hydrographic services was organized to secure the navigational safety and to maintain the shipping lane along the Mekong River having the assistance from EU. However, the hydrographic survey technology they had was not too much to say that it was the level of 30 years ago.

In this project, an emphasis was placed not only on the technology transfer for production of ENC near SHV port but also for the enlightenment of importance on the maintenance of survey equipment. C/Ps have been encouraged for their devotion to the project training and contribution on the hydrographic services, i.e. maintenance and updating of Chart and ENC. Based on the principal project policy, their hydrographic survey technology had been strengthened through the 1st - term hydrographic survey, from Oct. 2013 to May 2014, and the 2nd -term hydrographic survey, from Nov. 2014 to Mar. 2015. Further, the editing and compilation technology of Navigational Charting have been upgraded through the 1st Training in Japan, for one month, and 2nd Training in Japan and the Third Country, for one month.

Although the practical experience of hydrographic activity is not enough at this moment, all the C/Ps have improved their knowledge and techniques for hydrographic survey considerably. On the other hand, ENC leader training was executed in Philippines and Singapore on Aug. 2014 for one week, and the ENC management training was carried out in Japan on Sep. 2015 for 1 week, in order for the C/Ps and their management staff to recognize the importance on the hydrographic services and the requirement of navigational safety to upgrade the credibility of Cambodia though, it seems that it's still on the half way in terms of systematization of hydrographic services and its management and planning in the MPWT/WD.

Followings explain some of the issues on the Technology Transfer at site:

- (1) During the SW monsoon season from February through March, the offshore of SHV becomes rather a rough sea with the swell of about 1m, and is also being affected by the winds and waves going around the southern coast of Vietnam due to the stormy weather in the South China Sea. It was a hard time for all the C/Ps to have the OJT satisfaction because of their first encounter with the seasickness. An experience and tolerance against maritime activity should be one of the issues for them to overcome.

Although the C/Ps have sufficient experience of bathymetric survey in the Mekong River, the equipment and the methodology they utilize have already been outdated and the gap between the modern technology and their conventional one became far enough as the result. As of December 2014, they came up to the level of SBES survey techniques by themselves somehow. Moreover, it is envisaged that the C/Ps should accumulate more experience of the MBES survey under the instruction of the survey expert. Since then, some of the C/Ps could operate the DHSDAS independently even under sea rough condition.

- (2) Some of the C/Ps seemingly lack of enthusiasm sometimes for the acquisition of modern technology especially on the sea. All the trainees should be aware of the fact that knowing the field conditions during the data acquisition period should be far more important than the deskwork. Completely different from the normal office work, a certain extent of flexibility and concentration should be desired for the C/Ps to acquire new technology and skills in this project.
- (3) It is envisaged that C/Ps need more consciousness initially on the maintenance of survey equipment procured by JICA for this project. However, a certain improvement had evidenced by the study team.

Taking into account the present situation, Study Team summarizes the possible issues for MPWT/WD to cope with in the near future, as shown below:

Issue 1: Statutory Arrangement for Supporting Hydro-Oceanographic Services

MPWT/WD has acquired the technology to produce ENC. However, there is no relevant laws and/or regulations nor the supporting legal systems and/or structures pertaining to the hydrographic and oceanographic services, hence MPWT/WD will encounter the difficult time in the upcoming age where MPWT/WD will face the increasing demand for updating of ENC and/or data acquisition and ENC production for port development in the other area. And, on the other hand there are no supporting legal systems for data compilation and dissemination including relevant budgetary allocation for its purposes. It is envisaged that the necessary information for updating/revision on maritime construction work and any other changes different from the present information of the navigational chart such as the information on navigational aids and etc. would certainly be informed to MPWT/WD, so that the navigational chart could promptly updated.

=> **Arrangement of relevant laws and regulations for supporting the hydro-oceanographic services.**

Issue 2: Accumulation of Empirical Knowledge to Strengthen the Organizational Capabilities

Given the appropriate steps to familiarize the ENC world along with the timely OJT and off-site training by the study team, the trainees from MPWT/WD could get to know the basic knowledge on ENC, and further they could attain the working-level on the empirical knowledge on ENC and its production capability. It is envisaged that these 8 trainees could more accumulate the working-experience and strengthen their capability for the time being to the production and updating skills on ENC in order for them to perform the hydro-oceanographic services for the development of Cambodia.

=> **Strengthening the organizational capabilities for supporting the hydro-oceanographic services.**

Issue 3: Application of ENC Technology on various Fields

Although the ENC in SHV port has been produced for the vessels engaging the international voyages, it should be essential to secure the budgetary allocation and to have the survey boat in order to cope with the increasing demands of hydro-oceanographic services for the navigational safety of the domestic vessels, port development projects in other part of the region, fishery activity and preservation of ambient natural environment. And, also the important things are the maintenance of navigational aids, especially the lighthouse, monitoring of sea level fluctuation and the CDL, measures against storm surges and extreme high tide and etc. MPWT/WD is well recognized these urgent issues and requested for further assisting to develop the countermeasures for these matters at the 5th JCC meeting because Cambodia is totally incompetent and scarce knowledge in these urgent matters.

Since all the survey equipment was transferred to MPWT/WD on February 2017 from JICA, JICA study team discussed with MPWT/WD on the insurance coverage of the survey equipment after March 2017.

Originally, the overall plan of operation for hydrographic survey inclusive of updating work of ENC due to the dredging work was scheduled to complete by the end of 2016. However, there happened a different situation than expected before. Namely, the completion of dredging operation for the passage of PAS was unexpectedly postponed to June 2017, which was reported on the 5th JCC meeting. Therefore, the updating work of ENC using the survey equipment should be necessitated from June 2017 onward, which would already be after the ENC project and also be the exclusion period from application of insurance for the survey equipment. Therefore, MPWT/WD urged on JICA the need for assistance of providing them with the insurance coverage for the survey equipment, even after March 2017, for another one year up to the end of February 2018. And, moreover, they pleaded that it's

difficult for them to allocate the relevant budget for the insurance immediately. MPWT/WD also defined clearly that they would ask for necessary budget to the Cambodian government to cover the survey equipment with the insurance starting from the beginning of March 2018, as their own liability even if the exemption amount would be raised.

Actually, they had a will to expand the insurance coverage to a wider area, covering all the Cambodian waters than the present limited area because they were planning to enlarge the hydrographic services to the regional ports and harbors.

According to the information from the insurance company, the insurance amount would not be changed should the coverage area were expanded. However, the amount for exemption of the policy would be raised to some extent. But, MPWT/WD preferred this condition as their management policy for hydrographic services even if the exemption amount would be raised.

Taking into account the situation MPWT/WD faced, JICA accepted their request to insure the survey equipment for another one year from March 2017 to the end of February 2018. Accordingly, MPWT/WD will take the insurance coverage over from JICA after March 2018.

=> Securing the navigational safety and budgetary allocation

7 - 2 - 2 Proposal on Technical Transfer

Strengthening of hydrographic survey capability for 8 C/Ps through the 1st and 2nd terms of hydrographic surveys has been carried out mainly by OJT using digital data acquisition and its data processing systems. Among the C/Ps, 2 officers were selected to dispatch to the training in Japan and the Third Country to further acquire editing techniques of ENC. Study team also dispatched Japanese ENC expert to Cambodia from time to time to undertake OJT of Technology Transfer on the production of ENCs for Navigational Purposes of 5 for Harbour in and around the SHV port.

Next issues after the completion of navigational charting near SHV should be rested on their effort how they could strengthen the updating capability and maintenance management, which will open the door for publication of ENC officially. Therefore, Study Team designed the ENC management training aiming at strengthening of ENC management capability for the Cambodian officials. Further, ENC updating technology had been transferred during the extension project, which was to produce the medium scale ENC of Navigational Purpose 3 for Coastal Navigation.

However, strengthening of ENC management and servicing system together with the improvement of empirical knowledge and its accumulation should be indispensable processes to cope with the international standard and requirements as MPWT/WD are not necessarily independent in terms of management ability and systematic services on ENC.

Unless the data processor knows the site operation how the data are acquired, it's difficult to process the data in order and appropriately. And, it should know that even a small defective part could lead to a fatal system shutdown. Accordingly, all the surveyors should further improve their knowledge and skills to accommodate the difficulty and to detect the solution. It's not an easy job to understand the in-depth function and performance of DHSDAS and DHSDPS in a limited period of times though, it should be envisaged that C/Ps would give all-out their effort to improve their skills and knowledge for the updating and maintenance of ENC they produced.

7 - 3 Comments and Remarks on Production of ENC by the Team Leader of JICA Study Team:

Refer to former report, the Kingdom of Cambodia was the only one country that had not produced nor published navigational chart, not to mention ENC, among the ASEAN countries at the time of being examined on the feasibility of this project as the technical cooperation project by JICA around 2012. Due to the national crisis experienced from 1970's to 1980's in Cambodia, maritime security services including search and rescue, maintenance of navigational aids and hydrographic survey service became vulnerable seriously. Especially, accumulation of empirical knowledge essential to train the human

resources that handled the hydrographic survey as well as the compilation of navigational chart was extremely deficient.

Under such circumstances, technical assistance services by JICA had been tailed off in more than 10 years ago. However, a concerted action by the then staff of JICA Cambodia Office, Embassy of Japan and the then JICA expert had realized this project considering the significance of this technical cooperation project in Cambodia.

Under the circumstances and understanding, JICA study team carried out various types of technical trainings including OJT and technical transfer, and as a result, joint study team produced the ENC's of medium scale and large scale, which were naturally acceptable for the international ENC arena.

Further, C/Ps themselves carried out the hydrographic survey both for the practical purpose and for their self-training, and now they are on the process of producing the vector fair sheet complying with the ENC format and the paper chart. However, there still exists a little uneasy about the capability of using the DHSDAS for updating the current ENC including the weak structural supporting system within the MPWT/WD.

Moreover, JICA study team tried to enlighten the importance of equipment maintenance and sound operation and management as stated in the 'Issues on Technical Transfer and Proposal' above.

In the manner stated above, JICA study team strived for the development of hydro-oceanographic services that MPWT/WD would be able to catch up with the other ASEAN nations primarily. However, there still exist many other factors to be addressed in building up the harmonization and cooperative relation with the international hydrographic services such as 1) arrangements of the laws and regulations for supporting the hydro-oceanographic services, 2) strengthening the organizational capability and 3) securing the navigational safety and preservation of ambient natural environment.

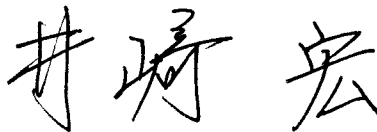
There are naturally the limitations to change the present status as a private consultant in other country. In addition, there was the request by MPWT to JICA at the 5th JCC meeting for 1) construction of permanent Tide station, 2) renovation of old lighthouse, 3) provision of survey boat and pick-up trucks for transportation of precious survey equipment and 4) long-term expert for statutory arrangement. JICA study team considers that it requires the broadening consciousness and renewing themselves for the beginning of new era.

For the time being, MPWT is expected to strive for the broadening consciousness on the necessities for arrangements of laws and regulations, strengthening of organizational capability and securing the navigational safety and preservation of ambient natural environment and etc., having the long-term experts dispatched by JHOD to have the understanding on their request of further assistance by JICA.

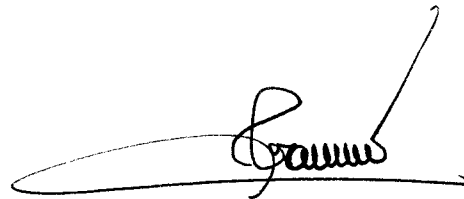
Finally, JICA study team would like to emphasize that MPWT/WD should have the perception that it would be utmost essential to strengthen the organizational capabilities and accumulate the empirical knowledge on the ENC in order for MPWT/WD to have the capabilities to maintain the hydro-oceanographic services worthy of the international standard.

RECORD OF DISCUSSIONS
ON
THE PROJECT FOR
PRODUCTIONS OF INTEGRATED DIGITAL TERRAIN MODEL
AND ELECTRONIC NAVIGATIONAL CHART
IN
THE KINGDOM OF CAMBODIA
AGREED UPON BETWEEN
MINISTRY OF PUBLIC WORKS AND TRANSPORT
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Phnom Penh, 15 March, 2013



Izaki Hiroshi
Chief Representative /
Cambodia Office
Japan International Cooperation
Agency
Japan



H.E. Tram Iv Tek Du
Minister
Ministry of Public Works and
Transport
The Kingdom of Cambodia

In response to the official request of the Government of Cambodia (hereinafter referred to as "GOC") to the Government of Japan (hereinafter referred to as "GOJ"), the Japan International Cooperation Agency (hereinafter referred to as "JICA") held a series of discussions with Ministry of Public Works and Transport of GOC(hereinafter referred to as "MPWT") and relevant organizations to develop a detailed plan of the Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart (hereinafter referred to as "the Project").

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that MPWT, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of Cambodia.

The Project will be implemented within the framework of the Note Verbales exchanged on 11th June, 2012 between GOJ and GOC.

Appendix 1: Project Description

Appendix 2: Main Points Discussed

Appendix 1**PROJECT DESCRIPTION****I. BACKGROUND**

One of the mission of MPWT (Department of Waterways) is to ensure the safety of navigation on the main trading routes. This commitment includes ensuring the availability of the adequate coverage on major ports and trade routes with ENC's, Electronic Navigational Charts, for the safety of navigation approaching the main ports. MPWT is of the view that it is necessary to update the present outdated bathymetric data and oceanographic information on the currently used chart with lots of uncertainties. After all, the ambient conditions in terms of the available geographic information are still be the same as it was in the '70s, exposing the incoming and outgoing vessels to danger. However, MPWT has neither the hardware nor the software and the necessary technical know-how, which are needed for production of ENC through the digital hydrographic survey and data processing. While the Sihanoukville Port is being gradually improved in management and operation through various stages via the assistance of development partners, especially Japan; and due to its vital role as the Cambodia's main international maritime gateway to the world, it is urgently required to improve the programs of disaster management and conservation of the environment, all of which should be based on the updated geospatial terrain model.

The direction of Japanese assistance to Cambodia for the program of social and economic infrastructure development is partially focusing on the development and expansion of port sector from both sides of software and hardware. ENC is important and urgently needed part of software for Cambodian port sector.

Given these situations, "The Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart" has been conceptualized in order to contribute to safety, effectiveness, efficiency and competitiveness of the Sihanoukville port.

II. OUTLINE OF THE PROJECT

1. Title of the Project

The Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart

2. Expected Goals which will be attained after the Project Completion

2-1. Goal of the Proposed Plan

- Strengthening the navigation safety in and around the Sihanoukville Port.
- Enhancement of international credibility of the Sihanoukville Port.

2-2. Goal which will be attained by utilizing the Proposed Plan

- Capacity building (Transfer of Technology) on the planning and hydrographic and oceanographic surveys
- Capacity building for development of and skills for publication of ENC and dissemination system of navigational information
- Capacity building on the ENC management and operation skill for the technical officers
- Development of the ENC of the proposed area

3. Outputs

- Knowledge and ability improvement of relevant technical staffs of MPWT and other relevant organizations for hydrographic and oceanographic survey techniques, such as data acquisition, data processing including updating skills for sustainability, and capacity to assimilate its procedures/outputs.
- Enhancement of the skill for establishment of Database of Integrated Digital Geospatial Terrain Model of Land and Sea (DTM).
- Production of hydrographic and oceanographic data in Sihanoukville coastal area.
- Enhancement of management and operation skill for technical staffs on ENC.

4. Activities

- Coordination of survey party and mobilization of equipment to site.
- Collection and analysis of the existing data
- Acquisition of sonar images, hydrographic images seabed image and sounding data at Sihanoukville harbor area
- Collection of satellite images for lineation of coastline and land information
- Collection of bottom samples for anchorage purpose and study for biotope identification
- Measurement of tides and currents
- Data processing and analysis of oceanographic data for tide table and current prediction
- Data processing and production of DTM for ENC and paper chart in the Sihanoukville Port
- On-the-job trainings of hydrographic and oceanographic surveys to the Cambodian trainees
- On-the-job training and lectures for data analysis, processing and assessment, inclusive of overseas training in Japan, for future maintenance of digitalized geospatial information by the Cambodian personnel in charge
- Conduct seminar/workshop for dissemination of the product and confirmation of social impacts induced by the project
- Technical visit to Japan and neighboring countries on the operation and management of ENC

5. Input

5-1. Input by JICA

- i. Dispatch of Missions
- ii. C/P training both in and outside of Cambodia
- iii. Necessary Equipment for the implementation of the survey

Input other than indicated above will be determined through mutual consultations between JICA and MPWT during the implementation of the Project, as necessary.

5-2. Input by MPWT

MPWT will take the following necessary measures to provide at its own expense.

- i. Services of MPWT's counterpart personnel and administrative personnel as referred to in II. 6
- ii. Suitable office space with necessary equipment
- iii. Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA (including Survey Ship for operating bathymetric surveys works)
- iv. Information as well as support in obtaining medical service
- v. Credentials or identification cards
- vi. Available data (including maps and photographs) and information related to the Project
- vii. Expenses necessary for transportation within Cambodia of the equipment referred to in II. 5-1 as well as for the installation, operation and maintenance thereof
- viii. Necessary facilities to members of JICA missions for the remittance as well as utilization of the funds introduced into Cambodia from Japan in connection with the implementation of the Project

If there arise other expenses necessary for implementing the project, MPWT will make the best effort to cover it and in case there is any difficulty, both sides will discuss the solution.

6. Implementation Structure

In order to implement the project, the following mechanisms will be established by Prakas of the Minister of Public Works and Transport:

6-1. Joint Coordinating Committee

- i. Function: Joint Coordinating Committee (hereinafter referred to as "JCC") will be established in order to supervise the project and to facilitate inter-organizational coordination. JCC meeting will be held

every six months and whenever deems it necessary.

II. Chairperson:

- 1) Chairperson: Minister of MPWT and Chief Representative of JICA Cambodia Office
- 2) Vice-Chairperson: Secretary of State
- 3) Vice-Chairperson: Chairman and CEO of PAS

III. Members:

Cambodian Side

- Members of Task Force
- Any other person concerned to be decided by MPWT

Japanese Side

- Chief Representative of JICA Cambodia Office as Co-Chairperson
- JICA missions
- Any other person recommended by JICA Cambodia Office

6-2. Task Force

I. Function: to manage and implement the project and discuss practical matters. The Task Force should meet once every three months or whenever it deems necessary.

II. The Task Force is led by:

1. Project Director: Under Secretary of State
2. Deputy Project Director: Deputy Director General of Transport
3. Deputy Project Director: Director of Department of Waterway
4. Members: Officials from General Department of Public Works (Department of Waterway) and General Department of Transport (Department of Marine Merchant and Department of Inland Waterway Transport) of MPWT and PAS.

6-3. Practical Counterpart Persons for Technical Transfer: Staffs including the four (4) staffs of participating departments who participated in JICA Group Training Course (Marine Information Management for Navigation Safety, Disaster prevention and Environment Protection) for 6 months in 2011 and 2012 fiscal year.

6-4. Cooperating Agency: Sihanoukville Autonomous Port (PAS)

6-5. JICA Missions

Members of JICA missions will give necessary technical guidance, advice and recommendations to MPWT and other relevant organizations including PAS and Phnom Penh autonomous Port (PPAP) on any matters pertaining to the implementation of the Project.

7. Project Site(s) and Beneficiaries

The project sites will be “From 10°34’ N to 10°45’ N, From 103°24’ E to 103°34’ E” which is in and around Sihanoukville Port as shown in Annex-1. The beneficiaries extend to wide range of fields, such as incoming and outgoing vessels to and from the Sihanoukville Port, contractors of development and rehabilitation project of the port, etc.

8. Duration

The duration of the Project will be carried out for approximately twenty (24) months as shown below from the date of arrival of JICA missions. Duration and timing of submitting reports may change according to the progress of the project.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Project																									
JCC																									
Report	▲ ICR							▲ PRR								▲ ITR						▲ DFR		▲ FR	

Notes: JCC: Joint Coordinating Committee, ICR: Inception Report, PRR: Progress Report, ITR: Interim Report, DFR: Draft Final Report, FR: Final Report

9. Reports

JICA will prepare and submit the following reports to MPWT in English.

- I. Thirty (30) copies of Inception Report at the commencement of the first work period in Cambodia.
- II. Thirty (30) copies of Progress Report at the time about eight (8) months after the commencement of the first work period in Cambodia.
- III. Thirty (30) copies of Interim Report at the time of sixteen (16) months after the commencement of the first work period in Cambodia.
- IV. Thirty (30) copies of Draft Final Report at the end of the last work

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period in Cambodia.

- V. Thirty (30) copies of Final Report within one (1) month after the receipt of the comments on the Draft Final Report

10. Environmental and Social Considerations

MPWT agreed to abide by 'JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF MPWT AND GOC

MPWT and GOC will take necessary measures to:

- I. ensure that the technologies and knowledge acquired by the Cambodian nationals as a result of Japanese technical cooperation contributes to the economic and social development of Cambodia, and that the knowledge and experience acquired by the personnel of Cambodia from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and
- II. grant privileges, exemptions and benefits to members of JICA missions referred to in II. 5-1 above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Cambodia.
- III. update the ENC produced by the project in a timely manner after the project by cooperating within the relevant organizations, so that the credibility of ENC will be maintained.

IV. EVALUATION

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. MPWT is required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting its support for the Project, MPWT will take appropriate measures to make the Project widely known to the people of Cambodia.

VI. MUTUAL CONSULTATION

JICA and MPWT will consult each other whenever any major issues arise in the course of Project implementation.

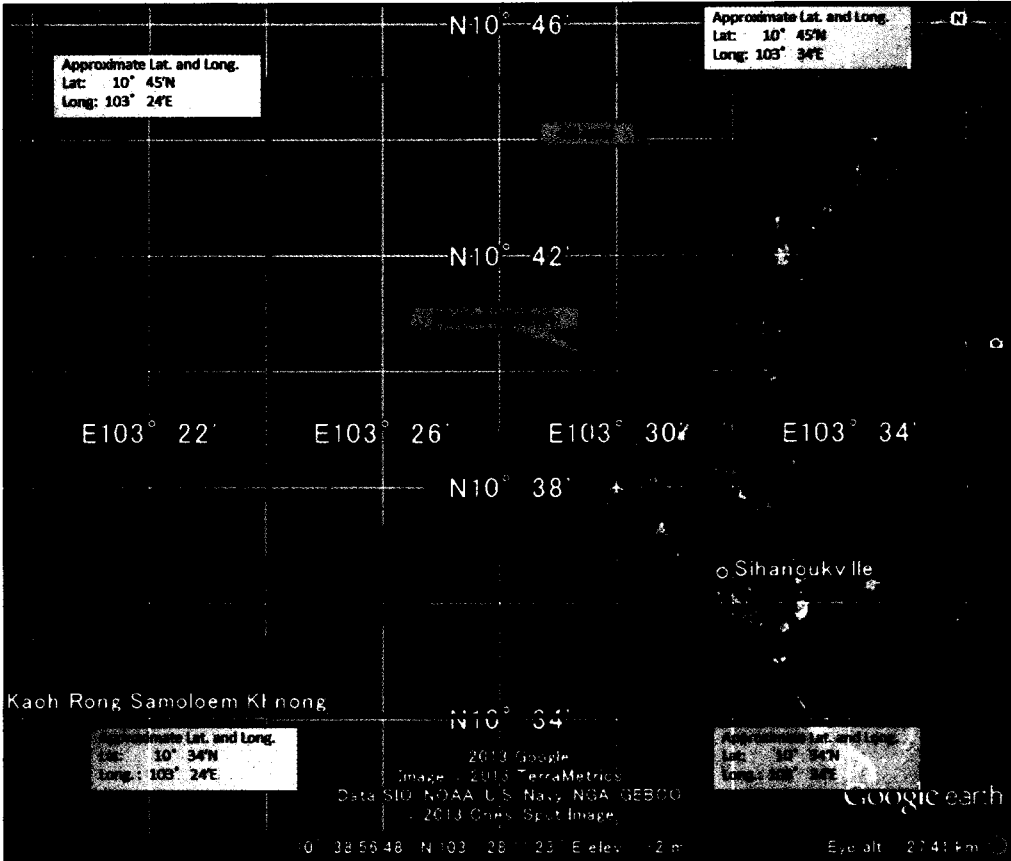
VII. AMENDMENTS

The record of discussions may be amended by the minutes of meetings between JICA and MPWT.

The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex-1 ENC Coverage Area of Sihanoukville port and its Adjacent Waters

Annex-1



ENC Coverage Area of Sihanoukville port and its Adjacent Waters

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Appendix 2

MAIN POINTS DISCUSSED

- Both sides had a discussion regarding the area of ENC to be covered by the project and agreed to extend the area to the further west up to 103°24' E from 103°26' E which is proposed in the original application form. Thus, the area to be covered by the project is changed to "From 10°34' N to 10°45' N, From 103°24' E to 103°34' E".
- Both sides also discussed whether to extend to north or south, but agreed that further extension should be executed by the Cambodian side's own after the necessary techniques and knowledge are transferred by the project.
- The team explained the importance to update the ENC produced by the project in a timely manner after the project by the Cambodian side's own effort, so that the credibility and value of ENC will be maintained. MPWT replied to make full effort for the update of ENC by coordinating the related departments, authorities etc.
- Tentative list of Equipment which will be procured in the project is shown in Table 1. Purchased equipment by JICA will be handed over to MPWT, while the procurement method will be determined by June 2013 by JICA taking into consideration the budget and necessity for the equipment to be used for maintaining and updating ENC by MPWT.

Table1 Tentative list of Equipment

Type of Survey System	Name of Survey Equipment (Quantity)
Sea Positioning and Navigation System	SBAS DGPS system (2)
	Helmsman display for vessel navigation (2)
	Navigation software (2)
	Laptop PC for vessel navigation and control (2)
Depth Sounding System	Single-beam echo sounder (1)
	Swath sounding system with side scan function (1)
	Under water sound speed measuring system (1)
	Motion sensor for correction of vessel posture (1)
	USB cables and serial port with multiple sockets(2)
	Data acquisition and processing software: HYPACK (2)
	Bar-check bar, Generator, Converter, Mount (2)
	Laptop PC (2)
	Desktop PC (2)
	External hard disks and ancillary systems (2)
Seabed Imaging	Side Scan Sonar Is used to examine the riverbed(1)
Oceanographic Measure-System	Water level recorder (Tide gauge) (2)
	ADCP current meter with bottom tracking (1)
Production of ENC & Paper Chart	Software for production of ENC & Paper Chart (1)
	Hardware for ENC production (1)
	CAD mapping software for analysis of sounding data and production of survey sheet (2)
	A0 plotter (1)
	UPS (To balance the use of electricity) (3)

MINUTES OF MEETINGS

BETWEEN

JAPAN INTERNATIONAL COOPERATION AGENCY

AND

MINISTRY OF PUBLIC WORKS AND TRANSPORT

FOR AMENDMENT OF THE RECORD OF DISCUSSIONS

ON

**THE PROJECT FOR PRODUCTIONS OF INTEGRATED DIGITAL TERRAIN MODEL
AND ELECTRONIC NAVIGATIONAL CHART**

Phnom Penh, *November 10th*, 2015 *Re*



Itsu Adachi

Mr. Itsu Adachi
Chief Representative
Cambodia Office
Japan International Cooperation Agency
Japan

H.E. Tram Iv Tek

H.E. Tram Iv Tek
Minister
Ministry of Public Works and Transport
The Kingdom of Cambodia *TR*

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and Ministry of Public Works and Transport hereby agree that the Record of Discussions on The Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart (hereinafter referred to as "the Project") signed on March 15th, 2013 will be amended as follows;

1. Amendment Contents

(1) Project Site(s) and Beneficiaries

Before	Amended Version
The project sites will be "From 10°34' N to 10°45' N, From 103°24' E to 103°34' E" which is in and around Sihanoukville Port as shown in Annex-1.	The project sites will be "From 10°13' N to 10°56' N, From 102°50' E to 103°43.5' E" which is in and around Sihanoukville Port as shown in Annex-2.
Reason: In addition to the original coverage area of the large scale (1:20,000) Electronic Navigational Chart (ENC), there is an urgent demand for the middle scale (1:150,000) ENC of approach route to the Sihanoukville Port from the maritime stakeholders as well as the pilots and the personnel concerned in the port.	

(2) Duration

Before	Amended Version
The duration of the Project will be carried out for approximately twenty-four (24) months as shown below from the date of arrival of JICA missions.	The duration of the Project will be carried out for approximately forty (40) months as shown in Annex-3 from the date of arrival of JICA missions.
Reason: The Project site (coverage area of ENC) will be expanded, therefore the duration of the Project has to be extended.	

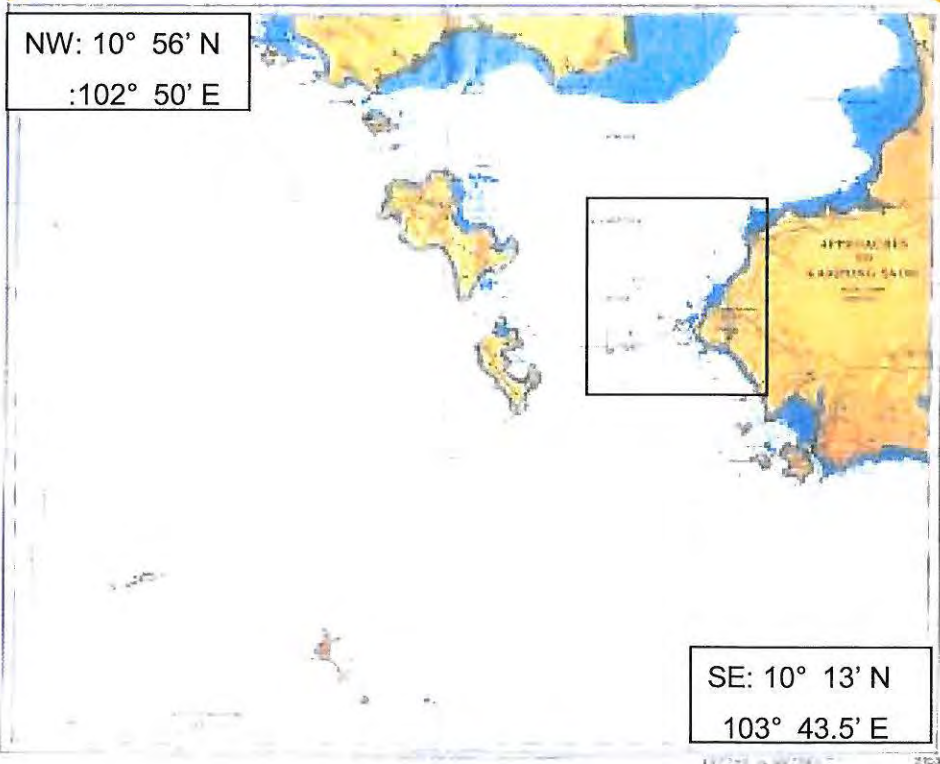
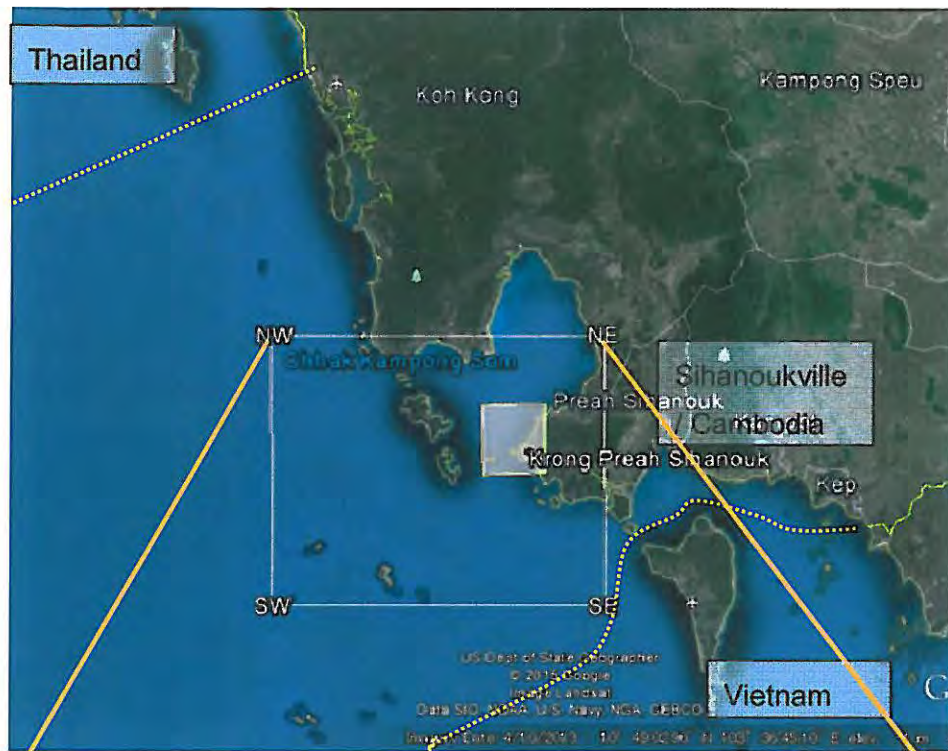
2. Effectuation Date

This amendment will become effective as of *November 10th*, 2015.

Annex 1 : Record of Discussions (signed on March 15, 2013)

Annex 2 : ENC coverage area (Amended)

Annex 3 : Duration of the Project (Amended)



ENC coverage area (Amended)

Duration of the Project (Amended)

	2013-												2014-												2015-												2016-											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12						
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41							
JCC			▲							▲											▲									▲											▲							
Report		△ IC /R								△ PR /R										△ IT/ R (1)									△ IT/ R (2)											△ DF /R	△ F/R							

MINUTE OF MEETING
of the First Meeting of Joint Coordinating Committee
for

The Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart
in the Kingdom of Cambodia


Following the RECORD OF DISCUSSIONS BETWEEN THE JAPAN INTERNATIONAL COOPERATION AGENCY AND AUTHORITIES CONCERNED OF THE ROYAL GOVERNMENT OF CAMBODIA ON THE PROJECT FOR PRODUCTIONS OF INTEGRATED DIGITAL TERRAIN MODEL AND ELECTRONIC NAVIGATIONAL CHART IN THE KINGDOM OF CAMBODIA signed on March 15th, 2013 hereinafter referred to as "The Project"}, The First JCC Meeting for the said Project was held on September 26th, under the Chairmanship of H.E Mr. **Tram Iv Tek**, Minister for Public Works and Transport, and H.E Mr. **Izaki Hiroshi**, JICA Chief Representative, Phnom Penh. The list of attendants is attached.

At the meeting, the Inception Report including the work plan of the Project was presented by the JICA Expert Team.

JCC discussed intensively the Inception Report and Work Plan and noted that the methodology and technology applied are clear, accurate and universal applicable despite it is introduced first time in the world (Production of ENC before Paper Chart).

JCC recognizes the importance of an Integrated Digital Terrain Model and Electronic Chart. JCC and JICA agreed on the importance of obtaining ground control points for Sihanuokville bay.

JCC and the expert team also expressed interest of the importance of understanding port management and chart datum as well as the importance of the MPWT to carry out a technical visit in a relevant third party country and/or international organizations to obtain and review international standards and norms as well as the lessons learnt.

JCC endorsed the work plan and urge all stakeholders for full cooperation for the project implementation. 

Phnom Penh, September 26th, 2103.



H.E Tram Iv Tek
Chairperson of JCC

The Minister of public Works and Transport

MINUTE OF SECOND MEETING
of the Joint Coordinating Committee
for


The Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart
in the Kingdom of Cambodia

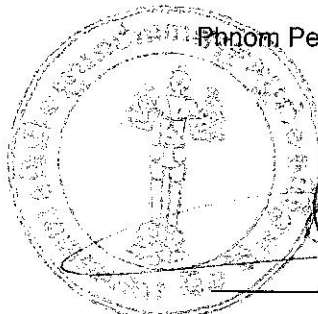
In accordance with the work plan of the **PROJECT FOR PRODUCTIONS OF INTEGRATED DIGITAL TERRAIN MODEL AND ELECTRONIC NAVIGATIONAL CHART IN THE KINGDOM OF CAMBODIA**, hereinafter referred to as "**The Project**", and as a follow up to the progress of the implementation of the Project, the Second Meeting of the Joint Coordinating Committee (JCC) for the said Project was held on May 22nd, 2014, under the Chairmanship of **H.E Mr. Tram Iv Tek**, Minister for Public Works and Transport, and **H.E Mr. Izaki Hiroshi**, JICA Chief Representative, Phnom Penh. Mr. KOYANAGI Yoshimoto, Deputy Director of Transportation and ICT Division of JICA Headquarter in Tokyo, was also in attendance. The list of attendants is attached.

The JICA Expert Team together with the Task Force Team presented the Progress Report on the Implementation and achievement of the Project Phase 1; that is the Hydrographic Survey including Geodetic and Tidal Observation; and the Activity Plan to be implemented at the Phase 2 of the Project. The progress of the Knowledge and Technology Transfer was also presented by the Task Force Team.

JCC discussed intensively the Progress Report and noted that the purpose of the Phase 1, the Hydrographic Survey, was almost completed and the capacity or Technology Transfer is progressed gradually. JCC also praises the accomplishment made by the study team despite it has faced a number of difficulties during the project implementation.

JCC also agreed with the activity plan for the Phase 2 and urge the study team to work closely together to conclude this phase 2 timely. JCC also encourages the Task Force to digest knowledge and technology from the Expert Team.

Phnom Penh, May 22nd, 2014 



H.E Mr. Tram Iv Tek

Chairperson of JCC

The Minister for Public Works and Transport

MINUTE OF THIRD MEETING

of the Joint Coordinating Committee

for

The Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart
in the Kingdom of Cambodia

In accordance with the work plan of the *PROJECT FOR PRODUCTION OF INTEGRATED DIGITAL TERR MODEL AND ELECTRONIC NAVIGATIONAL CHART IN THE KINGDOM OF CAMBODIA*, hereinafter referred to as "*The Project*" and as a follow up to the progress of the implementation of the Project, the Third Meeting of the Joint Coordinating Committee (JCC) for the said Project was held on April 22nd 2015 under the Chairmanship of H.E. Mr. Tram Iv Tek, Minister for Public Works and Transport, and H.E. Mr. Itsu Adachi, Chief Representative of JICA Cambodia Office. The list of attendants is attached.

The JICA Study Team together with the Task Force Team presented the Interim Report on the implementation and achievement of the Project Phase 2; that is the supplementary Hydrographic Survey including Tidal Observation and Tidal Current Measurement; and Data Processing for enormous acquisition data of the Phase 1; starting to produce ENC; and the Activity Plan to be implemented until the end of the Project. The progress of the Knowledge and Technology Transfer was also presented by the Task Force Team.

JCC discussed intensively the Interim Report and noted that the purpose of the Hydrographic Survey including enormous Data Processing was almost achieved, and is ongoing to produce ENC and Technology Transfer is progressed gradually. JCC also praises the accomplishment made by the study team despite it has faced a number of difficulties during the Project implementation.

JCC also agreed with the activity plan until the end of the Project and urge the Study team to work closely together to conclude the Project timely. JCC also encourages the Task Force Team to digest Knowledge and technology from the Study Team.

Phnom Penh, April 22nd 2015



H.E Tram Iv Tek

Chairperson of JCC

The Minister of public Works and Transport



MINUTE OF FORTH MEETING
of the Joint Coordinating Committee
for

The Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart
in the Kingdom of Cambodia

In accordance with the work plan of the *PROJECT FOR PRODUCTION OF INTEGRATED DIGITAL TERR MODEL AND ELECTRONIC NAVIGATIONAL CHART IN THE KINGDOM OF CAMBODIA*, hereinafter referred to as "The Project" and as a follow up to the progress of the implementation of the Project, the Forth Meeting of the Joint Coordinating Committee for the said Project was held on March 11 2016 under the Chairmanship of H.E. Mr. Tram Iv Tek, Minister for Public Works and Transport, and H.E. Mr. Itsu Adachi, Chief Representative of JICA Cambodia Office. The list of attendants is attached.

The JICA Study Team together with the Task Force Team presented the Interim Report 2 on the implementation and achievement of the original Project up to December 2015; that is the Hydrographic Survey including Tidal Observation and Current Measurement; and Data Processing for enormous acquisition data; Production ENC; and the Activity Plan to be implemented in the extension Project until the end of December 2016. The progress of the Knowledge and Technology Transfer was also presented by the Task Force Team. (The Project has been extended for a year because of producing a middle scale ENC by requesting of the Third JCC.)

JCC discussed intensively the Interim Report 2 and noted that the purpose of the Hydrographic Survey including enormous Data Processing and the Cartography including ENC Production was achieved as of the original plan, and Technology Transfer is progressed gradually. JCC also praises the accomplishment made by the study team despite it has faced a number of difficulties during the Project implementation.

JCC also agreed with the activity plan for the extension Project and urge the Study Team to work closely together with Task Force Team to conclude the Project timely. JCC also encourages the Task Force Team to digest Knowledge and Technology from the Study Team.

Phnom Penh, March 11 2016



A handwritten signature in black ink, appearing to read 'Tram Iv Tek', written over a horizontal line.

H.E Tram Iv Tek
Chairperson of JCC
The Minister of public Works and Transport

MINUTE OF FIFTH MEETING
of the Joint Coordinating Committee
for

The Project for Productions of Integrated Digital Terrain Model and Electronic Navigational Chart
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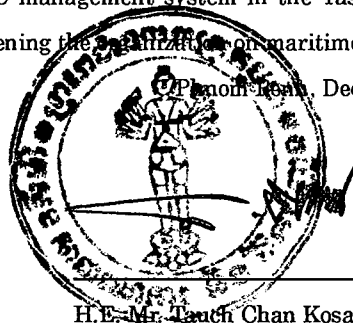
In accordance with the work plan of the *PROJECT FOR PRODUCTION OF INTEGRATED DIGITAL TERRAIN MODEL AND ELECTRONIC NAVIGATIONAL CHART IN THE KINGDOM OF CAMBODIA*, hereinafter referred to as "The Project" and as a confirmation of completion of the Project implementation, the Fifth Meeting of the Joint Coordinating Committee for the said Project was held on December 8 2016 under the Chairmanship of H.E. Mr. Tauch Chan Kosal, Acting Minister for the Ministry of Public Works and Transport, and H.E. Mr. Itsu Adachi, Chief Representative of JICA Cambodia Office. The list of attendants is attached.

The JICA Study Team together with the Task Force Team presented the Draft Final Report on the implementation, achievement and results of the original and extensional Project over three years; that is the Hydrographic Survey including Tidal Observation and Current Measurement; and Data Processing for enormous acquisition data; Production ENC until the end of December 2016. The progress of the Knowledge and Technology Transfer was also presented by the Task Force Team. (The Project has been extended for a year because of producing a middle scale ENC by requesting of the Third JCC.)

JCC discussed intensively the Draft Final Report and noted that the purpose of the Hydrographic Survey including enormous Data Processing using GIS technology such as practical use of satellite imagery and the Cartography including ENC Production has been achieved as of the original / extensional plan, and Technology Transfer is progressed gradually. JCC also praises the accomplishment made by the study team despite it has faced a number of difficulties during the Project implementation.

JCC also agreed on the summarization of the Draft Final Report for the whole Project and urge the Study Team (JICA mission) to advise effectually on the continuity of the ENC management system and urge to have a strong will to continue the ENC management system in the Task Force Team of MPWT, and expected for JICA's support for strengthening the organization on maritime safety.

Phnom Penh, December 8 2016



H.E. Mr. Tauch Chan Kosal

Chairperson of JCC

The Acting Minister of Ministry public Works and Transport