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SIMULTANEOUS MARINE DATA COLLECTION ALONG WITH HYDROGRAPHIC SURVEY FOR MARINE STUDY/ OCEANOGRAPHIC RESEARCH WITHOUT COMPROMISING ON TIME/ DATA QUALITY/ RESOURCES

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Abstract: *Hydrography is the branch of applied science of measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defense, scientific research, and environmental protection". The science of hydrography originated in the need for the production of maps specially designed for the use of the mariner. Nothing has been of more importance to the foundation and expansion of sea-borne trade among the nations than the production of the charts which represent the results of the hydrographic surveyor's work. Not only directly related to the sequence of activities data collection, but also related to the movement of the ship survey, the capabilities of survey ship, the strength of the logistics and stretches on the ability of the crew and the user survey equipment. So the planning process or time management is very important and is a challenge create a survey team leader, the challenge of how to manage the time, survey equipment and energy of the crew with the end objective of which is the founding both the data and hydrographic data oceanography data. In oceanography data collection during a survey of hydrography required adequate equipment and professional workers, without the two main factors are very difficult to implement the collection of both survey data. The main factor is the equipment that qualified in implementing the data collection. Required a good planning before starting operation this survey, with good planning it is expected that the survey can walk in accordance with the main purpose. The survey vessel can do many things in the collection of data during the survey, specially hydrographic data and Oceanography data. With technology and completeness of sophisticated equipment on the survey vessel is a source of great power in the conduct of the survey and maritime data collection, only requires professionals on each of the equipment to operate the equipment so that data is collected in accordance with the expected. So that the collection of data simultaneously can be done without interrupting on the subject of the hydrographic survey. In collecting additional sea data, required additional resources to support implementing such during hydrographic survey, this very determine the level of success in the collection of additional data oceanography. Additional resources to gather additional sea data are divided into two: a) Manpower and scientist. The success of a survey is very dependent on manpower, because manpower that will operate the various types of equipment and software. Without manpower impossible survey can be running smoothly and finished on time. While for the scientist also have a very important role because they will analyze all the results of the data that has been obtained during the survey. b) Equipment and software. With the support of the equipment and software that sophisticated, then each data collection can run smoothly, either hydrographic data collection or oceanography data. Before we implement Oceanography data collection during the period hydrographic survey, so we need to know kind of the data what we need and what equipment that will be used in the collection of data. So that we understand when the right time to implement every part of the work for oceanographic data collection during the implementation of the hydrographic survey and it is expected that the both collection of this data can be running at the same time in accordance with the plan.*
Keywords: *Simultaneous Marine Data, Hydrographic, Study Oceanographic.*

INTRODUCTION

The hydrography, etymologically, 'hydrography' found from the nature of the French medieval 'hydrographique', as the word is related to the nature and the measurement of the bodies of water, for example: depth and current (Merriam-Webster Online, 2004). Until around 1980s hydrographic activities dominated by the survey and mapping of the sea to the making of the map sea navigation and survey for oil and gas exploration earth sea navigation map contains important information that is required to ensure the safety of navigation, like: the depth of the waters, beacon the beacon navigation, the coastline, shipping flow, the dangers of shipping and etc. besides, hydrographic activities also dominated by the determination of the position and depth of harmlessly into the offshore that supports the exploitation of oil and gas. During the past twenty years there had been a fundamental shift in the scope and application of hydrography. Hydrograph is no longer solely associated with the mapping of the sea and the determination of the position, but also with the Law of the sea (the Law of the Sea and the physical aspects of Integrated Coastal Area Management (lntegrated Coastal Zone Management) (Dyer, 1979; de Jong et al., 2O02). This shift caused by the progress of computing and measurement instrument technology. In addition, this shift also caused by the demands of the community and user industries hydrographic products as a result of increasing human activity in the area of the waters.

"Hydrography is the branch of applied science of measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defense, scientific research, and environmental protection". The science of hydrography originated in the need for the production of maps specially designed for the use of the mariner. Nothing has been of more importance to the foundation and expansion of sea-borne trade among the nations than the production of the charts which represent the results of the hydrographic surveyor's work.

IHO publication C-17 outlines the benefits and options for the development of a national hydrographic policy that ensures a State has a knowledge of the physical features of the seabed and coast, as well as the currents, tides and certain physical properties of the sea water, such that the needs of safety of navigation and protection of the marine environment can be met.2 A successful national hydrographic policy will not only meet the requirements of the mariner but can provide additional and often greater benefits to the State. Such benefits include:

- Safe and efficient operation of maritime traffic;
- Coastal Zone Management;
- Exploration and Exploitation of Marine Resources;
- Environmental Protection; and
- Maritime Defense.

RESEARCH METHODS

CHALLENGES FOR EFFECTIVELY IMPLEMENTING THIS CONCEPT DURING HYDROGRAPHIC SURVEY

Talking about the challenges in implementing the collection oceanography data during the period hydrographic survey is very varied, There are some of the biggest challenges during this data collection process, among others are:

Time management is the biggest challenge in implementing this oceanography data collection activities. The head or leader of the survey team required skill in planning all activities start from early stages until the end, not only directly related to the sequence of activities data collection, but also related to the movement of the ship survey, the capabilities of survey ship, the strength of the logistics and stretches on the ability of the crew and the user survey equipment. So the planning process or time management is very important and is a challenge create a survey team leader, the challenge of how to manage the time, survey equipment and energy of the crew with the end objective of which is the founding both the data and hydrographic data oceanography data.

Next is the challenges in creating and educate crew to become the experts in the field for oceanography specialists, experts in operational oceanography instruments and tools and skilled in the use of the software for process collection oceanography data, so that we do not need to use energy other people or another manpower outside the crew of our own. But this also is not an easy job because it requires a process that is quite long time consuming, especially if the crew that we will preparation or that will be educated did not have the knowledge base in oceanography, this made the challenge for the leaders of the survey in preparing for experts in the field of oceanography.

The next challenge is how to deal with the problems or resolve problems if an error occurs in one of the data collection process that may be caused by an error on the equipment or error on people, so that require quick thinking from a leader of the survey team to overcome or alter some part of the plan that has been created for all this relates to the time that continues to run during the period of the survey.

RESULTS AND DISCUSSION

Options Available For Conducting Oceanographic Research

(a) Before we implement the collection Oceanography data, should we grouping the first type of data what we need, whether we will collect all types of data or only some data. Oceanography data types can we group as below:

(i) Oceanography physics data: The tides, waves, current, and temperatures and sound velocity profiler.

(ii) Oceanography chemical data: Among other nutrient content (nitrate, fosfat, amoniak, nitric, no silicates), carbon (particulate organic carbon, dissolved organic carbon and dissolved inorganic carbon), conductivity alkalinity, novel type of catalyst for selection oxidation of dissolved, and pH from sea water.

(iii) Oceanography marine biology data (including fisheries data): The data category marine biology is the concentration of chlorophyll phytoplankton composition, plankton and types of biota sea.

(iv) Geological data of the sea (including hydrographic data): Among other sea sea depth data, types of rocks or sediments at the bottom of the sea, mount in the bottom of the sea and the trough of the sea.

(b) Some parameters above is that can be measured directly using the appliance measurement as the tides, waves, current, and temperatures. Some other parameters must be measured indirectly through laboratory analysis of sea water samples taken, such as nutrient content and composition of plankton. On the indirect measurement, some special treatment must be performed on water samples taken (such as the type of the container or bottle where samples, giving chemicals (reagent) specific for preserves samples or slow down the reaction, etc.). On the ships, research laboratory facilities are usually available complete and integrated, so that both the measurement directly or indirectly can be done simultaneously on an expedition in progress.

The development of this time, the ships of the survey has been equipped with various equipment and sophisticated technology to collect data of hydrography and oceanography, in other words the boats are to be multi purpose research vehicle. Now we will discuss the equipment and the software what is required or in trends is currently in the process of collection of data on hydrography and oceanography.

Hydrographic Data

First we will talk about hydrographic data, configuration from the hydrographic survey is the beginning of knowledge before planning the survey hydrographic, survey configuration is as follows:

The determination of the position of the sea and the use of reference system.
Measuring depth (sounding/ bathymetri).
The measurement of the current.
Measuring (sampling and analysis) sediment.
Observations of the tides the water of the sea.
The measurement of the details of the situation and the coast line (for coastal mapping).

Below will be mentioned about instrument used in collecting hydrographic data;

The determination of the position of the sea and the use of reference system include the measurement of the details of the situation and the coast line (for coastal mapping), in these measurements we use a set of the GPS that we can find in various brand. Compared with the system and method of the determination of the other position, GPS has many advantages and offer more benefits both in the aspect of operasionalisas and the quality of the given position.

Figure 2 GPS instrument for observation and positioning of ship

Measuring depth (sounding/ bathymetri). Bathimetry is the process and the activity is intended to get a clearer picture (model) forms the surface (topography) seabed. The measurement of the depth we can perform using the single beam and multibeam. With various choices of this equipment easier for us in depth measurements.

Figure 3 Multibeam Echosounder Kongsberg EM2040

Measuring (sampling and analysis) sediment, the study of sediment examples are very useful for the determination of the physical characteristics of sediment and the composition of her womb. Interpretasi to information about the physical characteristics and the composition of the content of sediment is very important to be developed to be further studies for, among others, the analysis of the dynamics of bathimetry, durability of the land, the potential for mining or contamination. For sample of sediment we can use the grab sampling or gravity corer.

Figure 4 Gravity corer and Grab sampling

Observations of the tides the water of the sea and the measurement of the current. The tides observation done to obtain high data the face of the waters of the sea in a location. Based on the results of the observations can be specified vertical datum. This time the tides observations already using the instrument of sophisticated, but manual observation from tide pole still carried out.

Figure 5 Wave and Tide Recorder (WTR) and Mini Tide

Oceanography Data

Now we will talk about oceanography data. Configuration from the oceanographic survey is the beginning of knowledge before planning the survey oceanographic, oceanography data types can we group is as follows:

The measurement of the oceanography data is directly:

Oceanography physics data: The tides, waves, current, and temperatures and sound velocity profiler.

Geological data of the sea (including hydrographic data): Among other sea depth data, types of rocks or sediments at the bottom of the sea, mount in the bottom of the sea and the trough of the sea.

Below will be mentioned about instrument used in collecting oceanographic data;

The measurement of the directly with the use of measurement tools such as the tides, waves, current, and temperatures. The measurement of the tides, appliance used are mentioned in the previous section, the measurement directly to obtain data physics, some including into category oceanography physics data is the current, waves, temperatures and sound velocity profiler. To measure directly there are many choices of instrument that we can select, among others;

The ADCP measures velocities from its transducer head to a specified range and divides this range into uniform segments called depth cells (or bins).

The measurement of the waves from sea waters, we have the choice Wave and Tide Recorder (WTR), is a instrument that many used in data collection waves because provides ease in recording data.

Figure 6 Midas wave and tide recorder

Next is the measurement temperatures and sound velocity profiler. In make it easier for the user to retrieve data temperatures and sound profiler, this time the size of this appliance has been very small, in addition to facilitate the loading data also make it easier in terms of storage and the movement so it does not need many people, as the example below:

Figure 7 Midas CTD+

The CTD, Conductivity, Temperature and Depth (pressure), data can be used to calculate salinity, density, sound ve-locity. CTD is often used to describe a package that includes other parameters like water sampler. Advanced setup software allows a variety of sampling regimes including burst modes, delay starts, and conditional sampling. The combined SVP/CTD profiled calculate with a sound velocimeter or with salinity temperature and depth measurement. It can be used on real time operation or self recording operation.

Figure 8 Midas SVX2 Combined SVP/CTD profiler

Figure 9 Midas miniSVS&T (Sound velocity profiling with temperature)

The sub-bottom profiler allow to identify, characterize and measure layers of sediment or rock under the sea-floor. One kind of instrument is a SES-2000, there version of the SES-2000 deep model is with beam steering for roll compensation only with all electronics in one transceiver unit.

Figure 10 SES-2000 Transceiver unit for permanent installation and The Transducer

The measurement of the next oceanography data is indirectly or in other words take an example of the water of the sea. Some other parameters must be measured indirectly through laboratory analysis of sea water samples taken. On the indirect measurement, some special treatment must be performed on water samples taken (such as the type of the container or bottle where samples, giving chemicals (reagent) specific for preserves samples or slow down the reaction, etc.). To take an example of sea water we can use the appliance operates manually or automatically, excess on the appliance automatically can take an example of water each layer on the depth sea.

The collection of examples of sea water manually, Nansen bottle an instrument used by oceanographers for obtaining samples of sea water from a desired depth.

Figure 11 Nansen Bottle

Note that the device is presently open at both ends so it can take a pure sample at the depth of interest before being sealed off at both ends by a weighted messenger from the surface.

The collection of examples of sea water automatically, this time the collection of examples of the water of the sea many using the appliance automatically that work based on the depth (pressure).

Figure 12 Niskin Rosette Rack with & Midas CTD+ with KC Niskin Bottles

Niskin bottles are often either set up in a series of individual bottles that trigger each other in turn as they close, or they are set up in a circular rosette of as many as 12-24 bottles attached around a CTD instrument. Either arrangement allows samples to be taken at different water depths in a way that seals off the sample and allows it to be brought to the surface without mixing with water from different depths. Polar researchers sometimes use Niskin Bottles to collect water samples from below the ice. The water collected by Niskin Bottles is used for studying plankton or measuring many physical characteristics such as salinity, dissolved oxygen, nutrient concentrations (such as phosphate, nitrate and nitrite), and dissolved organic and inorganic carbon.

Supporting Software For Oceanography Physics Data Collection

In the collection of oceanography physical data directly, such as data current, subbottom profile, additional software required to support the collection of data is continuously at the same time with the depth of the data collection. K-Sync is a multibeam echosounder software for running several acoustic systems with

sequencing. This sequencing avoid interference and optimize data quality by controlling the triggering of each instrument's transmission.

The Synchronizing Unit uses the runtime parameters to determine the individual timing of the echo sounders, while the trigger groups specify in what order and which echo sounders will transmit together. The display consists of two parts :

(i) Active group indicator (1). Shows which group is currently active. Groups that do not have any echo sounders assigned to them are skipped. A maximum of 16 groups can be scheduled. The duration of each group will depend upon which echo sounders are assigned to the group.

(ii) Trigger schedule (2). The trigger schedule shows one system per row, and the trigger groups are shown across. A green LED designates that the echo sounder has been assigned to that group.

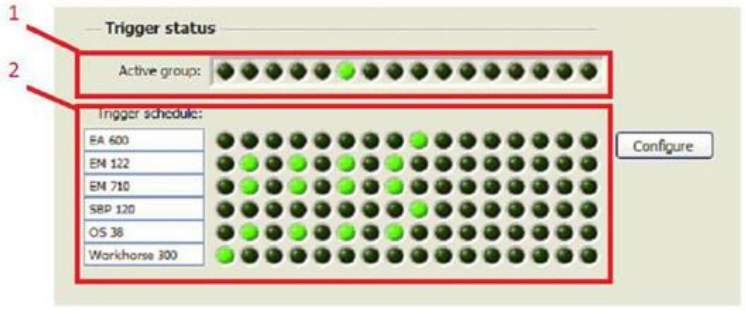

Figure 14 K-sync Trigger status

To modify the schedule, click configure. And check the groups that an echo sounder should be assigned to. Trigger group configuration dialogue allows user to assign echo sounders to trigger groups.

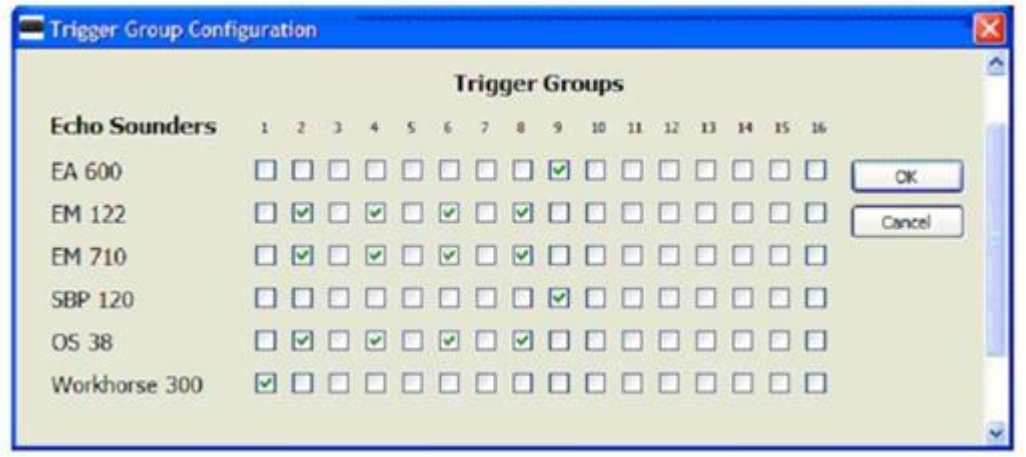

Figure 15 K-sync Trigger groups

The trigger display is a real-time display that shows the current state of each echo sounder plotted across time. There are two plots for each echo sounder:

Trigger Plot. The trigger plot shows a pulse whenever the Synchronizing Unit is triggering the echo sounder. This line is blue.

State Plot. The state plot shows the current state based on scheduling and feedback signals and is conveyed by its colour.

Disabled	State plot	Grey line	Echo sounder is ready to be triggered Echo sounder has been disabled by operator or the echo sounder is in standby state (time out / not ready)
Ready	State plot	Green line	Echo sounder is ready to be triggered
Busy	State plot	Red line	Echo sounder is currently transmitting, receiving and/or processing samples
Transmit	Trigger plot	Red pulse	Echo sounder acknowledged that a transmit occurred (width of pulse is always constant)
Trigger	Trigger plot	Blue pulse	Trigger pulse

Figure 16 Trigger display plots

Each trigger group is visually separated by the vertical group line in yellow. By inspecting the trigger chart for a particular group it is possible to see which echo sounder is taking the longest to complete the ping cycle. This echo sounder will have a red line that starts at the beginning and extends all the way to the end of the group.

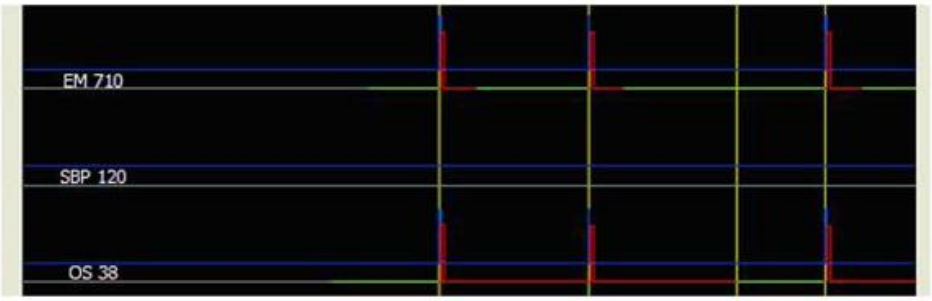

Figure 17 K-Sync Echo Sounder

From picture above, this plot shows an echo sounder, OS 38, which has the longest period in the group and consequently determines the overall ping rate for the groups it is assigned to.

Echo Sounder Status. The individual states of the echo sounders are shown in the Echo sounder status display. For each echo sounder there is also a check box for enabling and disabling the system. The Echo sounder status provides synchronizing status for each of the installed echo sounders.

Figure 18 K-sync Echo Sounder Status

Even if an echo sounder is scheduled, it can be overridden by enable/disable setting. If enabled (checked) it will be triggered according to the schedule, if disabled (unchecked) it will not be triggered even if scheduled. This setting is seen in the check box on the left hand side of the Echo sounder status area of the user interface.

Figure 19 K-sync Enable/disable echo sounder

The Diagnostic Display dialogue shows the signal level of each digital input and output, there are :
48 feedback signals (inputs) (1),
16 trigger signals (outputs) (2).

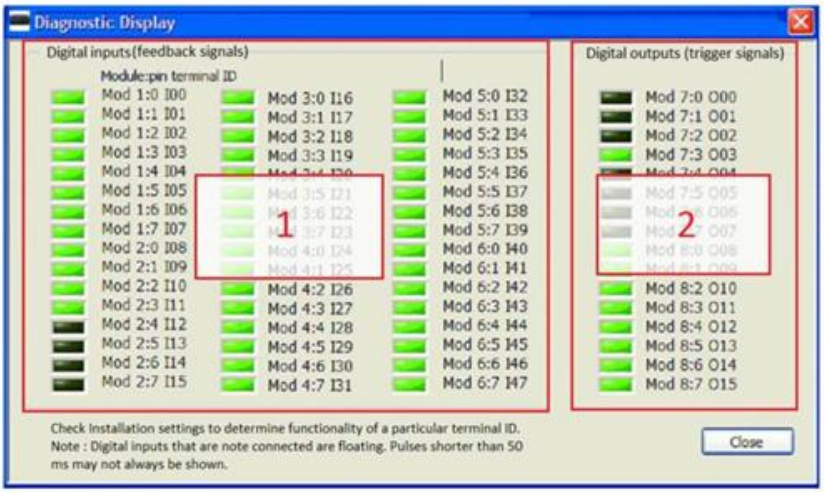

Figure 20 K-sync diagnostic display

The label next to each LED describes which module and pin number as well as terminal ID the state is associated with. The module and pin number refer to the physical connections inside the Synchronizing Unit, while the terminal ID refer to the selections in the installation settings. Note: The LEDs refer to the actual voltage level on the input (referred to as 5 V). If signal conditioning has been applied, the states may become inverted.

Technical Specifications. Some of the timing and signal specifications with respect to the K–Sync are listed in the table below.

Display resolution (horizontal)	50 ms
Display width	10, 30 or 60 seconds
Max. trigger groups	16
Timing resolution of synchronization	1 ms
Available signal inputs	48
Max systems/trigger outputs:	16
Supported signal levels (inputs and outputs):	TTL and RS-232
Signal latency (feedback signal to trigger output)	40 µs
Supported depth datagram input	EMx : D,X, and E EA 500 NMEA : DPT and DBS

Figure 21 K-Sync specifications

Other Supporting Equipment / Vessel

Automatic Oceanographic Winch. This support equipment including one important part in data collection, Oceanography data measured obtained directly or indirectly. The use of automatic winch system is required in oceanography data collection, with automatic system can reduce the time required in data collection. Oceanographic winch systems are continuously involved in the safe and efficient launch and recovery of ROVs, towed systems, corers, drills, ploughs, pumps, sonars, sensors, diving systems and a vast range of other equipment types, under harsh maritime conditions, all across the globe, With the length of the wire around 2000 - 6000 meters and can bear the burden of around 2000 daN (decanewton), we can collect data on the deep sea, but all depends on the winch specifications, The more the length of the wire, then more in oceanography tools can collect data.

Figure 22 Automatic Oceanographic Winch

Dynamic Positioning. A Dynamic Positioning Ship is very helpful in monitoring the natural occurrences that take place offshore and aids in ships to maintain its position in the deep sea by pinpointing about the wind and the wave data which would otherwise make a ship lose control and veer off its course. Through Dynamic Positioning, a ship does not require the usage of anchors to maintain its course in the deep waters and thus can carry out its main purpose well. Ships with dynamic positioning system are known as dynamic positioning ships. Dynamic Positioning is generally used in research ships and drilling vessels which have to venture into the deepest parts of the ocean and sea where winds and waves tend to be perpetually altering. In situations like this, it could prove very tedious for a ship's crew to lay the

anchors. A ship enabled with Dynamic Positioning can get to know about the changes in the wind and the waves and thus alter its course suitably without having to compromise on its main purpose. Ships enabled with Dynamic Positioning are independent of anchors and other support system in the sense that a Dynamic Positioning Ship enables the use of pushers and propellers to make the ship stay on course and steady rather than get carried away by the fluctuating winds and waves. This is perhaps the most advantageous feature of the system of Dynamic Positioning.

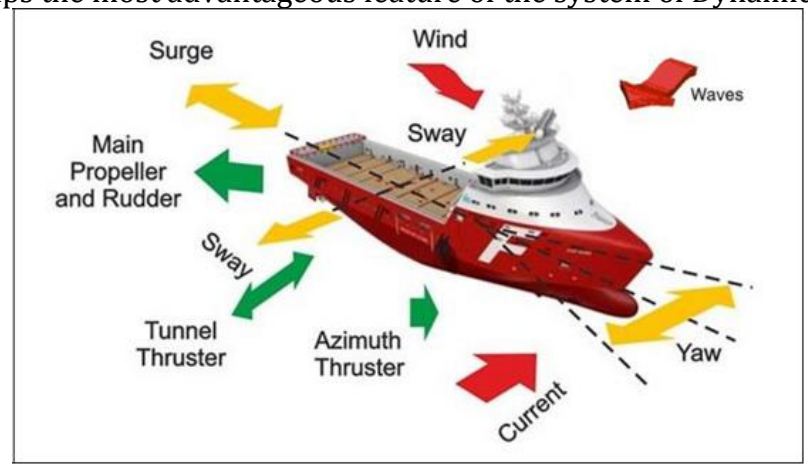

Figure 23 Dynamic Positioning

(c) Autonomous Underwater Vehicle (Auv Hugin). The HUGIN AUV is a scientific underwater vehicle system or free-swimming vehicle with many different operational purposes such as high-resolution seabed mapping and imaging, scientific and fisheries research, water quality measuring and also mine reconnaissance to mention a few. It comprises a topside system installed on the host vessel and an Autonomous Underwater Vehicle (AUV) which has the primary purpose of transporting a sensor package underwater at a constant speed along a straight path. The vehicle navigates using a list of programmed way points generated from a mission plan. The mission plan is normally set up before the mission is executed but it can be altered during a mission through communication with the host vessel. The communication links the host vessel can use are acoustic links for communication when HUGIN AUV is submerged, RF link and Iridium link while the vehicle is at the surface and finally network communication or WLAN while HUGIN AUV is on board the host vessel.

Figure 24 AUV with Multibeam Echosounder, Subbottom Profile, Side Scan Sonar

MULTI PURPOSE RESEARCH VEHICLE (MPRV)

The survey ship has a very important role in the data collection of hydrographic data and oceanography data, qualities of the ships of the survey from the structure and

design of ships that must be made in such a manner or specifically for the purpose of data collection and in the design to reduce the various sources of error during data collection. This time so many ships of the survey are built by some shipbuilding activities, if we see in special product, survey ship (MPRV) must have various criteria, among others about the structure of the build ships, the main material of the body of the ship, system machinery, capabilities long voyages, the ability to handle the seastate of waves, complete with dry laboratory and wet laboratory for oceanography research, accommodation for crew ships and various kinds of things that must be considered before designing the ship survey.

Maximum utilization of a survey ship can help smooth and ease of data collection process either hydrographic data and oceanography data. For example if a ship survey able to sail for 20 days continuously without fueling surely very help in the collection of data if compared with ordinary ships to fill the fuel after approximately sailed for ten days. It is expected that with the increasingly ever ability sailed a ship survey can provide the use and utilization of time in data collection during the survey.

One example of the survey ship that is currently derived from Indonesia namely Rigel class, this survey ships is made from the ingredients allumunium an alloy for all the body of the ship, with the system driving the use of diesel engine coupled with the electric motor to rotate the propeller ships with the aim to reduce fuel consumption and reduce the noises that can be disruption during data collection of hydrographic data or oseananographic data. Good enough accommodation is also required by the crew to reduce boredom during sail that may spend weeks at sea.

Figure 25 Survey Vessel KRI SPICA 934 from Rigel Class

Integration With Hydro Data Collection. At a time when we plan a hydrographic survey or planning for bathymetry data collection of course we will definitely plan every lines for sounding, with guidance from this sounding lines we can plan the points to where the later survey ships will stop using the dynamic positioning to implement data collection, Oceanography data example sound velocity profile data to construct the point, data of the waters sampling from the sea, and data an bottom sampling from sea bottom. While for the collection of data current of the sea and the data sub bottom profile can be done simultaneously with the measurement of the bathymetry of that time efficiency can be done because the collection of data can be done simultaneously and sustainable. With the support of the equipment and software a complete collection of data on hydrography and Oceanography data can be executed once the way.

CONCLUSIONS

The author resume conclusions about collecting additional data for marine study/ oceanographic research during the course of a hydrographic survey, among others:

In oceanography data collection during a survey of hydrography required adequate equipment and professional workers, without the two main factors are very difficult to implement the collection of both survey data. The main factor is the equipment that qualified in implementing the data collection. Required a good planning before starting operation this survey, with good planning it is expected that the survey can walk in accordance with the main purpose.

The survey vessel can do many things in the collection of data during thesurvey, specially hydrographic data and Oceanography data. With technology and completeness of sophisticated equipment on the survey vessel is a source of great power in the conduct of the survey and maritime data collection, only requires professionals on each of the equipment to operate the equipment so that data is collected in accordance with the expected. So that the collection of data simultaneously can be done without interrupting on the subject of the hydrographic survey.

In collecting additional sea data, required additional resources to support implementing such during hydrographic survey, this very determine the level of success in the collection of additional data oceanography. Additional resources to gather additional sea data are divided into two:

a) Manpower and scientist. The success of a survey is very dependent on manpower, because manpower that will operate the various types of equipment and software. Without manpower impossible survey can be running smoothly and finished on time. While for the scientist also have a very important role because they will analyze all the results of the data that has been obtained during the survey.

b) Equipment and software. With the support of the equipment and software that sophisticated, then each data collection can run smoothly, either hydrographic data collection or oceanography data. Before we implement Oceanography data collection during the period hydrographic survey, so we need to know kind of the data what we need and what equipment that will be used in the collection of data. So that we understand when the right time to implement every part of the work for oceanographic data collection during the implementation of the hydrographic survey and it is expected that the both collection of this data can be running at the same time in accordance with the plan.

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