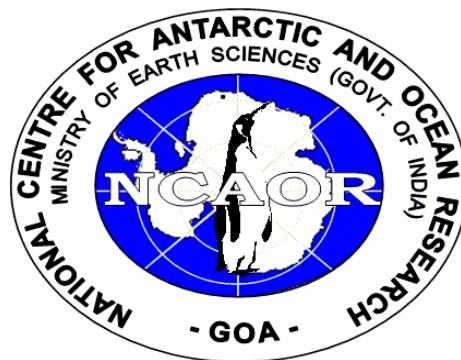


ORV SAGAR KANYA (SK-286 CRUISE)

(13th June to 13th July 2011)

Multibeam Swath Bathymetric Survey of Andaman region, Bay of Bengal (Indian EEZ Mapping)

Dr. Babula Jena (Chief Scientist)



**National Centre for Antarctic and Ocean Research
(NCAOR), Headland sada, Vasco-da-gama, Goa**

<u>Contents</u>	<u>Page no.</u>
<i>1.0 Introduction and objectives</i>	<i>02</i>
<i>2.0 Cruise itinerary</i>	<i>02</i>
<i>3.0 Participants</i>	<i>03</i>
<i>4.0 Multibeam swath bathymetric survey and area of operation</i>	<i>04</i>
<i>5.0 Equipments used and method of data collection</i>	<i>05</i>
<i>6.0 Data collection during the cruise</i>	<i>10</i>
<i>7.0 Scientific observations and activities during the cruise</i>	<i>14</i>
<i>8.0 Diary of events</i>	<i>14</i>
<i>9.0 Multibeam system related issues</i>	<i>20</i>
<i>10.0 Acknowledgements</i>	<i>21</i>
<i>Annexure-I : OM for SK-286</i>	<i>22</i>

1.0 Introduction and objectives:

As part of entire Indian EEZ mapping, the major objective of this cruise (SK-286) is to undertake “Multibeam Swath Bathymetric Survey” to prepare a comprehensive seabed topographic map of Andaman region, Bay of Bengal. Other objectives includes sediment coring in some selected locations, collection of bucket sea surface temperature, and impart training to students (Cochin University and Andhra University) on marine sciences and onboard scientific instruments.

The present cruise (SK-286) is the 2nd multibeam survey for EEZ mapping considering after Sea-trial of SB3012 calibrations during 25th February 2011 to 03rd March 2011 from Colombo to Chennai.

2.0 Cruise itinerary:

All participants were embarked over ORV Sagar Kanya on 13th June 2011 and the vessel started sailing from Chennai port (Latitude-13° 05.878’N, Longitude-80° 17.996’ E) towards the survey area (Way point 1 : 11°16.84 N, 088°49.80 E) on 13th June (20.05 IST). The cruise was planned for the period of 31 days to cover all proposed survey lines.

Embarkment	:	Chennai	- 13.06.2011
Disembarkment	:	Chennai	- 13.07.2011

3.0 Participants:

A total of thirteen (13) scientific personnel and engineers participated from several organizations such as NCAOR, Cochin University of Science and Technology (CUSAT), Andhra University (AU) and NORINCO. List of participants are as follows:

	Participants	DOB	PASS PORT NO.	ORGANISATION
1	Dr. Babula Jena (Chief Scientist)	21/05/1976	E4447375	NCAOR
2	Bibin Abraham	16/11/1987	H 2629745	NCAOR
3	Pavan Shirodkar	11/04/1989	J2748180	NCAOR
4	Mohammed Shafeeq Basheer	20/12.1988	J1102056	CUSAT
5	Devarthodi Naseem	06/05/1988	H7452589	CUSAT
6	Bijesh C. Moothoor	21/09/1989	J1891413	CUSAT
7	Ajish Pranavam Saji	24/05/1990	H5386089	CUSAT
8	Sarunlal M Arunlal	14/02/1989	J5791004	CUSAT
9	K Seetanna	06/02/1984	H1069839	AU
10	Kalasadana Madhusudan	23/03/1960	E7757188	NORINCO
11	Palaniswamy Boopathy	10/02/1969	F3286172	NORINCO
12	Thangaraj Ramesh	24/06/1986	G5016523	NORINCO
13	Francis Berlin Leo	05/04/1987	H1745030	NORINCO

4.0 Multibeam swath bathymetric survey lines and area of operation:

The survey was carried out to cover the whole proposed area (Block 1 & 2) with 38 lines (Figure 1) after fixing the line spacing, anticipated using nearest multibeam bathymetry. The survey area consists of two blocks with total area of about 31,458 km². The multibeam swath coverage in block-1 is more than the block-2 because of deep bathymetry. The details on survey carried out in this cruise are given below,

Block-1 (Deep region)

No. of survey lines	:	12
Survey track length (Km)	:	3255
Survey area (Km ²)	:	25258
SVP collected	:	07

Block-2 (Typically shallow region)

No. of survey lines	:	26
Survey track length (Km)	:	2227
Survey area (Km ²)	:	6200
SVP collected	:	05

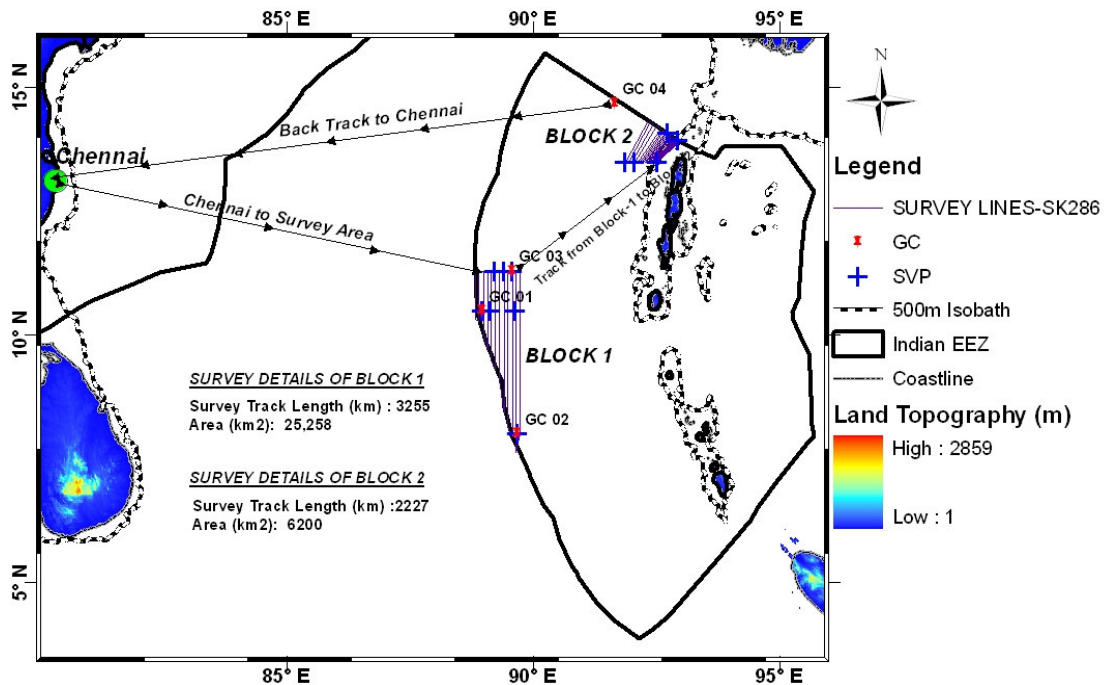


Figure 1: Final survey lines of multibeam bathymetry and other scientific operations.

5.0 EQUIPMENT USED AND METHOD OF DATA COLLECTION

5.1: SB-3012 Multibeam Echosounder System:

SeaBeam 3012 Multibeam Echosounder onboard ORV-Sagar Kanya was used to carry out the present survey. The SB3012 is a 12 KHz, 201 beam sonar system, with an effective 1500 of swath. The system has a beam width of 1 degree at nadir and is capable of depths 200 metres to 11000 metres. The swath coverage depends upon the beam angles. The beam angle will be a minimum of 90 degrees in the depth range of 4000 m and beyond. Multi beam system provides full swath coverage with minimum beam angle.

The beam angle and water depth are as:

Depth (m)	Beam Angle (°)
200 - 500	≈ 150 (Max)
500 – 1500	≈ 145
1500 - 2700	≈ 140
>4000	≈ 90

The Multibeam survey was carried out using standard practice. Planning of multibeam swath bathymetric survey lines are given in section-4. Navigational information is provided by C-NAV DGPS system. Total of six sound velocity profiles were taken from the survey area.

The specifications of the system are as follows:

Make:	L3-Communications Elac-Nautik
No. of beams:	201
Swath coverage:	5 x Water Column
Frequency of operation:	12 KHz
Technology:	Full motion compensation (Sweptbeam technology)
Depth performance:	Max. 11,000 m.
Acquisition software:	Hydrostar

Data Processing software: Eiva NaviPac

The complete Multibeam system comprises of many sub systems:

Surface Sound velocity (SSV): The surface sound velocity profiler is an underway ocean surface profiling system that can collect the water sound speed profiles while the vessel is still in motion.

Side Scan Imagery: Online printer provided with system and annotation interval was set at 30 minutes.

Gyro and Motion sensor: Multibeam system uses Octans sensor for Gyro and motion input. Octans is an IMO-compliant survey-grade gyrocompass with an integral motion sensor.

Positioning System: C-NAV DGPS subsystem is used for positioning accuracy. C-Nav GcGPS corrections are similar to other wide area DGPS system such as the Federal Aviation Administration's (FDA) wide area augmentation system (WAAS). The C-Nav GPS receiver can accept two (2) different GcGPS correction service message formats. The C-Nav, dual frequency, GPS user equipment receives either of these corrections broadcast from the communications satellite, applies them its own observed, refraction corrected C/A code, dual frequency observations, and performs a navigation solution. The resulting corrected GPS position; velocity and time (PVT) are output from the C-Nav equipment to other subsystems on the platform/vehicle/vessel to support the navigation positioning control requirements.

Network Timeserver with GPS synchronized time base: LANTIME (local area network timeserver) provides a high precision time base to a TCP/IP network (stratum-1-server). The NTP (network time protocol) is used to synchronize all NTP clients with the

reference. LANTIME/GPS is a set of equipment composed of a satellite controlled clock GPS167, a single-board computer with integrated network board and a power supply, all installed in a metal 19" on the single-board computer flash disk. Four push buttons and a 2 x 40 character LC display can be used configure and monitor the time server. After the network connection has been established the time server can also be configured and monitored remotely from a workstation via TELNET or FTP.

Network Time Protocol (NTP): NTP is a common method for synchronization of hardware clocks in local and global networks. Timeservers synchronize themselves by a reference time source, such as a radio controlled clock, GPS-receiver or modem time distribution. Stratum-1-servers distribute their time to several clients in the network which are called stratum-2.

A high precision synchronization is feasible because of the several time references. Every computer synchronizes itself by up to three valued time sources. NTP enables the comparison of the hardware times and the adjustment of the own clock, a time precision of 128ms, often better than 50ms, is possible.

Sound Velocity Profiler (SVP)

MIDAS SVP Sound Velocity Profiler was used to measure the sound velocity profile. It uses the advanced digital signal processing technique that removes virtually all noise from the data. The sound pulse is both transmitted and received, and allows measure the time of flight with a resolution of 1/100th of a



Fig 2: Instrument for Sound

nanosecond (10-11 seconds). The unit is fitted with the sound velocity, pressure and temperature sensors. The sound velocity profiler casting was carried out at 15 stations with depths ranging from 1000 to 2000 meters. The sound velocity and temperature is plotted against water depth and analyzed.

Data Acquisition Software: Sun workstation is the operator control station and Hydrostar the operator control station software. Sun workstation performs all commands to operate the SeaBeam 3012 system. Hydrostar is a data acquisition and control system for Multibeam sonar. It also acts as an interface for various external sensors (position, motion, heading and sound velocity sensors).

NaviPac software is used for navigation and data acquisition from various feeds such as GPS, Gyro, Motion sensor etc. NaviPac also allows the navigator to perform all phases of surface, sub-sea and remote navigation, to view all sensor data, to perform changes in navigation principles and components. The programme reads all basic information from the setup DB, present all available stations and let the navigator specify the stations wanted. All the information's is stored in the online DB file, which can be maintained by one or more online programs. NaviPac is installed in Windows NT workstation. NaviEdit, NaviModel and NaviPlot are the software to edit the data and create the model and plot the final chart.

5.2: Sub Bottom Profiler

GeoAcoustics Sub bottom profiler onboard was used to collect the sub bottom profile data along all the lines. SBP contains four units:

GeoPro data processing unit: It is the main processing unit and MacOS is the operating system. GeoPro software, which is a complete software system, installed in the main unit and software features, such as acquisition, target analysis, mosaicing and seismic processing are all part of one software application.

GeoPulse 5430A Transmitter: It is a stand-alone transmitter of 10 kW maximum power output in a frequency range of 2 KHz to 12 K HZ.

GeoPulse Receiver: The receiver is a universal amplifier/filter for use in sub bottom profiling. The receiver, combining many functions, replaces many single function boxes that would otherwise create space as well as interference problems.

Sidescan Sonar: It is the unit for side scan sonar operation.

5.4: Bucket Thermometer

It is used to measure the sea surface temperature. It consists of a mercury thermometer mounted inside a metallic container. The instrument has a maximum resolution of 0.5°C. It has maximum and minimum ranges of -15°C and 45°C respectively. The SSTs were collected at few locations during SK-286 cruise. It was difficult to collect the datasets throughout the survey area because of severe weather condition.



6.0 DATA COLLECTION DURING THE CRUISE

6.1 Multibeam Swath Bathymetric data.

The details on multibeam survey carried out in this cruise are given below,

Block-1

No. of survey lines : 12
Survey track length (Km) : 3255
Survey area (Km²) : 25258
SVP collected : 07

Block-2 (Typically shallow region)

No. of survey lines : 26
Survey track length (Km) : 2227
Survey area (Km²) : 6200
SVP collected : 05

6.2 GeoAcoustics Sub bottom profiler data.

SK 286
13.06.2011 to 13.07.2011
File details of Sub Bottom Profiler

Sl. No	Date	File Name
01	13.06.2011	SBP 20110613.Sit
02	14.06.2011	SBP 20110614.Sit
		SBP 20110614A.Sit
03	15.06.2011	SBP 20110615.Sit
		SBP 20110615A.Sit
04	16.06.2011	SBP 20110616.Sit
		SBP 20110616A.Sit
05	17.06.2011	SBP 20110617.Sit
		SBP 20110617A.Sit
06	18.06.2011	SBP 20110618.Sit
		SBP 20110618A.Sit
07	19.06.2011	SBP 20110619.Sit
		SBP 20110619A.Sit
08	20.06.2011	SBP 20110620.Sit
		SBP 20110620A.Sit
09	21.06.2011	SBP 20110621.Sit
		SBP 20110621A.Sit

10	22.06.2011	SBP 20110622.Sit
		SBP 20110622A.Sit
11	23.06.2011	SBP 20110623.Sit
		SBP 20110623A.Sit
12	24.06.2011	SBP 20110624.Sit
		SBP 20110624A.Sit
13	25.06.2011	SBP 20110625.Sit
		SBP 20110625A.Sit
14	26.06.2011	SBP 20110626.Sit
		SBP 20110626A.Sit
15	27.06.2011	SBP 20110627.Sit
		SBP 20110627A.Sit
16	28.06.2011	SBP 20110628.Sit
		SBP 20110628A.Sit
17	29.06.2011	SBP 20110629.Sit
		SBP 20110629A.Sit
18	30.06.2011	SBP 20110630.Sit
		SBP 20110630A.Sit
19	01.07.2011	SBP 20110701.Sit
		SBP 20110701A.Sit
20	02.07.2011	SBP 20110702.Sit
		SBP 20110702A.Sit
21	03.07.2011	SBP 20110703.Sit
		SBP 20110703A.Sit
22	04.07.2011	SBP 20110704.Sit
		SBP 20110704A.Sit
23	05.07.2011	SBP 20110705.Sit
		SBP 20110705A.Sit
24	06.07.2011	SBP 20110706.Sit
		SBP 20110706A.Sit
25	07.07.2011	SBP 20110707.Sit
		SBP 20110707A.Sit
		SBP 20110707B.Sit
26	08.07.2011	SBP 20110708.Sit
		SBP 20110708A.Sit
27	09.07.2011	SBP 20110709.Sit
		SBP 20110709A.Sit
28	10.07.2011	SBP 20110710.Sit
		SBP 20110710A.Sit
29	11.07.2011	SBP 20110711.Sit
		SBP 20110711A.Sit
30	12.07.2011	SBP 20110712.Sit

6.3. Sediment sampling operations: Gravity corer operated at 4 locations and sediment samples retrieved at 3 locations. Samples were washed out in one location.

Details on sediment coring						
Date	Time	Longitude	Latitude	Name	Depth	Core length
23.06.11	0900	88°58'E	10°29'N	GC01	3309m	Samples were washed out
28.06.11	0000	89°41'E	8°0'N	GC02	3613m	acquisition of 1.8m sediment core
29.06.11	0026	89°34.177'E	11°17.006'N	GC03	3187m	successful acquisition of 2.4m sediment core
08.07.11	0300	91°39'48''N	14°40'07''N	GC04	2703m	successful acquisition of 3m sediment core

6.4. Sound Velocity Profiler (SVP) observations.

SVP operations in survey block-1

Date	Time GM T	Location		Name	Depth (m)	SLD
		Longitude	Latitude			
23.06.11	1130	88°58'E	10°29'N	SVP-01	3309	2000m
23.06.11	1440	89°8.5'E	10°29'N	SVP-02	3296	2000m
26.06.11	1100	89°39.036'E	10°29.140' N	SVP-03	3269	2000m
28.06.11	0253	89°41'E	8°0'N	SVP-04	3613	2000m
29.06.11	0645	89°34.1774'E	11°17.006' N	SVP-05	3187	2000m
29.06.11	1010	89°24.5'E	11°17.006' N	SVP-06	3206	2000m
29.06.11	1354	89°13.6377'E	11°17.006' N	SVP-07	3221	2000m

SVP operations in survey block-2

Date	Time	Location		Name	Depth	SLD up to	For line
		Longitude	Latitude				
30.06.11	1640	92°30.483'	13°29.073'	SVP-08	570m	500m	
01.07.11	0900	92°56.080'	13°55.798'	SVP-09	638m	500m	
04.07.11	1050	92°44.14'	14°4.382'	SVP-10	1320m	1000m	
06.07.11	1205	92°2.923'	13°29.073'	SVP-11	1980m	1000m	
07.07.11	1725	91°51'45''	13°29'05''	SVP-12	3029m	1000m	

7.0 Scientific observations and activities during the cruise

In this cruise we have mapped few submarine channels in the Andaman region. This type of submarine channel is having a control on the sediment flow into the deep oceans. Sand bodies within these deep-sea channel systems can form important hydrocarbon reservoirs and are of significant interest to the hydrocarbon industry. The Andaman subduction trench where the heavier oceanic Indian plate is pushing below the lighter continental Southeast Asian plate is also mapped in this cruise along with various geomorphic features.

Lectures delivered related to MB survey, data processing and potential applications of bathymetry to marine sciences. All students were trained on the scientific instruments onboard SK.

8.0 DIARY OF EVENTS:

Date 13.06.2011

12 30: All participants signed on and embarked onboard Sagar Kanya

20 05: Vessel started sailing from Chennai Seaport (13°00.10 N, 89°18.25 E) towards way point one (11°16.84 N, 088°49.80 E.)

Vessel position @ 0800 (IST) 14.06.2011; 12°50.80 N, 081°52.35 E

Date 14.06.2011

Vessel sailing towards way point one 11°16.84 N, 088°49.80 E.

ETA of way point one is appx. 16.06.11 pm

Vessel position @ 0800 (IST) 15.06.2011; 12°06.15' N, 085°12.11' E

Date 15.06.2011

MBES system is working well. Vessel sailing towards way point one (11°16.84 N, 088°49.80 E).

ETA of way point one is appx. 16.06.11 am

0930 Safety familiarization meeting was held onboard at the dining saloon with Chief Officer and other participants to discuss the safety measures.

0430 Safety drills were carried out in primary muster station (balloon deck).

Vessel position @ 0800 (IST) 15.06.2011; 11°18.98' N, 088°42.05' E

Date 16.06.2011

0527 **Start of line-01** (88°49'37" E, 11°16'45"N). SVP operation could not be carried out due to rough weather condition, in turn makes difficult to maintain the vessel heading.

1753 **End of line-01** (88°49'33"E, 10°19'13"N)
1850 **Start of line-02** (88°53'14"E, 10°15'55"N)
Vessel position @ 0800 (IST) 17.06.2011; (10°56.23' N, 088°53.18' E)

Date 17.06.2011

0430 System failure at 88°53'12"E & 11°05'00N, and system restarted.
0500 Vessel reoccupied the line-02.
0742 End of line-02 (88°53'12" E, 11°17'006"N). Vessel is heading towards next way point.
0844 Start of line-03 (88°58'31"E, 11°17'006"N).
Vessel position @ 0800 (IST) 18.06.2011; (09°53.33' N, 089°01.14' E)

Date 18.06.2011

0030 End of line-03 (88°58.811 E, 10°0'N)
0230 System hanged and restarted.
0500 Start of line-04 (89°04'00"E, 09°43'N)
2251 End of line-04 (88°04'00" E, 11°17'N).
2330 Start of line-05 (88°8.7'E, 11°17'006"N).
SVP and Sediment Coring operations are yet to be carried out because of adverse weather condition.
Vessel position @ 0800 (IST) 19.06.2011; (11°06.25' N, 089°08.92' E)

Date 19.06.2011

0154 System hanged and restarted
Survey of Line-05 is under progress, vessel speed is below 5 Knts
Vessel position @ 0800 (IST) 19.06.2011; (09°33.36' N, 089°08.70' E)

Date 20.06.2011

0310 End of line-05 (89° 8.7' E, 9°30.26'N)
0549 Start of line-06 (89°13.63'E, 9°18.15'N)
0830 A lecture was delivered to students about the EEZ project details and fundamental principles of MBES.
* System hanged and restarted: 02 times
*SSV sensor is not yet functional though we keep on trying. It is risky to take out & refit the SSV sensor considering the bad weather condition. This problem was intimated by NORINCO to Mr. Brockhoff for possible suggestions and working on this problem.
Vessel position @ 0800 (IST) 21.06.2011; (11°17.56' N, 089°14.89' E)

Date 21.06.2011

0220 End of line-06 (89° 13.637'E, 11°17.006'N)
0311 Start of line-07 (89°18.75'E, 09°05.75'N)
* System hanged and restarted: 01 time
Vessel position @ 0800 (IST) 22.06.2011; (09°41.54' N, 089°18.75' E)

Date 22.06.2011

0735 End of line-07 (89°18.75'E, 9°5.75'N)
1323 Start of line-08 (89° 24.5'E, 08°25'N)

* System hanged and restarted: 01 time
Vessel position @ 0800 (IST) 23.06.2011; (10°10.59' N, 089°24.48' E)

Date 23.06.2011

0405 Vessel diverted for sediment coring at 88°58'E, 10°29'N (Depth-3309m)
0830 Vessel reached at sediment coring location -01 (88°58'E, 10°29'N).
0900 Sediment coring operation was started
1120 Sediment coring operation was completed but could not capture the sediment sample.
1130 SVP-01 was started (88°58'E, 10°29'N, Depth-3309m), SLD upto 2000m.
1300 SVP-01 completed successfully.
1440 SVP-02 was started (89°8.5'E, 10°29'N, Depth-3296m), SLD upto 2000m.
1630 SVP-02 completed successfully.
1900 Vessel rejoined in line-08 and continued for MBES survey.
2340 End of line-08 (89°24.5'E, 11°17.006'N)

* System hanged and restarted: 00 time
Vessel position @ 0800 (IST) 24.06.2011; (11°01.71'N, 089°28.77'E)

Date 24.06.2011

0030 Start of line-09 (89°28.77'E, 11°17.006'N)
Continuation of line-09.

* System hanged and restarted: 00 time
Vessel position @ 0800 (IST) 25.06.2011; (08°09.78'N, 089°28.77'E)

Date 25.06.2011

0235 End of line-09 (89°28.77'E, 08°9.8'N)
0426 Start of line-10 (89°34.177'E, 07°56'N)

* System hanged and restarted: 00 time
Vessel position @ 0800 (IST) 26.06.2011; (11°09.99'N, 089°34.17'E)

Date 26.06.2011

0319 End of line-10 (89°34.1774'E, 11°17.007'N)
0357 Start of line-11 (89°39.036'E, 11°17.006'N)
1100 SVP-03 was started (89°39.036'E, 10°29.140'N, Depth-3269), SLD upto 2000m.
1218 SVP-03 completed successfully.
1220 Capacitor bank fuses blown off. Replaced the fuses. (89°39.036'E, 10°29.140'N)
1325 System restarted and recording.

* System hanged and restarted: 01 time
Vessel position @ 0800 (IST) 27.06.2011; (09°11.43'N, 089°39.03'E)

Date 27.06.2011

1903 End of line-11 (89°39.036'E, 07°37.210'N)
Vessel heading towards Sediment coring location at (89°41'E, 8°0'N)

* System hanged and restarted: 01 time
Vessel position @ 0800 (IST) 28.06.2011; (08°0'N, 089°41'E)

Date 28.06.2011

0000 Vessel reached for sediment coring & SVP (89°41'E & 8°0'N, Depth -3613m).
0026 Sediment coring was started.
0235 Sediment coring was completed with successful acquisition of 1.8m sediment core.
0253 SVP 04 started.
0400 SVP 04 completed successfully (SLD up to 2000m).
0530 Start of line-12 (89°39.036'E, 07°37.210'N)
* System hanged and restarted: 01 time
Vessel position @ 0800 (IST) 29.06.2011; (11°15.72'N, 089°43.99'E)

Date 29.06.2011

0210 End of line-12 (89°44.00'E, 11°17.006'N)
Vessel heading towards Sediment Coring location at 89°34.1774'E, 11°17.006'N, Depth -3187m
0440 Sediment coring was started
0630 Sediment coring was completed with successful acquisition of 2.4m sediment core
0645 SVP-05 started (89°34.1774'E, 11°17.006'N, Depth -3187m)
0805 SVP-05 completed successfully (SLD up to 2000m)
Vessel proceeding to next SVP Station at 89°24.5'E, 11°17.006'N, Depth-3206
1010 SVP-06 started
1135 SVP-06 completed successfully (SLD up to 2000m)
Vessel proceeding to next SVP Station at 89°13.6377'E, 11°17.006'N, Depth-3221
1354 SVP-07 started
1505 SVP-07 completed successfully (SLD up to 2000m)
Vessel position @ 0800 (IST) 30.06.2011; (12°16.77'N, 090°42.77'E)

Date 30.06.2011

1618 Vessel reached at Survey area-02
1640 SVP-08 started at (92°30.483', 13°29.073' Depth 570m)
1700 SVP-08 completed successfully (SLD up to 500m)
1712 Start of line-13 (92°30.483', 13°29.073')
2142 End of line-13 (92°57.82', 13°54.23')
2152 Start of line-14 (92°57.250', 13°54.668')
Vessel position @ 0800 (IST) 01.07.2011; (13°31.29'N, 092°32.27'E)

Date 01.07.2011

0302 End of line-14 (92°29.913', 13°29.073')
0314 Start of line-15 (92°29.343', 13°29.073')
0756 End of line-15 (92°56.680', 13°55.073')
0900 SVP-09 started at 92°56.080', 13°55.798' (Depth 638m)
0930 SVP-09 completed successfully (SLD up to 500m)
1030 Start of line-16 (92°56.080', 13°55.798')
1557 End of line-16 (92°28.773', 13°29.073')
1603 Start of line-17 (92°28.203', 13°29.073')
2100 End of line-17 (92°55.530', 13°56.177,)
2111 Start of line-18 (92°54.980', 13°56.528')
Vessel position @ 0800 (IST) 02.07.2011; (13°30.19'N, 092°28.22'E)

Date 02.07.2011

0210 End of line-18 (92°29.913', 13°29.073')
0218 Start of line-19 (92°29.343', 13°29.073')
0711 End of line-19 (92°56.680', 13°55.073')
0728 Start of line-20 (92°56.080', 13°55.798')
1230 End of line-20 (92°28.773', 13°29.073')
1243 Start of line-21 (92°28.203', 13°29.073')
1743 End of line-21 (92°55.530', 13°56.177,)
1750 Start of line-22 (92°54.980', 13°56.528')
2319 End of line-22 (92°55.530', 13°56.177,)
2330 Start of line-23 (92°54.980', 13°56.528')

Students were asked to prepare the report on "Onboard-SK scientific instruments"
Vessel position @ 0800 (IST) 03.07.2011; (13°46.97'N, 092°41.27'E)

Date 03.07.2011

0400 End of line-23 (92°25.423', 13°29.073)
0445 Start of line-24 (92°24.823', 13°29.073
1000 End of line-24 (92°51.850', 13°58.497)
1017 Start of line-25 (92°51.190', 13°58.935)
1524 End of line-25 (92°24.223', 13°29.073)
1540 Start of line-26 (92°23.423', 13°29.073)
2127 End of line-26 (92°50.390', 13°59.374)
2134 Start of line-27 (92°48.790', 14°0.200)
Vessel position @ 0800 (IST) 04.07.2011; (13°59.56'N, 092°45.89'E)

Date 04.07.2011

0251 End of line-27 (92°19.723', 13°29.073')
0303 Start of line-28 (92°18.473', 13°29.073')
1015 End of line-28 (92°45.44', 14°2.974')
1050 SVP-10 started (92°44.14', 14°4.382' Depth 1320m)
1140 SVP-10 completed successfully (SLD up to 1000m)
1148 Start of line-29 (92°44.14', 14°4.382')
1731 End of line-29 (92°17.173', 13°29.073')
1813 Start of line-30 (92°15.823', 13°29.073')
Vessel position @ 0800 (IST) 05.07.2011; (13°36'45"N, 092°21'28"E)

Date 05.07.2011

0058 End of line-30 (92°45.44', 14°2.974')
0112 Start of line-31 (92°44.14', 14°4.382')
0706 End of line-31 (92°17.173', 13°29.073')
0751 Start of line-32 (92°15.823', 13°29.073')
1410 End of line-32 (92°42.79', 14°5.731')
1433 Start of line-33 (92°40.79', 14°6.411')
2058 End of line-33 (92°13.823', 13°29.073')
2125 Start of line-34 (92°11.823', 13°29.073')
Vessel position @ 0800 (IST) 06.07.2011; (13°40.04'N, 092°17.23'E)

Date 06.07.2011

0450 End of line-34 (92°34.59', 14°9.89)
0530 Start of line-35 (92°29.89', 14°13.337)
1200 End of line-35 (92°2.923', 13°29.073)
1205 SVP-11 started (92°2.923', 13°29.073, Depth 1980m)
1325 SVP-11 completed successfully (SLD up to 1000m)
1417 Start of line-36 (91°59.423', 13°29.073)
2357 End of line-36 (92°26.39', 14°15.5)
Vessel position @ 0800 (IST) 07.07.2011; (13°41.74'N, 092°06.77'E)

Date 07.07.2011

0033 Start of line-37 (91°59'49'', 13°28'46'')
0719 End of line-37 (92°26'14'', 14°15'16'')
0754 Start of line-38 (92°23'35'', 14°18'02'')
1634 End of line-38 (91°55'36'', 13°29'02'')
1725 SVP-12 started (91°51'45'', 13°29'05'', Depth-3029m)
1800 SVP-12 completed successfully (SLD up to 1000m)
Vessel position @ 0800 (IST) 08.07.2011; (13°46.33'N, 091°55.75'E)

Date 08.07.2011

1820 Start of line-39 (91°51'52''E, 13°29'08''N)

1930 Capacitor bank fuses were blown off. The fuses were replaced.

0030 Operating System (windows) was not booting up. The problem was rectified and the MB dataset was transferred safely to the PP system.

0030 The MB survey was stopped in the line-39 and the vessel was planned to divert towards 4th coring location (14°40'N, 91°40'E) due to time limitation.

0800 Sediment coring was started (14°40'N, 91°40'E, depth -2703m)

1230 Sediment coring was completed with successful acquisition of 3m sediment core

Vessel is heading towards the Chennai Seaport to reach on 13th July 2011

Vessel position @ 0800 (IST) 09.07.2011; (14°23.71'N, 089°40.30'E)

Date 09.07.2011

Students submitted their final onboard report.

Vessel is heading towards the Chennai Seaport to reach on 13th July 2011.

Vessel position @ 0800 (IST) 10.07.2011; (13°58.39'N, 086°37.28'E)

Date 10.07.2011

Vessel is heading towards the Chennai Seaport.

Vessel position @ 0800 (IST) 11.07.2011; (13°36.84'N, 084°02.33'E)

Date 11th-12th July 2011

Vessel is heading towards the Chennai Seaport.

ETA-13TH JULY 2011 0400 am.

Vessel position @ 0800 (IST) 12.07.2011; (13°18.51'N, 081°57.71'E)

9.0 Issues related to Multibeam data acquisition.

i) The multibeam system failed eleven times during data acquisition and the vessel was forced to turn back to re-occupy the survey line.

ii) When the vessel sailed out from Chennai, the MB system was pinging and SSV sensor was working well indicating yellow color of SSV sensor icon in Hydrostar software. However on 16th June 2011, the sensor was not working indicating grey color of SSV sensor icon in Hydrostar software. The cables and connectors were checked thoroughly and the sensor was cleaned. However the sensor was not getting on through out the survey period. This problem was communicated to OEM. Since SSV data is essential for multibeam bathymetry, the SSV from SVP profiles were given input during multibeam data acquisition. It was observed that the SSV values were not varying much in space and time strictly during the survey area and survey period. So the survey was continued by adopting the same process.

iii) The beams and depth values became zero several times while data acquisition. It was observed that the capacitor bank fuses were blowing off. In addition the workstation was not booting once and indicated a blank screen. This problem was taken care in the process and the fuses were replaced to enable the data acquisition.

10.0 Acknowledgements

The Chief Scientist and participants of SK-286 place on record their deep sense of gratitude to Director, National Centre for Antarctic and Ocean Research, for assigning responsibilities to take over the EEZ survey cruise. Team is thankful to Dr. Anil Kumar, Dr. John Kurian and Mr. M. M. Subramaniam for their support for the success of SK-286 cruise. The Scientific team also wishes to thank the Master and crew of the vessel for their co-operation during the cruise. The co-operation and support rendered by personnel of NORINCO is appreciated.

राष्ट्रीय अंटार्कटिक एवं समुद्री अनुसंधान केन्द्र
NATIONAL CENTRE FOR ANTARCTIC & OCEAN RESEARCH
पृथ्वी विज्ञान मंत्रालय(भारत सरकार)
MINISTRY OF EARTH SCIENCES (Govt. of India)
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HEADLAND SADA, VASCO-DA-GAMA, GOA - 403 804

No: NCAOR/OSSG/SK/66

9th June 2011

OFFICE MEMORANDUM

Sub: ORV Sagar Kanya Cruise SK-286

Director, NCAOR has been pleased to approve the following schedules and participants for ORV Sagar Kanya Cruise SK-286 for EEZ survey programme in Bay of Bengal.

PARTICIPANTS:

NCAOR, Goa

- | | |
|-------------------------|--|
| 1. Dr. Babula Jera | Research Scientist C — Chief Scientist |
| 2. Shri Bibin Abraham | Shipboard Ass start |
| 3. Shri Pavar Shirdekar | Project Technical Assistant |

CUSAT, Cochin

- | | |
|----------------------------------|----------------|
| 4. Shri Muhammad Shafeeq Basheer | M. Sc. Student |
| 5. Shri Devarthedi Nascem | do |
| 6. Shri Bijesh C. Moothoor | do |
| 7. Shri Ajish Pranayam Saji | do |
| 8. Shri Sarunlal M. Arandal | do |

Andhra University, Hyderabad *V. Sakthipriyam.*

- | | |
|---------------------|----------------|
| 9. Shri K. Socranna | Project Fellow |
|---------------------|----------------|

M/s Norineo Pvt. Ltd. (AMC)

- | | |
|-------------------------------|--------------|
| 10. Shri Kalasadan Madhusudan | AMC Engineer |
| 11. Shri Palaniswamy Boopathy | do |
| 12. Sri Thangaraj Ramesh | do |
| 13. Sri Francis Berlin Leo | do |

Standby AMC Engineers:

1. Shri Bija V. Neir
2. Shri Rajapandian Karthickraja
3. Shri Elavarasar Vasantharaja
4. Shri J. Viswanathan

Contd....2

Cruise Itinerary:

ETD: 13.06.2011: Chennai

ETA: 13.07.2011: Chennai

1. Any change in the participants/itinerary is to be duly approved expressly by Director, NCAOR.
2. Chief Scientist is to ensure that the laboratories are handed over in tidy condition on completion of cruise.
3. All participants are required to get a medical check-up done by DG approved doctor and submit certificate of fitness to Master, Sagar Kanya on embarkation.

Asst. Scientist
09/06/2011
Programme Manager
ORV Sagar Kanya

Copy to:

1. All participants through Chief Scientist.
2. Master, ORV Sagar Kanya.
3. PA to Director, NCAOR, Goa.
4. Dr. John Kurian P., Scientist 'D' NCAOR, Goa.
5. Dr. M. Sudhakar, Scientist 'G' & Advisor, Ministry of Earth Sciences, Mahasagar Bhavan, Block No. 12, CGO Complex, Lodhi Road, New Delhi – 110 003. (Fax No. 011-24360336).
6. The Shipping Corporation of India Ltd., Shipping House , 13th Floor, 245, Madame Cama Road, Mumbai – 400 021 (K/Attn.: Shri. G.S.Balla, Sr. Vice President). (Fax No. 022-22823531).
7. M/s Norinco Pvt. Ltd., D3/19 Sancoale Industrial Estate, Zuari Nagar, Goa-403 726 (K/Attn.: Shri V.S. Rajaraman, General Manager) (Fax No. 044 24742203).
8. M/s Joanes P. & Co., CU-3, Suvidha Complex, Opp. Tilak Maidan, Vasco-da-Gama Goa-403 802 (K/Attn. Mr. Glorio Fernandes, Partner) (Fax No. 2500465).
