

**ORV SAGAR KANYA**  
**CRUISE 237A**  
(18 to 23 August 2007)

**NATIONAL INSTITUTE OF**  
**OCEANOGRAPHY**  
(Council of Scientific and Industrial Research)  
Dona Paula, Goa 403004

**REPORT ON CRUISE 237A OF ORV SAGAR KANYA**

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## 1.0 Introduction

About 25% of India's population resides in the coastal zone. The activities of these people vary from traditional fishing to high-tech oil and gas exploration in the 2 million sq. km. of Indian EEZ. These communities, irrespective of their level of technology, would like to know 'how it is going to be out there when they are at sea'. Providing such information to this heterogeneous community demands the existence of a coastal environmental prediction system that would routinely provide forecasts on 'how it is going to be out there when they are at sea'. Such a forecast system requires a mathematical model (or, more correctly, a modelling system) that mimics the actual conditions at sea on a day-to-day basis. As a pre-condition, such a model should first mimic the observed currents, waves, etc. During the XIth plan, the CSIR funded project 'Observing and modelling the interaction between Indian Ocean, atmosphere and coastal seas (OMICS)' proposes at developing the science that will lead to a coastal ocean forecasting system on day-to-day basis.

The last decade has seen the emergence of a theoretical framework that explains the observations (mostly hydro graphic) along the Indian coast on the seasonal time scale. Given the wind forcing, which is now available from scatterometers, this framework, built on the basis of observations that needed to be explained, now allows us to 'predict' (say) the monthly-mean sea level off the Indian coast. Similarly, two-dimensional tidal models have been used successfully to make predictions of tides along the Indian coast and to decipher processes that lead to tidal amplification in some coastal regions.

An examination of the meagre current-meter data along the Indian coast, however, reveals much more than the seasonal cycle that much of present-day observations show and theories explain. These data are available for short durations, but they reveal that there is considerable energy in the currents at time periods varying from a few days to a few weeks. The short duration of these time-series measurements and the sporadic nature of the observations make it impossible to draw many inferences. What causes this variability? The observations available also show that these sub-tidal signals, which are forced by the winds, propagate into the estuaries, affecting sea level there. What are the implications for the chemistry and biology of the estuaries? Biogeochemical data from the continental shelf suggest that 'something is happening along the Indian coast' on such time scales, but these observations (and their implications to, say, fisheries) are not explicable owing to the absence of a concrete science underlying the variability of the physical system at these frequencies; extension to biochemistry can only follow successful modelling of the physics.

At present, we do not have sufficient data to document the changes at these intra-seasonal frequencies along the Indian coast. Absence of data leads to absence of hypotheses, which, in turn, implies that we do not have the means today to make predictions of 'the conditions at sea' on a day-to-day basis. Building such a prediction system requires two things: a system for making relevant observations

and the science that generalises these observations to yield theories (science) that enables predictions.

Building the science underlying a prediction system for the Indian coastal ocean is the objective of NIO's supra project. As stated above, this will involve making observations in the coastal seas around India and these observations will then have to be simulated using numerical models.

This cruise, SK-237A, is the part of a series of cruises to be conducted to carry out extensive observations in the coastal waters of India. This cruise was organized to retrieve and re-deploy the Acoustic Doppler Current Profiler (ADCP) moorings off Goa - one at the shelf region and the other at slope region. The vessel, ORV *Sagar Kanya*, sailed from Karwar on 18 August 2007 and was back in Kochi on 23 August 2007. The weather was tolerable though it turned bad, at times, with lots of rains and strong winds.

## 2.0 CRUISE TRACK

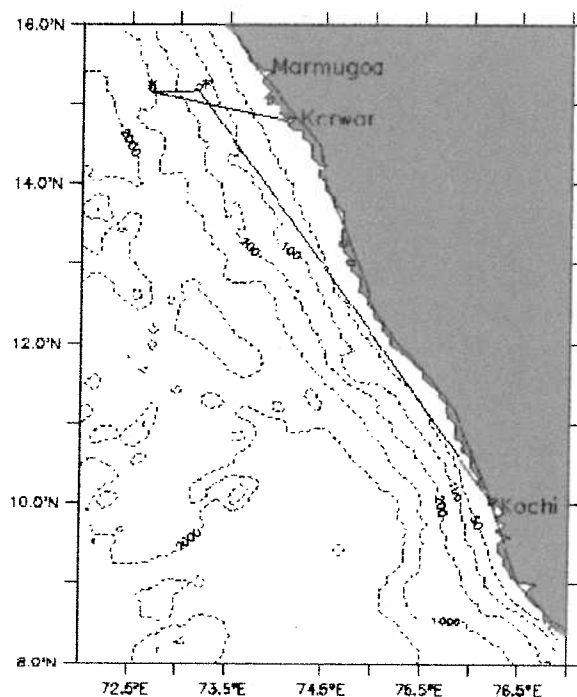


Figure 1. The final cruise track of SK-237A. The cruise started at Karwar and ended at Kochi. The mooring locations are indicated. The blue circles indicate the location of mooring deployed during this cruise. The red stars indicate the locations of previous moorings. The mooring at slope region (~ 1000 m) was recovered but the mooring on the shelf (~ 100 m depth) was non-recoverable.

### 3.0 ITINERARY

Departure: Karwar, 18 August 2007

Arrival: Kochi, 23 August 2007

### 4.0 PARTICIPANTS

#### 4.1 Scientific component

1. Dr. S.S.C. Shenoi, Chief Scientist NIO
2. Shri. V. Fernando -do-
3. Shri. A.M. Almeida -do-
4. Shri. D. Sundar -do-
5. Dr. M. Aparna -do-
6. Miss. T. Thejna -do-
7. Shri. K. Madhusudan NORINCO
8. Shri. J. Viswanathan -do-
9. Shri. T. Baiju -do-
10. Shri. N. Dhanasekharan -do-
11. Shri. Hafeezur Rahman -do-
12. Shri. Mukund B. Chavan NCAOR
13. Shri. Anilkumar Patel -do-

#### 4.2 Ship's complement

1. Capt. K.S.Pandian Master
2. Devendra Kumar Ch. Offr.
3. Pratap Purushottam Patkar 2/Officer
4. Dr. Bhavini R. Mistry M/Officer
5. Stephen A. Coutinho Rd/Offr.
6. Pandurang C. More Purser
7. Pritish R. Bandyopadhyay Ch. E/Offr
8. Saktidas Chakrabarti 2/E/Offr.
9. Sanjay H. Churi 3/E/Offr.
10. Durga Sankar Das 4/E/Offr.
11. George Mathew E/Engr
12. Francis S. Lobo CTO
13. Anthony A. Silveira A/CTO
14. Syed B. Hussain P.O.Mt.
15. Chhote Lal Dass P.O.Mt.
16. T.N. Sasidharan ERPOI
17. Manji Jadav Baria Electrician
18. Kirtikumar Kanjibhai Rawal D/Serang
19. Vasant Balram Kadam S/H'Man
20. Rapik Fakir G.H. Dave S/H'Man
21. Kumar Kabir Dheerendra S/H'Man
22. Mansoor Hussain Sheikh S/H'Man
23. Dahyabhai Khalasi S/H'Man

|                               |          |
|-------------------------------|----------|
| 24. Hiralal D.Tandel          | S/H'Man  |
| 25. Hrusikesh Rout            | SM-2     |
| 26. Dineshkumar D.Tandel      | Dk/U/Hd  |
| 27. Murugavel Gandhi          | Cr.Cook  |
| 28. Rashid Kasim Kurupkar     | ER/SRG   |
| 29. Sheik M. A.Hameed         | D/Grsr.  |
| 30. Akashkumar Vishwakarma    | D/Grsr.  |
| 31. Nanubhai M.Marolia        | D/Grsr   |
| 32. Kan Sakar Kapadia         | D/Grsr.  |
| 33. Ramesh Palaka             | ERRII    |
| 34. Bamifacio M. V. C.Dacosta | C/C/Bkr. |
| 35. AfansoJose Casimiro       | 2nd cook |
| 36. John Maria Jose           | 2nd cook |
| 37. Ahmed Ateeq               | 3/cook   |
| 38. Alvito S.P.Rodrigues      | G.Stwd   |
| 39. Kalpeshbhai T. Tandel     | G/Stwd.  |
| 40. Roni Kumar M. Tandel      | G/Stwd.  |
| 41. Nolaso J. Monteiro        | G.Stwd   |
| 42. Usman Mohmood             | G.Stwd   |
| 43. Burondkar I. Mohamood     | G/Stwd.  |
| 44. Mahesh B. Vaity           | U/Stwd.  |
| 45. Vasantlal F.Tandel        | S/U/Hd.  |
| 46. Shameer T. Ibrahim        | S/U/Hd.  |
| 47. Faiz M.                   | L'Man    |

## 5.0 OBJECTIVES

The objective of the cruise was collection of long-term data on currents in the upper water column of seas around India through moored instruments.

## 6.0 WORK ACCOMPLISHED

The cruise was planned to retrieve and re-deploy the moorings at 15° 08.96' N; 72° 42.65' E and at 15° 09.38' N; 73° 15.75' E and, if possible, to deploy a third mooring at 15° 42 min and 72° 30'.

The mooring at 15° 08.96' N; 72° 42.65' E located at the slope region (~ 1144 m) consisted of one 75 khz ADCP and one Aanderra self recording current meter. The ADCP was mounted on an elliptical buoy of ~ 1.2 m diameter. Duel acoustic releases (make XEL) were also attached. See Figure 2 for mooring configuration. The mooring was released at 06:00 hours on 19 August 2007. The floated mooring was sighted at 06:10 hrs. The retrieval operation, using the jibbom and Atlas crane fixed at the middle of the ship, was started at 06:15 hrs and completed at 08:00 hrs. The mooring was retrieved in good condition with no damage to the components and mooring wire.

IXSEA

DUAL

After downloading the data and servicing the ADCP, the mooring was re-deployed at same location ( $15^{\circ} 08.820' N$ ;  $72^{\circ} 42.574' E$ ). The ADCP batteries were replaced with new packs. The existing acoustic releases were replaced with two new releases. Two current meters were also attached, one near the bottom (1126 m) for the measurement of bottom currents and another  $\sim 25$  m below the ADCP. See Figure 3 for mooring configuration. The ADCP was positioned at a nominal depth of 414 m. The deployment operation started at 16:00 hrs ended at 18:00 hrs.

Three CTD casts were also taken at this location using a SBE portable CTD to record the temperature-salinity structure (up to  $\sim 900$  m).

The mooring at  $15^{\circ} 09.38' N$ ;  $73^{\circ} 15.75' E$  located on the shelf ( $\sim 90$  m) was a bottom mounted mooring (Figure 4). The 300 khz ADCP was mounted on a Trawl Resistant Bottom Mount (TRBM) frame. This arrangement keeps the ADCP, acoustic release and the floatation buoy inside the TRBM such a way that the whole assembly is resistant to the trawling nets. On the release of acoustic release, the floatation buoy and the ADCP are expected to float on the surface to facilitate retrieval. The mooring will not drift away after the surfacing of floatation buoy because it is still attached to the anchor weight at the bottom through wire *synthetic* rope.

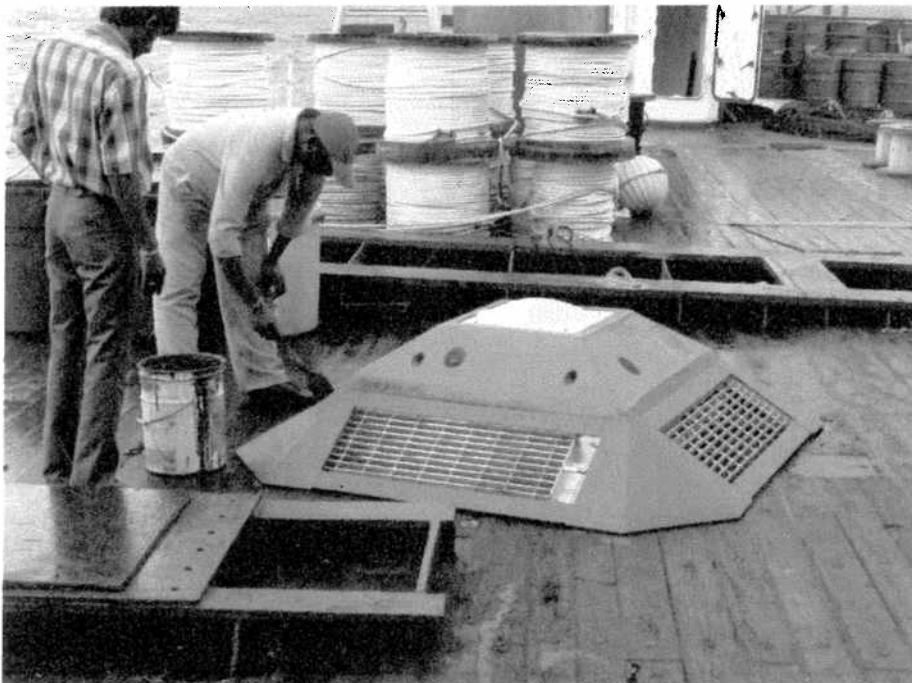


Figure 4. The ADCP, acoustic release and floatation buoy mounted on a TRBM frame.

7

$15^{\circ} 09.378' N$   
 $73^{\circ} 15.7508' E$

After the interrogation of acoustic release for range checks etc, the release command was issued at 0630 hrs on 20 August when the ship was positioned ~ 200 m away from the mooring location. Unfortunately, the mooring (the buoy carrying ADCP and acoustic release) did not surface. A thorough search of the area and the interrogations with the acoustic release confirmed that the floatation unit has some trouble in getting dislodged though the acoustic release. The search operations continued again on 21 August till 1300 hrs including the efforts to dislodge the mooring assembly from the bottom by dragging a make shift 'dredge like gadget' over the location several times. All efforts proved to be futile and the mooring remained unrecoverable.

Due to the non-recovery of the shallow mooring another mooring was assembled using the spare 300 khz ADCP (Sr. No. 9183) and ~ 1.2 m diameter elliptical floatation buoy. The mooring assembly is shown in Figure 5. Deployed that mooring at 15° 09.936' N; 73° 11.446' E. The depth of water column at the location is 103 m. The expected depth of ADCP is 93.2 m. The deployment was completed at 1625 hrs.

Two CTD casts were also taken at this location using a SBE portable CTD to record the temperature-salinity structure (up to ~ 85 m).

## **7.0 PERFORMANCE OF THE EQUIPMENT USED**

The following equipments were used during the cruise. All of them worked satisfactorily.

1. Deep-sea echo sounder
2. SBE portable CTD (lowered using the mainframe CTD frame).

The Atlas crane fixed in the mid-ship, jibboom, A-frame and the deep-sea winch all worked satisfactorily.

## **8.0 PERFORMANCE OF THE SHIP**

The performance of the ship on the whole was satisfactory. Specifically, the navigational aids of the ship and the abilities the officers. The air conditioners in accommodation and laboratories worked satisfactorily.

## **9.0 CONCLUSIONS**

The objectives of the cruise were accomplished partially only because of the non-recovery of the mooring deployed on the shelf region. Except for that unfortunate happening all other planned work was accomplished.



Perhaps, the bottom mounted mooring using TRBM in the shelf region of India may have be re-examined in the light of possible sediment deposition and biological growth that can hamper the working of such mooring assembly.

## **10.0 RECOMMENDATIONS**

- A virus free PC in the Chief Scientist cabin will be useful.

## **11.0 ACKNOWLEDGEMENTS**

The chief scientist and participants of cruise SK-237A place on record their deep sense of gratitude to Director, National Centre for Antarctic and Ocean Research, Goa for making available ORV Sagar Kanya for the retrieval and re-deployment of moorings.

Dr. M. Sudhakar, Group Director, OSSG, NCAOR, Goa and his team managing Sagar Kanya were always ready to help, and we thank them for their help in organizing this cruise. Specifically, Dr. Sudhakar's effort in finding a slot for this short cruise is gratefully acknowledged.

The mooring operations are tough and skillful. The successful conduct of mooring operations is a tribute to the vessel and to the officers and crew on board. The support received during the operations from the Master and his officers on the bridge, the CEO and his officers in the engine room, and the crew on the deck is gratefully acknowledged.

The NORINCO personnel were always there to help with the operations. They not only participated in the mooring operations, but also helped with CTD casts and search operation of non-recovered mooring. Their help is gratefully acknowledged.

**NATIONAL INSTITUTE OF OCEANOGRAPHY, GOA.  
SUPRA Pilot Mooring**

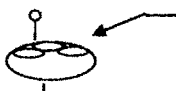
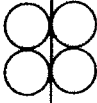

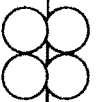
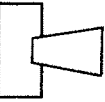

Cruise No : SK 237-a  
Mooring Design: *Fernando .V*

**Mooring System Information**

Mooring- I.D: OGD1.1  
**Recovery**  
SeaState: 2

**Anchor Drop:**  
15° 08 .969' N  
72° 42. 657' E

Deployment Date: 26-05-06  
Recovery Date: 19-08-07

|        |        | Mooring Diagram   | Description<br>Subsurface  | Remarks        | Deploy<br>Time IN<br>IST |
|--------|--------|---|--|----------------|--------------------------|
| m.a.b. | m.b.s. |   |  |                |                          |
|        |        | <u>Below Sea</u>  |  |                |                          |
| 687    | 458    |    | Ellip Float ( rdi ADCP 75 KHz)<br>CH 160.725(62)<br>1.3 m Chain 1/2" Chain | Novatech combo | 06:45                    |
| 684    | 461    |    | Dual Benthos<br>Glass floats   |                | 06:51                    |
|        |        |   | 1m chain   |                | 07:05                    |
|        |        |   | 20 m Nylon / WR  |                | 07:07                    |
|        |        |   | 500m Wire  |                | 07:45                    |
|        |        |  | 100m wire  |                | 07:50                    |
| 58     | 1087   |  | Dual benthos<br>Glass floats   |                | 08:07                    |
|        |        |   | 25m wire   |                | 08:08                    |
| 27     | 1118   |  | <b>current meter #1</b><br>ID # 1312 -RCM 9w                               |                |                          |
|        |        |   | 2.5m chain   |                |                          |
| 23     | 1122   |  | IXEA release # 502<br>and #503- orshk                                      |                |                          |

*Figure 2*

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SUPRA Pilot Mooring**

Cruise No : SK 237-a  
Mooring Design: *Fernando .V*

**Mooring System Information**

|                      |                     |                           |
|----------------------|---------------------|---------------------------|
| Mooring- I.D: OGD1.2 | <b>Anchor Drop:</b> | Deployment Date: 19-08-07 |
| <b>Deployment</b>    | 15° 08 .820' N      | Recovery Date: 19-08-07   |
|                      | 72° 42. 574' E      |                           |

SeaState: 2

| m.a.b. | m.b.s. | Mooring Diagram  | Description<br>Subsurface  | Remarks                                 | Deploy                        |
|--------|--------|------------------|--|---|-------------------------------|
|        |        |                  |  |   | Time out<br>IST               |
|        |        | <b>Below Sea</b> |  |   |                               |
| 741    | 414    |                  | Ellip Float ( rdi ADCP 75 KH<br>CH 160.725(62)                                   | 8m bin SD 1.59<br>Novatech combo<br>1.1 | 16:22                         |
| 737    | 418    |                  | Dual Benthos<br>Glass floats   |   | 16:23                         |
|        |        |                  | 1m chain<br>20 m Nylon / WR  |   |                               |
|        |        |                  | Current meter #1<br>ID # 1394 -RCM 9iw   |   | 16:26                         |
|        |        |                  | 125m wire  |   | 16:30                         |
|        |        |                  | 500M Wire  |   | 16:45<br>to 17:05             |
| 85     | 1070   |                  | Dual benthos<br>Glass floats   |   | 17:25                         |
|        |        |                  | 50m wire   |   | 17:30<br>wait for<br>position |
| 29     | 1126   |                  | 4 LL 1/2" Chain<br><b>current meter #2</b><br>ID# 1395 RCM9iw<br>4 LL 1/2" Chain |   | 17:50                         |
| 25     | 1130   |                  | 2.5m chain<br><br>IXEA release # 747<br>and #748<br>1M u 1/2" CHAIN              |   | 17:52                         |
|        |        |                  | 20m nylon  |   |                               |
|        | 1155   |                  | Anchor 9 x 100Kg.  |   | 17:54                         |

Slant range: 1184m

Radio signal  
Submerged 17:55

Figure 3

**NATIONAL INSTITUTE OF OCEANOGRAPHY, GOA.  
SUPRA Pilot Mooring**

Cruise No : SK 237-a  
Mooring Design: *Fernando V*

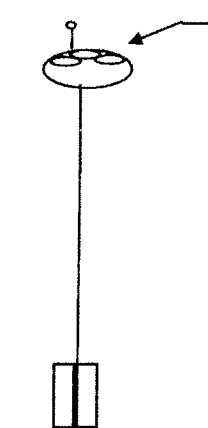

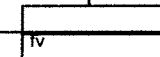
**Mooring System Information**

Mooring- I.D: OGS-1.2  
**Deployment**

**Anchor Drop:**  
15° 09 .936' N  
73° 11 .446' E

Deployment Date: 21-08-07  
Recovery Date:

SeaState: 2

| Mooring Diagram  |        | Description   | Remarks                   | Deploy Time out |
|------------------|--------|---|---------------------------|-----------------|
| m.a.b.           | m.b.s. | Subsurface  |                           | ISf             |
| Below Sea        |        |   |                           |                 |
| 9.8              | 93.2   |  <p>Ellip Float ( rdi ADCP 300KHz)<br/>CH 160.725(62)</p> <p>3m LLchain</p> | Novatech combo            | 16:12           |
| 4                | 99     |  <p>IXEA release # 502<br/>and #503</p>                                    | 152b<br>152c              | 16:10           |
|                  | 103    |  <p>Anchor 5 x 100Kg.</p>  |                           | 16:06           |
| Slant range: 110 |        |   | Radio signal<br>Submerged | 16:06           |

*Figure 5*

NATIONAL INSTITUTE OF OCEANOGRAPHY; GOA - INDIA  
(Supra Pilot Mooring)

CRUISE NO: **SK-237a**

RECOVERY DATE: 19.08.07

**MOORING SYSTEM INFORMATION**

Mooring I.D# OGD\_1.1

**RECOVERY**

---

|                          |   |
|--------------------------|---|
| Captain                  | K.S.Pandian   |
| Chief Scientist          | Satheesh Sheno                                      |
| First Mate               | Devendra Kumar                                      |
| Bosun                    | Kirtikumar Rawal                                    |
| Mooring Master           | Fernando Vijayan                                    |
| Scientific Hands         | Almeida, Yogesh, Sundar,<br>Pednekar, Aparna.       |
| Crane operations         | Kumar Kabir   |
| Norinco                  | Madhu, Visvanathan, Baiju,<br>Raheman, Dhanasekaran |
| Weather Condition        | Sea state 2,  |
| Water Depth              | 1145m   |
| Release Model            | IXEA AR 861 CS                                      |
| ARM Code                 | (#502) – 152B (#503) – 152C                         |
| Release Code             | Arm+1555  |
| Telemetry                | Arm+1549  |
| Battery Voltage          | #502=9.7 V, #503=11V                                |
| Mooring Top, Description | Ellipsoid Float (with 75Khz ADCP)                   |
| Radio Frequency          | 160.725 Mhz, Channel 62                             |
| Strobe Flash             | Novatech Combo                                      |
| Release                  | Yogesh.   |
| Slant range              | 1140m   |
| ANCHOR DROP              | <b>15° 08.969'N,<br/>72° 42.657'E</b>               |

NATIONAL INSTITUTE OF OCEANOGRAPHY; GOA - INDIA  
(Supra Pilot Mooring)

CRUISE NO: **SK-237a**

DEPLOYMENT DATE: 21.08.07

**MOORING SYSTEM INFORMATION**

Mooring I.D# OGS1.2

**DEPLOYMENT**

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|                                  |                                       |
|----------------------------------|---------------------------------------|
| Captain                          | K.S.Pandian                           |
| Chief Scientist                  | Satheesh Shenoi                       |
| First Mate                       | Devendra Kumar                        |
| Bosun                            | Kirtikumar Rawal                      |
| Mooring Master                   | Fernando Vijayan                      |
| Scientific Hands                 | Almeida, Yogesh, Sundar,<br>Pednekar  |
| Crane operations                 | Kumar Kabir                           |
| Norinco                          | Madhu, Visvanathan,                   |
| Weather Condition                | Sea state 2, Windy                    |
| Water Depth                      | 103m                                  |
| Release Model                    | IXSEA AR 861 CS                       |
| ARM Code                         | (#502) – 152B (#503) – 152C           |
| Release Code                     | Arm+1555                              |
| Diagnostic                       | Arm+1549                              |
| Mooring Top, Description         | Ellipsoid Float (with 300Khz ADCP)    |
| Radio Frequency                  | 160.725 Mhz, Channel 62               |
| Strobe Flash                     | Novatech Combo                        |
| Release Armed                    | Almeida, Yogesh.                      |
| ANCHOR DROP                      | <b>15° 09.936'N,<br/>73° 11.446'E</b> |
| Time: 16:12 hrs.                 |                                       |
| Adcp model: WHS 300, SI.No. 9183 |                                       |