

# ORV - SAGAR KANYA

## CRUISE REPORT

Cruise No. SK - 333

*(22<sup>nd</sup> August – 29<sup>th</sup> September, 2016)*



Submitted by

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## Objectives:

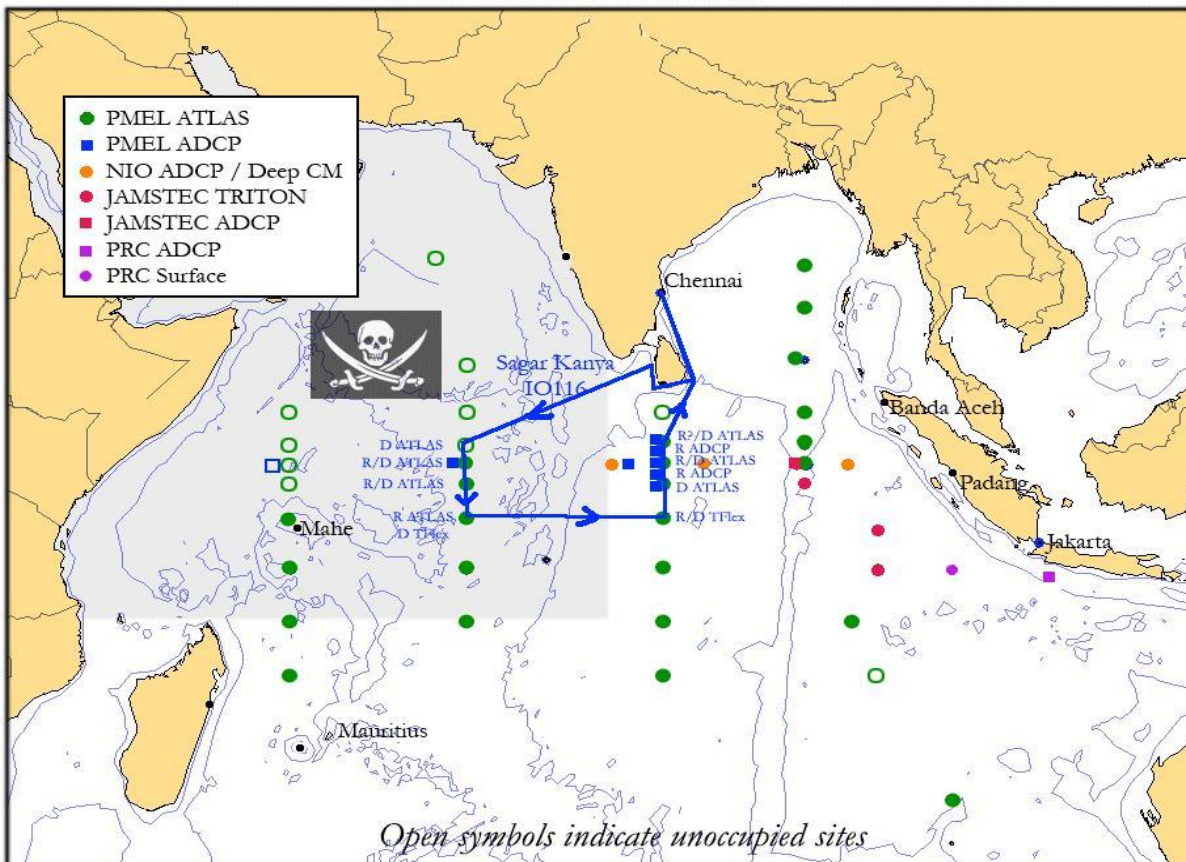
This cruise will be dedicated to the recovery of four and deployment of five deep ocean RAMA moorings, and the recovery of two deep ocean subsurface (Acoustic Doppler Current Profiler) ADCP moorings.

The moorings are a part of the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA). This array is under development as part of a multi-national effort to provide data essential for monitoring, understanding, and predicting basin scale ocean-atmosphere variability such as the Asian monsoon, the Indian Ocean Dipole, and the Madden-Julian Oscillation.

(Conductivity, Temperature and Depth) CTD operations were conducted after every Mooring buoy deployment and retrieval locations.

## Cruise Track:

### IO116 RAMA Cruise



## Scientific Participants SK-333

| Sr. No. | Name of Participants         | Designation                 | Institute | Nationality |
|---------|------------------------------|-----------------------------|-----------|-------------|
| 1.      | Mr. Ashok Kumar              | Chief Scientist             | INCOIS    | India       |
| 2.      | Mr. John Michael Strick      | Dy. Scientist               | NOAA/PMEL | USA         |
| 3.      | Mr. Ryan Christopher Wells   | Scientist                   | NOAA/PMEL | USA         |
| 4.      | Mr. Stephen Alan Smith       | Scientist                   | NOAA/PMEL | USA         |
| 5.      | Mr. Pavan Shirodkar          | Onboard Asst.               | NCAOR     | India       |
| 6.      | Mr. Alok Kumar Sinha         | Jr. Research Fellow         | NCAOR     | India       |
| 7.      | Mr. Bhaskar Kamble           | Project Assistant-Technical | NCAOR     | India       |
| 8.      | Mr. Palanisawamy Boopathy    | Senior Manager              | NORINCO   | India       |
| 9.      | Mr. Rajak Mohamed Ismail     | Assistant Manager           | NORINCO   | India       |
| 10.     | Mr. Ganapathy Mahadevan      | Service Engineer            | NORINCO   | India       |
| 11.     | Mr. Madar Parshuram Durgappa | Service Engineer            | NORINCO   | India       |
| 12.     | Mr. Venkatesan Selvaraj      | Deployment Assistant        | INCOIS    | India       |
| 13.     | Mr. Udhayakumar Raji         | Deployment Assistant        | INCOIS    | India       |
| 14.     | Mr. Subramanian Natesan      | Deployment Assistant        | INCOIS    | India       |
| 15.     | Mr. Nivas Niraimathi         | Deployment Assistant        | INCOIS    | India       |

### Recovery and Deployment of RAMA mooring Buoy:

The Research Moored Array for African Asian Australian Monsoon Analysis and Prediction (RAMA) moored buoy is an international program of Global Ocean Observation System (GOOS). RAMA & ADCP buoys were recovered and redeployed at assigned locations in Equatorial Indian Ocean and Bay of Bengal by MoES/INCOIS & NOAA/PMEL scientists during this cruise.

The recovery operations start with sighting the buoy on Radar or visually. Then the vessel moved close (up to 50-100 m) to the buoy float. Buoy is then released from the anchor weights by sending acoustic pulses to the Acoustic Release unit which connected between the Mooring line and Anchors. After that a small inflatable boat can be used to carry scientists and seaman's, lowered from the ship main deck midships Starboard from main deck. This boat approached to the buoy and all meteorological sensors (wind speed and direction, solar radiation, humidity and air temperature) taken off from the buoy tower. The buoy is then hooked with a rope (working Line ~300m) which is passed to the boat from ship. Finally the buoy was recovered on the main deck using A-frame and Win-tech Electric winch capstan and after recovery of the buoy float, the cable was pulled by winch and all sub-surface sensors were taken off from the mooring cable. Similar procedure followed for recovery of all RAMA buoys during the cruise.

Deployment of RAMA buoy was performed from midships of the ship using ATLAS Crane, before the deployment, the top tower, with all meteorological sensors clamped on it, was fixed on the Buoy. Then a cable Nilspin (Conductive Cable) was connected to the bottom tower of float and subsurface sensors were clamped at defined Depths on the mooring cable. The cable was laid along the Main Deck of the ship towards the ship aft. The RAMA buoy was deployed using the midships ATLAS crane deployed by A-frame from main deck and mooring cable passed over the Hanging Pulley Block connected in the deep sea winch and then by finally pass it Wintech Electrical Winch tech by entangle with 4-5 straps in winch of NOAA heaving capacity ~6 Ton . For Surface Buoy after completing Pay out ~ 600 m of Nilspin cable, the nylon rope was connected to the buoy mooring line for remaining length till up to sea-bed. At the end before connecting Anchors an Acoustic release was connected to the line, followed by the heavy anchor weight. The anchors were dropped from the ship aft by using A-frame and deep see winch capstan. Similar procedure followed for all RAMA buoy deployments.

### **Details of Buoy Retrievals/Deployments:**

| Sr. No. | Mooring Descriptions    | Date        | Mooring Locations |               |
|---------|-------------------------|-------------|-------------------|---------------|
|         |                         |             | Latitude          | Longitude     |
| 1       | RAMA DEPLOYMENT – RA145 | 04-Sep-2016 | 01° 44.87' N      | 066° 43.68' E |
| 2       | RAMA RECOVERY – RA133   | 05-Sep-2016 | 00° 24.50' N      | 067° 00.77' E |
| 3       | RAMA DEPLOYMENT – RA146 | 06-Sep-2016 | 00° 23.36' N      | 067° 02.94' E |
| 4       | RAMA RECOVERY – RA132   | 07-Sep-2016 | 01° 37.35' S      | 066° 49.36' E |
| 5       | RAMA DEPLOYMENT – RA147 | 08-Sep-2016 | 01° 36.77' S      | 066° 47.87' E |
| 6       | RAMA RECOVERY - RA131   | 09-Sep-2016 | 04° 01.46' S      | 067° 13.68' E |
| 7       | RAMA DEPLOYMENT – RT009 | 10-Sep-2016 | 04° 01.29' S      | 067° 13.20' E |
| 8       | RAMA RECOVERY – RA130   | 16-Sep-2016 | 02° 38.27' S      | 081° 58.54' E |
| 9       | RAMA DEPLOYMENT – RA148 | 17-Sep-2016 | 01° 30.44' S      | 080° 29.40' E |
| 10      | ADCP RECOVERY - IO052   | 18-Sep-2016 | 00° 46.03' S      | 080° 30.12' E |
| 11      | RAMA RECOVERY – RA126   | 19-Sep-2016 | 00° 05.24' N      | 080° 35.86' E |
| 12      | RAMA DEPLOYMENT – RA149 | 19-Sep-2016 | 00° 04.65' N      | 080° 33.99' E |
| 13      | ADCP RECOVERY - IO053   | 20-Sep-2016 | 00° 36.91' N      | 080° 27.21' E |

## CTD operations:

Conductivity, Temperature, and Depth (CTD) casts were made up to 700 meters depth at all the locations where RAMA buoys were deployed/recovered.

| Sl.No | Latitude    | Longitude    | Date        | start time (LT) | End time (LT) | Remarks                         |
|-------|-------------|--------------|-------------|-----------------|---------------|---------------------------------|
| 1     | 01° 67.57 N | 066° 69.99 E | 05-Sep-2016 | 03:10           | 05:12         | CTD was lowered upto 700 Meters |
| 2     | 00° 38.94 N | 067° 04.91 E | 06-Sep-2016 | 07:03           | 08:52         | CTD was lowered upto 700 Meters |
| 3     | 01° 61.23 S | 066° 79.51 E | 07-Sep-2016 | 21:40           | 22:45         | CTD was lowered upto 700 Meters |
| 4     | 04° 02.42 S | 067° 22.79 E | 09-Sep-2016 | 20:50           | 22:05         | CTD was lowered upto 700 Meters |
| 5     | 02° 63.77 S | 081° 97.57 E | 16-Sep-2016 | 11:25           | 12:18         | CTD was lowered upto 500 Meters |
| 6     | 01° 51.59 S | 080° 47.90 E | 17-Sep-2016 | 12:03           | 13:07         | CTD was lowered upto 700 Meters |
| 7     | 00° 79.93 S | 080° 49.61 E | 17-Sep-2016 | 19:48           | 20:44         | CTD was lowered upto 700 Meters |
| 8     | 00° 04.90 N | 080° 58.01 E | 19-Sep-2016 | 06:50           | 07:55         | CTD was lowered upto 700 Meters |
| 9     | 01° 51.84 N | 080° 64.91 E | 20-Sep-2016 | 21:26           | 22:03         | CTD was lowered upto 500 Meters |

## Drifter:

| Sl.No | Drifter ID | Latitude   | Longitude    | Date        | Time (GMT) |
|-------|------------|------------|--------------|-------------|------------|
| 1     | 145624     | 03 52.29 N | 071° 03.19 E | 02-Sep-2016 | 06:50      |
| 2     | 145637     | 01 37.08 N | 068° 27.47 E | 03-Sep-2016 | 05:00      |
| 3     | 145636     | 00 03.70 N | 066° 58.71 E | 06-Sep-2016 | 15:10      |
| 4     | 145614     | 03 00.55 S | 067° 01.30 E | 09-Sep-2016 | 19:55      |
| 5     | 145616     | 04 00.30 S | 069° 02.40 E | 10-Sep-2016 | 01:59      |
| 6     | 145608     | 03 54.65 S | 072° 11.01 E | 12-Sep-2016 | 05:52      |
| 7     | 145598     | 03 10.47 S | 074° 44.15 E | 13-Sep-2016 | 10:57      |
| 8     | 145548     | 02 40.95 S | 080° 28.30 E | 15-Sep-2016 | 13:25      |
| 9     | 145559     | 00 05.76 N | 080° 34.31 E | 18-Sep-2016 | 20:53      |
| 10    | 145550     | 03 00.60 N | 080° 29.86 E | 21-Sep-2016 | 12:17      |

## **Dairy of Events**

### **22- Aug -2016, Day 1**

- Scientific team signed on at 16:30 Hrs and accommodation allotted to all of them.
- All scientific equipments from NIOT were loaded prior onboard on 20-Aug- 2016 from 14 trucks.
- PMEL Electrical winch is successfully fitted in main deck with local workshop people.
- All scientific gears were inventoried and verified by PMEL team. All four seamen secure all the cruise material.
- Because of Bunkering and Provision issue sailing is not done.

### **23- Aug -2016, Day 2**

- Bunkering & other provision was carried out aboard.
- @ 12:00 Hrs, we had meeting regarding sailing with ship captain.
- @ 17:30 Pilot onboard and 18:00 Hrs, Vessel sail out from JD3 Chennai port.
- @ 20:00 Hrs, we had meeting regarding email issue with radio officer, because ship email was not working.
- Vessel heading towards Colombo port, Sri Lanka.

### **24- Aug -2016, Day 3**

- @ 20:00 Hrs, we had a small meeting regarding email issue with radio officer, because ship email was not working.
- NOAA scientist with help of seamen's set up the lab facility & instruments on deck and staged the mooring hardware and gears according to the order of operations.
- @ 16:15 Hrs, Safety drills were conducted onboard with scientific team and ship crew members.

### **25- Aug -2016, Day 4**

- @ 11:00 Hrs, we had meeting regarding for operation and plan with ship captain, officers and few crew members and scientific team and Norinco Engineers.
- Assembled one RAMA buoy for our first deployment operation and fixed all met sensor near to first accommodation deck for testing.

- Email service is not working from first day Radio officer, Captain said because of some software issue email is not working, and after reached Colombo they will rectify this issue.

#### **26- Aug -2016, Day 5**

- @ 09:00 Hrs, a small discussion with Norinco engineers regarding bathymetry queries.
- Kept 2 no's RAMA tube to second accommodation deck for testing the met sensors.
- PMEL team and all seamen's are preparing for first RAMA buoy deployment like rope, pulley - A frame, winch power supply, etc.
- ETA to reach Colombo 10:00 Hrs.

#### **27- Aug -2016, Day 6**

- Seamen's are doing paint work on RAMA mooring, which we are going to deploy in this cruise.
- ETA to reach Colombo 10:30 Hrs.

#### **28- Aug -2016, Day 7**

- Assembled one more RAMA buoy for our deployment operation and fixed all met sensor near to first accommodation deck for testing.
- ETA to reach Colombo 09:30 Hrs.

#### **29- Aug -2016, Day 8**

- @ 09:12 Hrs, ship reached at near to Colombo port (60 miles distance from Colombo port to Sagar Kanya ship).
- SCI (Shipping Corporation of India) sent a CD to Colombo port agent, Agent came to ship and handover to captain.
- @ 14:30 Hrs, 2 no's PMEL team persons sign on, 16:00 Hrs Bunkering has done, starts 10:00 Hrs.
- Provisional work also completed at 15:30 Hrs.
- Vessel proceeds to first RAMA buoy deployment location.

#### **30- Aug -2016, Day 9**

- Ship email is not working at chief scientist room, but in radio officer room email is working so we are sending email from radio officer room.
- Current meter we tested/configure and kept to second deck for testing, it is working fine or not.

- Once again we cross check, all the buoy secure or not which we kept to transmission test.
- Approx. ETA is 04<sup>th</sup> Sep-2016, 05:30 Hrs, for first location.

### **31- Aug -2016, Day 10**

- Sent an email to INCOIS OSF team regarding ocean forecast.
- A small meeting happened with NORINCO, PMEL team regarding Bathymetry survey, which we will do before our first RAMA buoy deployment.
- Approx. ETA is 04<sup>th</sup> Sep-2016, 05:30 Hrs, for first location.

### **01- Sep -2016, Day 11**

- A small meeting happened with captain, PMEL team and chief officer regarding small boat trial.
- @ 09:35 Hrs, small boat lowered in the sea with three persons (2-PMEL, 1-Seamen) for testing the small boat 09:50 Hrs, boat onboard.
- @ 16:00 Hrs, we had meeting regarding for operation and plan with ship captain, officers and few crew members and scientific team and Norinco Engineers.
- Approx. ETA is 04<sup>th</sup> Sep-2016, 05:00 Hrs, for first location.

### **02- Sep -2016, Day 12**

- Testing of RAMA mooring sensors and doing data testing, checking coming right or not from sensors.
- Testing, checking of Acoustic release and deck unit before deployment of Acoustic release.
- Approx. ETA is 04<sup>th</sup> Sep-2016, 15:30 Hrs, for first location because of ship speed delay for reach location.

### **03- Sep -2016, Day 13**

- RAMA buoy is ready for deployment with all met and ocean sensors.
- Tested all the sensors which we are going to deployed/fixed to the our first RAMA buoy deployment.
- Approx. ETA is 04<sup>th</sup> Sep-2016, 15:00 Hrs, for first location of RAMA deployment.

### **04- Sep -2016, Day 14**

- @ 15:20 Hrs, Vessel arrived first RAMA buoy site in 1.5N|67E.



- @ 15:40 Hrs, we started the bathymetry survey and completed by 18:40 hrs.
- @ 21:00 Hrs, we started the new RAMA buoy (RA145) deployment.

#### **05- Sep -2016, Day 15**

- @ 00:30 anchors dropped in targeted site.
- @ 05:15 Hrs, CTD cast taken for 700 meter.
- Heading next operation site in equator region.
- PMEL Electrical winch is not working we and Electrical officer tried to repair the winch but not success.
- Ship deep sea winch we use for our retrieval operation and from now onward we will use deep sea winch for our all deployment/retrieval operation.
- @ 15:45 Hrs, RAMA buoy (RA133) signed.
- @ 16:10 Hrs, Transducer lower in the water from starboard side for release the buoy and we got release confirmation.
- @ 16:30 Hrs, small boat lowered in water and tied the buoy and around 17:00 Hrs, small boat onboard.
- @ 19:43 Hrs, RAMA Recovery operation started.

#### **06- Sep -2016, Day 16**

- @ 02:50 Hrs, RAMA Recovery operation completed.
- @ 09:15 Hrs, CTD cast taken for 700 meter.
- @ 12:05 Hrs, we started the new RAMA buoy (RA146) deployment.
- @ 15:30 Hrs, anchors dropped in targeted site.
- Vessel proceeds to next location.

#### **07- Sep -2016, Day 17**

- @ 10:00 Hrs, RAMA buoy (RA132) signed, now we are going to near (approx. 200m) the buoy for release.
- @ 10:30 Hrs, Transducer lower in the water from starboard side for release the buoy and we got release confirmation.

- @ 11:30 Hrs, small boat lowered in water and tied the buoy and around 11:55 Hrs, small boat onboard.
- @ 12:10 Hrs, RAMA Recovery operation started. 14:00 Hrs we recovered 700m wire rope with all oceanographic sensors.
- @ 18:10 Hrs, RAMA Recovery operation completed.
- @ 22:45 Hrs, CTD cast taken for 700 meter.

#### **08- Sep -2016, Day 18**

- @ 06:45 Hrs, we are ready for deploy the RAMA buoy, waiting for deployment position ETA 10 to 15 minutes.
- @ 07:00 Hrs, we started the RAMA buoy (RA147) deployment.
- @ 08:20 Hrs, we deployed 700m wire rope and fixed all the sensors on it according plan.
- @ 10:25 Hrs deployed all the nylon rope according the depth now we are waiting for Anchor deployment position.
- @ 10:45 Hrs, anchors dropped in targeted site.

#### **09- Sep -2016, Day 19**

- @ 12:15 Hrs, vessel reached the site to recover the RAMA buoy,
- Vessel in DP and well close to buoy the working line has connected to buoy before it would have to release, but unfortunately the bottom release and ship board Acoustic transducers couldn't make communication successfully.
- @ 13:05 Hrs, we lowered a small boat in water and this time three persons, for release the Acoustic because it not release while we tried from onboard. They couldn't able to do release the buoy because of some communication issued.
- Later by 04:00 Hrs, we tried to pull the working line and picked up the RAMA buoy on deck while heaving the buoy, the tag line which we connected between Buoy and A-Frame Railings got high tensed.
- @ 14:30 Hrs, RAMA buoy (RA131) on deck.
- @ 16:15 Hrs, recovered 700m wire rope with all oceanographic sensors.
- @ 20:40 Hrs, recovery operation was completed.
- @ 21:25 Hrs, CTD cast taken for 700 meter.

- Vessel proceeds to next RAMA buoy deployment site.

#### **10- Sep -2016, Day 20**

- @ 07:00 Hrs, deployment of RAMA buoy (RT009) were started.
- @ 11:30 Hrs, anchors dropped in targeted site.
- @ 12:25 Hrs, we lowered a small boat in water and this time four persons, for fixed the Wind sensor, which they forget to fix on RAMA buoy.
- @ 13:45 Hrs, small boat onboard and sensor is communicating.
- @ 14:00 Hrs, Vessel heading towards next location, Approx. ETA is 15<sup>th</sup> Sep-2016, 20:00 Hrs, ship speed is 6.2 knots.

#### **11- Sep -2016, Day 21**

- PMEL team with help of seamen's set up the RAMA buoy for next operations.
- Downloading of data is started from retrieval RAMA mooring.
- @ 10:00 Hrs, we had meeting regarding for next operation plan with PMEL team and Norinco Engineers.
- Approx. ETA is 15<sup>th</sup> Sep-2016, 17:30 Hrs, because ship speed is 6.7 knots for next location.

#### **12- Sep -2016, Day 22**

- @ 14:00 Hrs, we had meeting regarding for operation and plan with ship captain, officers.
- PMEL team plan to skip two operations because of time shortage this decision was taken PMEL office, from ship side everything is ok.
- Approx. ETA is 15<sup>th</sup> Sep-2016, 16:00 Hrs, because ship speed is 6.8 knots for next location.

#### **13- Sep -2016, Day 23**

- Prepared one RAMA buoy for our next deployment with connected all the sensors.
- @ 10:45 Hrs, One small meeting happened with third officer and PMEL team regarding new RAMA mooring retrieval, which we got information from PMEL office America.
- @ 22:45 Hrs, we came to know the news from PMEL office that 1S RAMA buoy (RA130) is drifted and now it near to 2S, which we deployed last year 28<sup>th</sup> Aug-2015, now we are going to recovering of this buoy.
- Approx. ETA is 16<sup>th</sup> Sep-2016, 01:00 Hrs, because ship speed is 6.5 knots for next location.

#### **14- Sep-2016, Day 24**

- A small meeting with chief officer, second officer, captain and PMEL team regarding ETA for Galle, after meeting we got ETA for Galle 23<sup>rd</sup> –September-2016.
- Approx. ETA is 16<sup>th</sup> Sep-2016, 04:00 Hrs, because ship speed is 6.2 knots for next location.

#### **15- Sep-2016, Day 25**

- A small meeting with PMEL team regarding sign off, PMEL team (03 persons) want to sign off Galle port. They also requested for transport from Galle to Colombo.
- A small meeting with NCAOR junior research fellow (Mr. Alok Kumar Sinha) regarding the extra CTD operation, he need around 500 meter CTD.
- Approx. ETA is 16<sup>th</sup> Sep-2016, 05:30 Hrs for our next RAMA buoy retrieval location.

#### **16- Sep-2016, Day 26**

- @ 07:00 Hrs, RAMA buoy (RA130) signed and vessel is going to near the buoy because we have to release the buoy/lower the small boat.
- @ 09:00 Hrs, small boat lowered in water and tied the buoy and around 09:30 Hrs, small boat onboard.
- @ 10:00 Hrs, RAMA Recovery operation started.
- @ 11:45 Hrs, RAMA Recovery operation completed.
- This RAMA buoy we lost all Nylon rope, only wire rope we recovered.
- @ 12:30 Hrs, CTD cast taken for 500 meter.
- Approx. ETA is 17<sup>th</sup> Sep-2016, 07:00 Hrs for our next RAMA buoy deployment location.

#### **17- Sep-2016, Day 27**

- @ 08:15 Hrs, deployment of RAMA buoy (RA148) were started.
- @ 10:00 Hrs, we deployed 700m wire rope with all the oceanographic sensors.
- @ 12:30 Hrs, anchors dropped in targeted site after deployment of anchor we went to little far for our CTD operation.
- @ 13:00 Hrs, from the buoy position we shifted 1.5 nm away and done the CTD cast for 700 meters.
- Vessel proceeds to our first ADCP buoy recovery site, approx. ETA is 17<sup>th</sup> Sep-2016, 20:00 Hrs.

- @ 21:15 Hrs, CTD cast taken for 700 meter.

### **18- Sep-2016, Day 28**

- @ 06:15 Hrs, we reached ADCP recovery site.
- @ 06:30 Hrs, Transducer lower in the water from starboard side for release the ADCP buoy and we got release confirmation.
- @ 06:35 Hrs, ADCP buoy (IO052) signed.
- @ 06:50 Hrs, we lowered a small boat in water and tied the ADCP buoy.
- @ 07:10 Hrs, small boat onboard.
- @ 08:15 Hrs, ADCP buoy onboard and we started the recovery of ADCP mooring.
- @ 12:00 Hrs, we finished recovery of ADCP.
- Vessel heading towards next location (RAMA recovery), Approx. ETA is 18<sup>th</sup> Sep-2016, 18:00 Hrs, ship speed is 6.7 knots.
- Data downloaded from retrieve ADCP buoy.
- @ 17:10 Hrs, we reached RAMA buoy (RA126) position and RAMA buoy signed.
- @ 17:30 Hrs, Transducer lower in the water from starboard side for release the RAMA buoy and we got release confirmation.
- @ 18:00 Hrs, small boat lowered in water and tied the buoy and around 18:30 Hrs, small boat onboard.
- @ 18:50 Hrs, RAMA recovery operation started, RAMA buoy onboard.

### **19- Sep-2016, Day 29**

- @ 02:20 Hrs, RAMA recovery operation completed.
- @ 08:15 Hrs, from the buoy position we shifted 1.5 nm away and done the CTD cast for 700 meters.
- @ 10:45 Hrs, deployment of RAMA buoy (RA149) were started.
- @ 12:00 Hrs, we deployed 700m rope with all the oceanographic sensors.
- @ 14:00 Hrs, anchors dropped in targeted site.
- All the sensors are giving good data, we checked from system.

- Vessel proceeds to our 2<sup>nd</sup> ADCP buoy recovery site, approx. ETA is 19<sup>th</sup> Sep-2016, 20:00 Hrs.

### **20- Sep-2016, Day 30**

- @ 06:15 Hrs, we reached 200m far from ADCP recovery site.
- @ 06:30 Hrs, Transducer lower in the water from starboard side for release the ADCP buoy and we got release confirmation.
- @ 06:35 Hrs, ADCP buoy (IO053) signed.
- @ 06:50 Hrs, we lowered a small boat in water and tied the ADCP buoy.
- @ 07:10 Hrs, small boat onboard while recovery the weather picked up badly.
- @ 08:30 Hrs, ADCP buoy onboard and we started the recovery of ADCP mooring.
- @ 12:30 Hrs, we finished recovery of ADCP.
- Vessel heading towards next location (RAMA recovery), Approx. ETA is 20<sup>th</sup> Sep-2016, 19:00 Hrs, ship speed is 6.8 knots.
- @ 20:00 Hrs, vessel reached buoy location (RAMA recovery), but buoy was not there.
- We lost RAMA buoy with all underwater instruments and special high frequency sensors and plenty meters of Nylon rope with one Acoustic release. At last we got very bad and it's not our day.....
- Finally we come to a decision, skipped this location because someone taken our mooring from here and possibility to lost future also.
- @ 22:00 Hrs, CTD cast taken for 500 meter.
- Vessel heading towards Galle port, Approx. ETA is 23<sup>rd</sup> Sep-2016, 08:00 Hrs.

### **21- Sep-2016, Day 31**

- @ 11:00 Hrs, we had meeting regarding for sign off for PMEL team with ship captain, chief officers, chief engineer.
- Packing of instruments started, making new material list according material which we have onboard.
- Finally we made list of material which have to offload from ORV Sagar Kanya ship, when ship will reach Chennai.

- Vessel heading towards Galle port, Approx. ETA is 23<sup>rd</sup> Sep-2016, 08:00 Hrs.

#### **22- Sep-2016, Day 32**

- All PMEL team are preparing for their sign-off.
- Labelled the entire material according list.
- Vessel heading towards Galle port, Approx. ETA is 23<sup>rd</sup> Sep-2016, 08:00 Hrs.

#### **23- Sep-2016, Day 33**

- @ 08:00 Hrs, Vessel reached near to Galle port, a small boat came for pickup PMEL team and around 08:20 Hrs all PMEL team went to small boat.
- Vessel heading towards Chennai port, Approx. ETA is 27<sup>th</sup> Sep-2016, 08:00 Hrs.

#### **24- Sep-2016, Day 34**

- Vessel heading towards Chennai port.

#### **25- Sep-2016, Day 35**

- Vessel heading towards Chennai port, Approx. ETA is 28<sup>th</sup> Sep-2016, 14:00 Hrs. ship speed is 4.2 knots.

#### **26- Sep-2016, Day 36**

- Vessel heading towards Chennai port, Approx. ETA is 27<sup>th</sup> Sep-2016, 18:00 Hrs. ship speed is 5.6 knots.

#### **27- Sep-2016, Day 37**

- Vessel reached near to Chennai port at 18:00 Hrs. and anchored, awaiting for berth.

#### **28- Sep-2016, Day 38**

- We did not get berth, Approx tomorrow morning 07:00 Hrs will get berth.

#### **29- Sep-2016, Day 39**

- Offloading works successfully completed and Sign off all the cruise participated.

## Summary of the scientific works done during cruise SK-333:

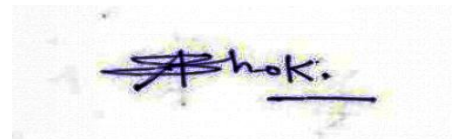
1. 5-RAMA buoys were deployed and 6-RAMA & 2-ADCP buoys were recovered in Latitudes 1.5N, 0N along with 67 E longitude lines and Latitudes 1.5S, 4S along with 67E longitude of RAMA Moorings.
2. Conductivity-Temperature-Depth (CTD) profiles taken every RAMA and ADCP buoy locations.
3. Bathymetry survey was commenced for first RAMA buoy deployment locations.

## Acknowledgements

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