

# ORV - SAGAR KANYA

## CRUISE REPORT

**Cruise No. SK - 307**

*(27<sup>th</sup> November – 27<sup>th</sup> December, 2013)*



**Submitted by**

***Mr. Suresh Kumar N***

Chief Scientist, SK - 307

Indian National Centre for Ocean Information Services

Hyderabad – 500 090

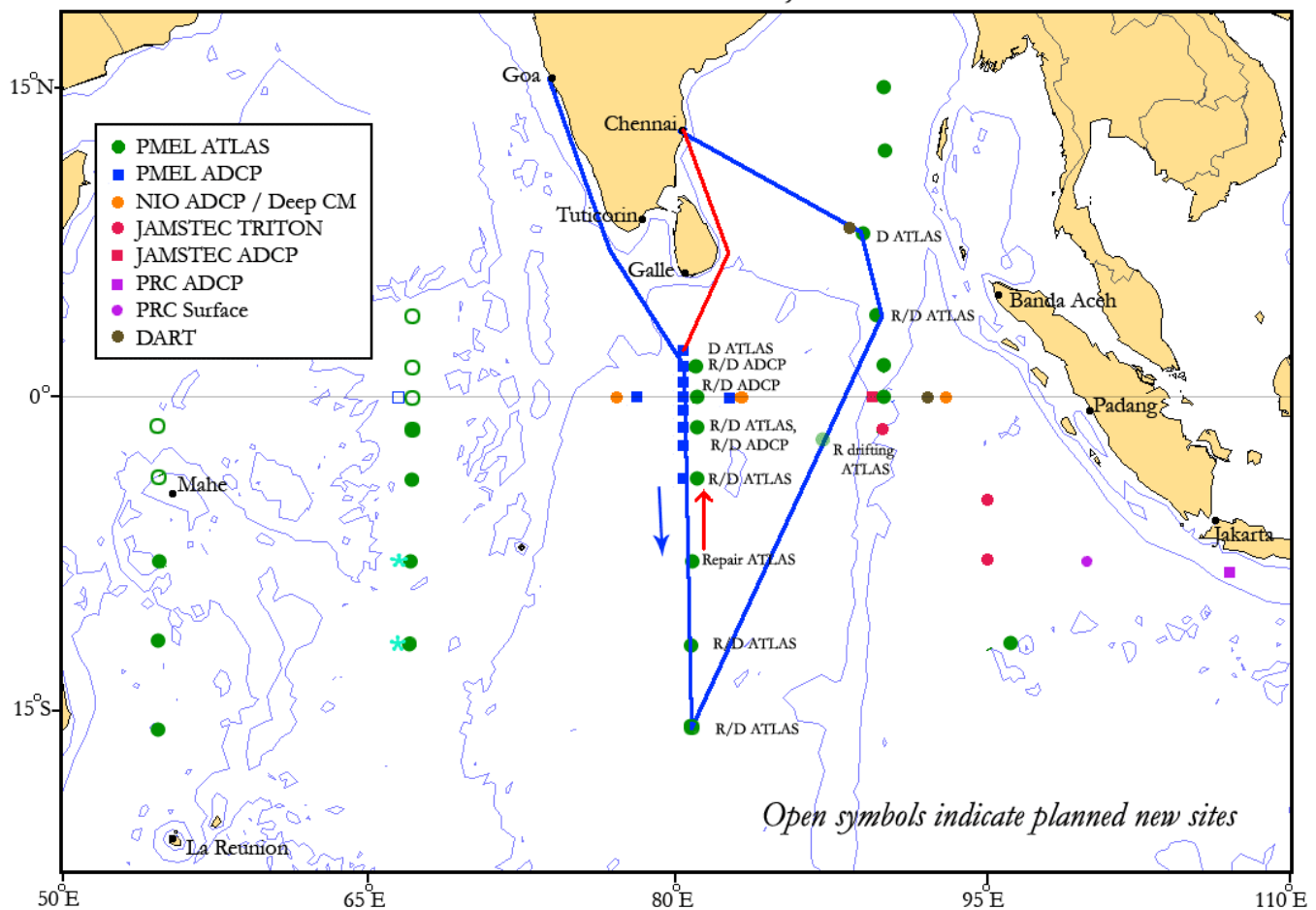
## Objectives:

This cruise is principally dedicated to the recovery and deployment of deep ocean surface ATLAS moorings and recovery & deployment of deep ocean subsurface ADCP moorings as detailed in Table 1.

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.

## Cruise Track:

80.5 E and 90 E cruise, 2013



**Note:** red line - modified cruise track from 16S

**Table 1: Mooring Operations:**

“D” = deployment, “R” = Recover locations are nominal locations. Exact positions are provided to ship operators at that time of operations

| Mooring ID | Operation | Mooring Type | Lat       | Long      | Comments                |
|------------|-----------|--------------|-----------|-----------|-------------------------|
| RA106A     | D         | ATLAS        | 01 30.0 N | 80 30.0 E | Previous mooring adrift |
| IO039      | R         | ADCP         | 01 30.0 N | 80 30.0 E |                         |
| IO048      | D         | ADCP         | 01 30.0 N | 80 30.0 E |                         |
| RA098A     | Visit     | ATLAS/Flux   | 00 07.1 N | 80 31.3 E |                         |
| IO040      | R         | ADCP         | 00 00.0 N | 80 30.0 E |                         |
| IO049      | D         | ADCP         | 00 03.5 N | 80 43.8 E |                         |
| RA089B     | R         | ATLAS        | 01 30.3 S | 80 30.2 E |                         |
| RA107A     | D         | ATLAS        | 01 30.0 S | 80 30.0 E |                         |
| IO042      | R         | ADCP         | 01 34.2 S | 80 24.9 E |                         |
| IO050      | D         | ADCP         | 01 30.0 S | 80 30.0 E |                         |
| RA099A     | R         | ATLAS        | 03 58.9 S | 80 30.0 E |                         |
| RA108A     | D         | ATLAS        | 04 00.0 S | 80 30.0 E |                         |
| RA100A     | Repair    | ATLAS        | 08 00.0 S | 80 30.0 E | Swap ATRH, rain         |
| RA085A     | R         | ATLAS        | 12 00.0 S | 80 30.0 E |                         |
| RA109A     | D         | ATLAS        | 12 00.0 S | 80 30.0 E |                         |
| RA084B     | R         | ATLAS        | 16 00.0 S | 80 30.0 E |                         |
| RA110A     | D         | ATLAS        | 16 00.0 S | 80 30.0 E |                         |

### Scientific Participants SK-297

| Sr. No. | Name of Participants           | Designation      | Institute | Nationality |
|---------|--------------------------------|------------------|-----------|-------------|
| 1.      | Mr. SURESH KUMAR NEELAKANDAN   | Chief Scientist  | INCOIS    | INDIA       |
| 2.      | Mr. WILLIAM LESTER HIGLEY      | Dy. Scientist    | NOAA/PMEL | USA         |
| 3.      | Mr. STEPHEN ALAN SMITH         | Scientific       | NOAA/PMEL | USA         |
| 4.      | Mr. ERICH JAY BOHABOY          | Scientist        | NOAA/PMEL | USA         |
| 5.      | Dr. JEAN YVES ROYER            | Scientist        | CNES      | FRANCE      |
| 6.      | Mr. RUPESH SAWANT              | Onboard Asst.    | NCAOR     | INDIA       |
| 7.      | Mr. NATARAJAN SATHISH KUMAR    | AMC Engineer     | NORINCO   | INDIA       |
| 8.      | Mr. MADAR PARSHURAM DURGAPPA   | AMC Engineer     | NORINCO   | INDIA       |
| 9.      | Mr. AVERTANO CALLISTUS LUIS    | AMC Engineer     | NORINCO   | INDIA       |
| 10.     | Mr. JOHNSON ANISH SHAJIN JOHNS | AMC Engineer     | NORINCO   | INDIA       |
| 11.     | Mr. MANUEL MICHELL MATHEW      | AMC Engineer     | NORINCO   | INDIA       |
| 12.     | Mr. THIVAKAR SANKAR            | Deployment Asst. | INCOIS    | INDIA       |
| 13.     | Mr. EMAYAVARAMBAN SELVARAJ     | Deployment Asst. | INCOIS    | INDIA       |
| 14.     | Mr. KIRUBAKARAN NARAYANASAMY   | Deployment Asst. | INCOIS    | INDIA       |
| 15.     | Mr. RAJAPART RAMALINGAM        | Deployment Asst. | INCOIS    | INDIA       |
| 16.     | Mr. SATHISH PANDIAN            | Deployment Asst. | 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 ATLAS – Autonomous Temperature Line Acquisition System & ADCP –Acoustic Doppler Current profiler buoys were recovered and redeployed at assigned locations in Equatorial Indian Ocean and Bay of Bengal by MoES/INCOIS & NOAA/PMEL scientists.

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 with the help of DP or main propulsion. 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, 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-ATLAS buoy was performed from midships of the ship using ATLAS Crane or National Oilwel Crane, before the deployment, the top tower section fitted with all meteorological sensors and clamped on it, 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 ATLAS buoy was deployed using the midships ATLAS crane and ADCP 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 wrapping with 4-5 straps in winch of PMEL heaving capacity ~6 Ton . For Surface Buoy after completing Pay out ~ 700 m of Nilspin cable, the nylon rope was connected to the buoy mooring line for remaining length till up to seabed. 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 National Oilwel Crane and deep sea winch capstan. Similar procedure followed for all RAMA & ADCP buoy deployments.

**Complete details of Buoy Retrievals/Deployments:**

| Sr. No. | Mooring Descriptions           | Date      | Mooring Locations |           |
|---------|--------------------------------|-----------|-------------------|-----------|
|         |                                |           | Latitude          | Longitude |
| 1       | <b>ATLAS DEPLOYED -RA106A</b>  | 02-Dec-13 | 01°32.8 N         | 80°34.4 E |
| 2       | <b>ADCP RECOVERED -IO039</b>   | 03-Dec-13 | 01°33.9 N         | 80°41.7 E |
| 3       | <b>ADCP DEPLOYED -IO048</b>    | 03-Dec-13 | 01°33.9 N         | 80°42.2 E |
| 4       | <b>ATLAS RECOVERED -RA098A</b> | 05-Dec-13 | 00°09.2 N         | 81°04.3 E |
| 5       | <b>ATLAS DEPLOYED -RA098A</b>  | 05-Dec-13 | 00°04.9 N         | 80°36.5 E |
| 6       | <b>ATLAS RECOVERED -RA106A</b> | 06-Dec-13 | 01°38.6 N         | 81°02.7 E |
| 7       | <b>ATLAS DEPLOYED -RA106A</b>  | 06-Dec-13 | 01°33.6 N         | 80°35.3 E |
| 8       | <b>ADCP RECOVERED -IO040</b>   | 07-Dec-13 | 00°04.3 N         | 80°43.3 E |
| 9       | <b>ADCP DEPLOYED -IO049</b>    | 07-Dec-13 | 00°04.3 N         | 80°43.0 E |
| 10      | <b>ATLAS RECOVERED -RA089B</b> | 08-Dec-13 | 01°30.0 S         | 80°33.5 E |
| 11      | <b>ADCP RECOVERED -IO042</b>   | 09-Dec-13 | 01°34.1 S         | 80°24.8 E |
| 12      | <b>ADCP DEPLOYED -IO050</b>    | 09-Dec-13 | 01°34.5 S         | 80°24.5 E |
| 13      | <b>ATLAS RECOVERED -RA099A</b> | 10-Dec-13 | 03°59.7 S         | 80°29.6 E |
| 14      | <b>ATLAS DEPLOYED -RA109A</b>  | 14-Dec-13 | 11°56.2 S         | 80°24.3 E |
| 15      | <b>ATLAS RECOVERED -RA099A</b> | 14-Dec-13 | 11°58.4 S         | 80°29.7 E |
| 16      | <b>ATLAS DEPLOYED -RA110A</b>  | 16-Dec-13 | 16°00.5 S         | 80°31.9 E |
| 17      | <b>ATLAS RECOVERED -RA084B</b> | 16-Dec-13 | 15°59.1 S         | 80°30.4 E |
| 18      | <b>ATLAS REPAIR -RA100A</b>    | 19-Dec-13 | 08°00.1 S         | 80°25.8 E |
| 19      | <b>ATLAS DEPLOYED -RA108A</b>  | 20-Dec-13 | 04°00.7 S         | 80°27.4 E |
| 20      | <b>ATLAS DEPLOYED -RA107A</b>  | 21-Dec-13 | 01°30.7 S         | 80°31.2 E |
| 21      | <b>ATLAS RECOVERED -RA106A</b> | 22-Dec-13 | 01°32.6 N         | 80°36.1 E |
| 22      | <b>ATLAS DEPLOYED -RA106A</b>  | 22-Dec-13 | 01°32.9 N         | 80°36.7 E |

## CTD operations:

Conductivity, Temperature, and Depth (CTD) casts were made up to 600/2000 meters depth at selective locations where RAMA buoys were deployed/recovered due to hard seas we skipped CTD in some locations.

| Sl.No | Latitude    | Longitude   | Date        | Time (UTC) | Remarks                              |
|-------|-------------|-------------|-------------|------------|--------------------------------------|
| 1     | 01°33.803 N | 80°35.689 E | 02-Dec-2013 | 14:07      | SBE CTD was lowered upto 608 Meters  |
| 2     | 03°52.520 S | 80°48.838 E | 10-Dec-2013 | 18:41      | SBE CTD was lowered upto 2024 Meters |
| 3     | 16°03.373 S | 80°32.259 E | 16-Dec-2013 | 14:11      | SBE CTD was lowered upto 606 Meters  |
| 4     | 04°01.997 S | 80°34.339 E | 20-Dec-2013 | 08:03      | SBE CTD was lowered upto 608 Meters  |
| 5     | 01°30.116 S | 80°38.323 E | 21-Dec-2013 | 07:40      | SBE CTD was lowered upto 608 Meters  |

## Drifter Deployments:

| Sr. No. | Drifter Id             | Date & Time (UTC) | Deploy Locations |           |
|---------|------------------------|-------------------|------------------|-----------|
|         |                        |                   | Latitude         | Longitude |
| 1       | <b>300234060450480</b> | 10-Dec-13   06:11 | 03°49.1 S        | 80°28.5 E |
| 2       | <b>300234060454500</b> | 10-Dec-13   06:11 | 03°49.1 S        | 80°28.5 E |
| 3       | <b>101668</b>          | 11-Dec-12   21:15 | 05°48.3 S        | 80°47.9 E |
| 4       | <b>101663</b>          | 11-Dec-12   21:15 | 05°48.3 S        | 80°47.9 E |
| 5       | <b>101658</b>          | 12-Dec-13   20:38 | 09°03.2 S        | 80°27.4 E |
| 6       | <b>101665</b>          | 12-Dec-13   20:38 | 09°03.2 S        | 80°27.4 E |
| 7       | <b>101670</b>          | 14-Dec-13  01:16  | 12°02.7 S        | 80°28.6 E |
| 8       | <b>101667</b>          | 14-Dec-13  01:16  | 12°02.7 S        | 80°28.6 E |
| 9       | <b>101664</b>          | 15-Dec-13   16:05 | 15°01.6 S        | 81°13.1 E |
| 10      | <b>101666</b>          | 15-Dec-13   16:05 | 15°01.6 S        | 81°13.1 E |
| 11      | <b>300234060450620</b> | 16-Dec-13   13:00 | 12°58.1 S        | 80°27.4 E |
| 12      | <b>300234060650110</b> | 16-Dec-13   13:00 | 12°58.1 S        | 80°27.4 E |
| 13      | <b>300234060150420</b> | 17-Dec-13   09:34 | 09°56.0 S        | 80°26.6 E |
| 14      | <b>30023406050190</b>  | 17-Dec-13   09:34 | 09°56.0 S        | 80°26.6 E |
| 15      | <b>300234060650200</b> | 19-Dec-13   11:54 | 06°34.4 S        | 80°27.1 E |
| 16      | <b>300234060454740</b> | 19-Dec-13   11:54 | 06°34.4 S        | 80°27.1 E |
| 17      | <b>300234060650120</b> | 20-Dec-13   07:19 | 04°00.4 S        | 80°27.1 E |
| 18      | <b>300234060450500</b> | 20-Dec-13   07:19 | 04°00.4 S        | 80°27.1 E |
| 19      | <b>101813</b>          | 21-Dec-13   13:17 | 01°01.5 S        | 80°31.5 E |
| 20      | <b>101698</b>          | 21-Dec-13   13:17 | 01°01.5 S        | 80°31.5 E |

## **Diary of Events**

### **27-Nov-2013, Day 1**

- Scientific team Signed ON at 12:00 Hrs and accommodation allotted to all of them.
- All cruise equipments were loaded onboard by 24-Nov-13 itself and secured.
- PMEL Electrical winch is successfully fitted in main deck with local workshop people.
- All scientific gears were inventoried and verified by scientists.
- Bunkering & other provision is carried out aboard.
- Deep Sea Winch cables reeving job is successfully finished and ready to use.
- Vessel departed Mormugao port @ 20:30 Hrs.

### **28-Nov-2013, Day 2**

- @ 11:00 Hrs, familiarisation meeting were carried for SK-307 scientific participants.
- @ 15:45 Hrs, onboard Safety drills were conducted onboard with scientific team and ship crew members.
- NOAA scientists set up the lab facility & instruments on deck and staged the mooring hardware and gears according to the order of operations.

### **29-Nov-2013, Day 3**

- @ 08:00 Hrs, Vessel propelled to first site of RAMA 1.5N|80.5E.

### **30-Nov-2013, Day 4**

- @ 10:00 Hrs, RISK assessment meeting were conducted in officer recreation room with respective head

### **01-Dec-2013, Day 5**

- @ 10:00 Hrs, onboard pre-cruise meeting regarding for operation and plan with ship master, officers and few crew members and scientific team and Norinco Engineers..
- @ 12:00 Hrs, a small discussion with Norinco engineers regarding bathymetry queries.

### **02-Dec-2013, Day 6**

- @ 06:00 Hrs, Vessel arrived first RAMA Atlas buoy site in 1.5N|80.5E.
- @ 12:00 Hrs, during the buoy deployment abruptly vessel main power got tripped out and deep sea winch power system got repaired, due to electrical failure.



- At last we skipped the deep sea winch method and used national oilwell crane for Anchors deployment.
- @ 14:40 Hrs, first RAMA ATLAS (RA106A) buoy anchor deployed
- @ 19:30 Hrs, CTD lowered in water up to 600 meters and completed around 20:12 Hrs.

#### **03-Dec-2013, Day 7**

- @ 06:00 Hrs, Recovery/Deployment of ADCP operation planned in 1.5N|80.5E.
- @ 06:55 Hrs, lowered Acoustic deck set in water to release the ADCP –didn't get good range and signal from the instrument and advise wheel house to move the location in around to the buoy location.
- @ 12:30 Hrs, we successfully release the buoy and stated the recovery of it.
- @ 13:00 Hrs, buoy were hooked up with working line with the help of small boat in water and connected to electric capstan for heaving to bring the buoy on deck.
- @ 13:30-16:00 Hrs, recovery of ADCP done and later we start the ADCP deployment.
- @ 16:58-18:27 Hrs, deployment of ADCP completed and started the triangulation of the bottom release to locate the exact spot of Anchor locations.
- @ 22:30 Hrs, Vessel departed to equator operation site.

#### **04-Dec-2013, Day 8**

- Due to bad weather we skipped the ADCP recovery and deployment and started back to search the ATLAS buoy which existing in this location earlier. From the Ship radar screen we are unable to find out the buoy. Suspected it may break free.
- Later we decide to do recovery of ADCP - @ 16:30 after the triangulation we pick the spot to give release command the ADCP releases but for concerning the weather state we aborted the operation and plan to do next day first light in the morning.
- @21:30 got message from PMEL that the buoy in equator it's adrift. Advise the bridge to trace the drifted buoy for recovery.

#### **05-Dec-2013, Day 9**

- @ 05:00 Hrs, vessel sighted the buoy in radar screen from the actual location the buoy was drifted nearly 40 nm distances.
- @ 07:30 Hrs, Recovery of the adrift buoy started & completed by 11:00 hrs.

- @ 17:42 Hrs, recovered buoy got repaired and ready for re-deployment
- Late night evening 22:00 Hrs the adrift buoy successfully deployed in same location.
- @ 23:00 Hrs –received bad news from PMEL that the buoy we deployed in 1.5N also start drifting and moved towards south easterly.
- Vessel head back to 1.5 N again for recovery of second adrift buoy.

#### **06-Dec-2013, Day 10**

- @ 11:40 Hrs, adrift buoy is sighted 01 38.6'N|81 02.7'E.
- @ 14:00 Hrs, recovery operation was done smoothly.
- @ 15:00 Hrs, deployment began, @23:20 Hrs, Anchor deployed in water.
- We done the fly by (data transmission check between the buoy and onboard ARGOS receiver)

#### **07-Dec-2013, Day 11**

- @ 00:45 Hrs, Small boat operation were carried for repair the met sensors in ATLAS buoy
- @ 01:30 Hrs, small boat on deck and everyone safely return, it was quit scary operation at midnight at the end we done very successfully.
- Followed by ATLAS deployment we moved to ADCP R/D site in equator again.
- @ 13:00 Hrs, vessel arrived the site and lowered the transducer in water for release the acoustic releases in the mooring.
- @ 19:00 Hrs, ADCP recovery was done and started the deployment.
- @ 20:14 – 23:22 Hrs, ADCP deployment were completed successfully.
- Vessel approached the site and started the ATLAS buoy recovery in 1.5S|80.5E.

#### **08-Dec-2013, Day 12**

- @ 16:00 Hrs, ATLAS buoy is sited in radar screen and we found that - there were five small fishing boats nearby buoy and one of the boat tied up with our ATLAS buoy.
- @ 16:18 Hrs, ship blown horn to scare the fishing boats and make them the clear from the buoy.
- @ 17:10 – 21:30 Hrs, recovery operation completed.
- Same site 5 nm off we done triangulation for fixed the ADCP release spot.

- The ATLAS buoy is banged up massively by fishing boats –the top section is completely ruined out all met sensors are gone except the RADAR reflector.
- we carried out the triangulation for finding ADCP position

#### **09-Dec-2013, Day 13**

- @ 07:10 Hrs, ADCP buoy released and it's popped up the surface and sighted in position 01 34.317N|80 24.898E.
- @ 07:55-10:30 Hrs –ADCP recovery is completed later we started the deployment. At same site.
- By 15:41 Hrs, deployment of ADCP and triangulation is completed.
- Vsl. Headed to next site 4 South
- Due to fishing vandalism concern we didn't do the new deployment of ATLAS buoy here and plan to execute while we return from 16 S.

#### **10-Dec-2013, Day 14**

- Vessel arrived 4S|80.5E RAMA Atlas mooring.
- @ 17:45 Hrs, we started the recovery operation of ATLAS RAMA Buoy.
- @ 18:00 Hrs, we got release confirmation and heaving the mooring line on deck.
- @ 22:41 Hrs, we completed the recovery.

#### **11-Dec-2013, Day 15**

- @ 00:20 Hrs, CTD were started for 2000 meters
- @ 06:00 Hrs, prepared ATLAS buoy deployment –due to some technical issues we delayed the deployment and postponed after our breakfast.
- @ 09:30 seas becomes very hard again and unable execute the deployment of ATLAS buoy - operation aborted, plan to do later while when we return form 16 S.
- Vsl. Headed to 8S.

#### **12-Dec-2013, Day 16**

- @ 10:00 Hrs, weather is immoderate.
- @ 19:00 Hrs, due to weather state – we skipped the 8South repair-ATLAS works.
- @ 19:10 Hrs, Vsl. Headed 12 South site.

**13-Dec-2013, Day 17**

- Vessel propelled to 12 South
- @ 23:00 Hrs, vessel reached the deployment site, but we were unable to do recovery due to non available of empty spools for recover and coil the nylons ropes. Hence we decide to deploy first.
- @ 23:15 Hrs, Multibeam survey has started - 4x4 nm areas.

**14-Dec-2013, Day 18**

- @ 03:00 Hrs, survey completed.
- @ 05:30 Hrs, Multibeam survey plotted map present by Norinco onboard engineers but it was not useful to figure it out the Anchor target location, the map is in differ formats and unable to read the proper Lat/Long coordinates. At last from the processed data with the help of on screen by using the cursor we found the spot to deploy anchors for the moorings.
- @ 09:30 Hrs, ATLAS -buoy deployment begins and around 10:10 hrs buoy deployed in water.
- 12:30 Hrs, Anchors dropped in water @ 11 57.36S|80 21.336 E, followed by deployment we started the recovery of old ATLAS buoy
- 16:40 Hrs, ATLAS buoy recovery started and ended in 19:40 Hrs.
- Vsl. Headed to 16S.

**15-Dec-2013, Day 19**

- Vessel propelled to 12N site.

**16-Dec-2013, Day 20**

- @ 06:30-07:30 Hrs, Vessel reached the 16 south RAM site and Multibeam survey begins.
- @ 09:10-12:58 Hrs, ATLAS buoy deployed successfully. In position 16 00.51S|80 31.93E.
- @ 15:00-19:23 Hrs, ATLAS recovery operation completed and CTD operation carried out.
- @ 20:50 Hrs, Vsl. Streamed towards 8S|80.5E for repair ATLAS buoy.

**17-Dec-2013, Day 21**

- Vsl. Streamed towards 8S|80.5E

**18-Dec-2013, Day 22**

- Vsl. Streamed towards 8S|80.5E

**19-Dec-2013, Day 23**

- @ 06:20 Hrs, vessel arrived 8South ATLAS buoy in position 08 00.062 S | 80 25.853 E.
- @ 08:00 Hrs, Repair of ATLS buoy operation were successfully completed - swapped the faulty met sensors-raingauge & ATRH on top section.
- @ 08:15 Hrs, Vsl. departed to 4S|80.5E site

**20-Dec-2013, Day 24**

- @ 10:00 Hrs, arrived ATLAS buoy deployment site
- @ 11:00 Hrs, Atlas buoy deployed in water.
- @ 12:44 Hrs, Anchors dropped in water
- @ 13:32-14:10 Hrs, CTD cast were taken for 600 meters
- Visiting Buoy and done the fly by check. Advise wheel house to head next location 1.5S|80.5E.

**21-Dec-2013, Day 25**

- @ 10:12 Hrs, ATLAS buoy deploy in water in position 01 30.78 S| 80 33.15 E,
- @ 12:36 Hrs, Anchors dropped in position 01 30.53 S| 80 30.52 E.
- @ 13:10-13:53 Hrs, CTD operation carried out for 600 meters.
- @ 14:53-15:50, fly by completed and advised bridge to head next and last location 1.5N|80.5E.
- Vessel heading towards Chennai port, Approx. ETA is 5<sup>th</sup> Sep-12, 21:50 Hrs...

**22-Dec-2013, Day 26**

- @ 13:25 Hrs, ATLAS buoy is sighted in RADAR screen in position 01 33.35 S | 80 36.32 E.
- @ 14:46-15:45 Hrs, Lowered transducer for release the buoy from anchors.
- @ 15:45 Buoy is hooked up successfully from small boat team.
- @ 19:00 Recovery operation is completed in position 01 35.525 N | 80 34.754 E,
- @ 20:28 – 22:35 Hrs, last ATLAS buoy & anchors deployed
- @ 23:15 Hrs, during fly by we found that the raingauge in the system has working properly and decide to repair the met sensors, due to bad sea state we plan to do the repair works in next day morning in first day light.

**23-Dec-2013, Day 27**

- @ 01:30 Hrs, advise the wheel house to hold the position close to the buoy location,.
- @ 05:30 Hrs, prepare the boat operation for repair ATLAS.
- 05:57-07:30 Hrs, boat operation is carried out and successfully repaired the raingauge and wind sensors in the buoy and confirms the data from buoy is good.
- That's the moment we have done all the operation and happily back to home
- Vsl makes ETA on 26-Dec-2013, 14:30 Hrs.

**24-Dec-2013, Day 28**

- Vessel heading towards Chennai port,. ETA is revised to 27-Dec-2013|08:00Hrs due atmospheric condition in Srilanka waypoints ...
- Onboard preparing Christmas celebration.

**25-Dec-2013, Day 29**

- Christmas party onboard scientist, officer & crew celebrated very grand.

**26-Dec-2013, Day 30**

- Vessel heading towards Chennai port

**27-Dec-2013, Day 31**

- @ 05:30 Hrs, Vessel arrived Chennai port.
- @ \_\_\_\_\_Hrs, vessel got birthed in piers (North Quay)
- @ \_\_\_\_\_Hrs, offloading works of SK-307 started out.
- Scientific team were signed off successfully @ \_\_\_\_\_ Hrs.

## Summary of the scientific works done during cruise SK-307:

1. 08-ATLAS & 03-ADCP buoys were deployed and 07-ATLAS & 03-ADCP buoys were recovered in Latitudes 1.5N, to 16 S along with 80.5 E longitude lines of RAMA Moorings
2. Conductivity-Temperature-Depth (CTD) profiles taken every RAMA buoy locations.
3. Bathymetry surveys were accomplished for all RAMA deployment locations.
4. 20 – Surface drifter's deployed along with ship en route.

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**(N Suresh Kumar)**  
**Chief Scientist, SK-307**