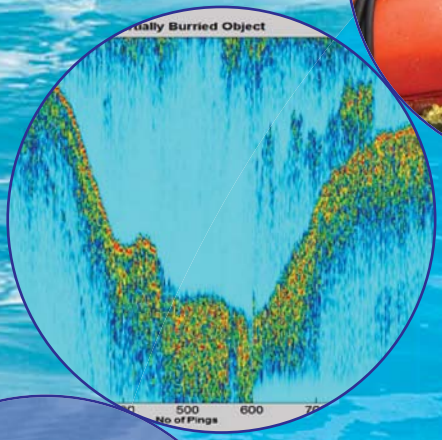
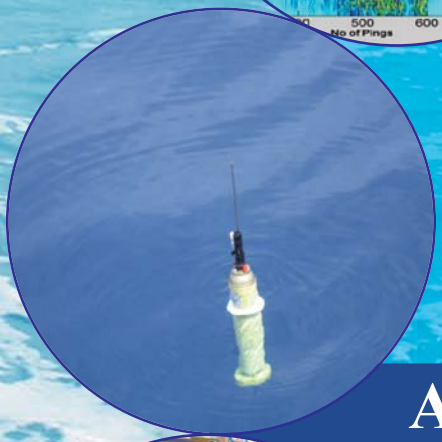
National Institute of Ocean Technology

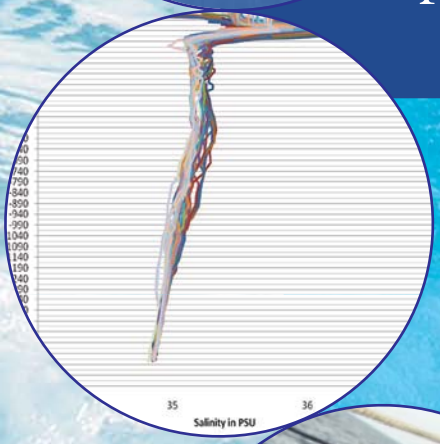
(ESSO, Ministry of Earth Sciences, Govt. of India)

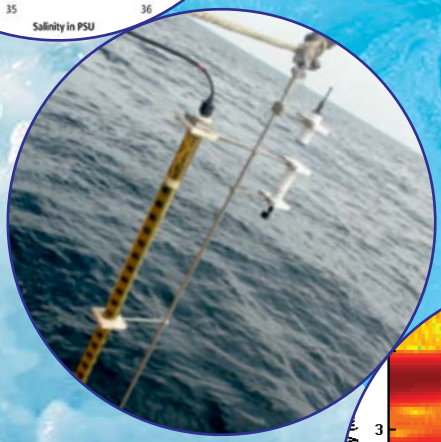


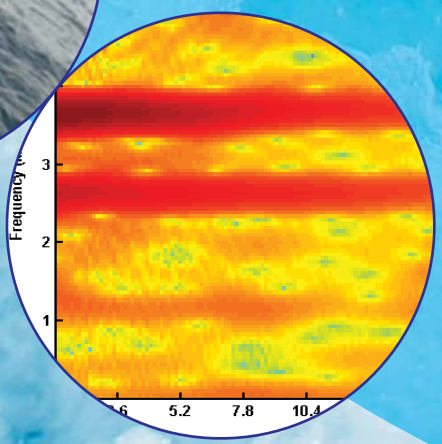


NATIONAL INSTITUTE OF OCEAN TECHNOLOGY
NIOT
CHENNAI

ANNUAL REPORT 2013-14







The Parliamentary Standing Committee on Science & Technology, Environment & Forests, visited ESSO-NIOT on January 7, 2014, reviewed the activities and appreciated the achievements.

A one day workshop on Underwater Technology was organized by IEEE OES India Council and ESSO-NIOT on October 21, 2013

International conference on Innovative Technologies and Management for water security (INDACON 2014) was organized and conducted successfully at ESSO-NIOT during February 12-14, 2014 with a very wide participation from students, academicians, scientists and experts from industry.

INSTITUTE AT A GLANCE

ORGANIZATION

The National Institute of Ocean Technology (NIOT) was established in November 1993 as an autonomous society under the Ministry of Earth Sciences, Government of India. ESSO-NIOT is managed by a Governing Council and the Director is the head of the Institute.

The major aim of starting NIOT under the Ministry of Earth Sciences, is to develop reliable indigenous technology to solve the various engineering problems associated with harvesting of non-living and living resources in the Indian Exclusive Economic Zone (EEZ), which is about two-thirds of the land area of India.

MISSION STATEMENT

- To develop world class technologies and their applications for sustainable utilization of ocean resources.
- To provide competitive, value added technical services and solutions to organizations working in the oceans.
- To develop a knowledge base and institutional capabilities in India for management of ocean resources and environment.

MEMBERS OF THE GOVERNING COUNCIL AND THE GENERAL BODY OF ESSO-NIOT (FROM APRIL 2013 TO MARCH 2014)

Sl.No.	Name	Designation
1	**Dr.Shailesh Nayak** Secretary to Govt. of India Ministry of Earth Sciences	Chairman From 27th August 2008
2	**Shri J.B.Mohapatra** JS & FA, Ministry of Earth Sciences, New Delhi	Member From 25th February 2013
3	**Shri B.N.Satpathy,** Sr.Adviser (S&T), Planning Commission, New Delhi	Member From 14th February 2013
4	**Shri U.V.Lakhane,** Executive Director (Projects), Engineers India Limited, New Delhi	Member From 27th February 2012
5	**Dr.P.S.Nair,** Former Dy. Director, ISAC, Bangalore	Member From 6th June 2006
6	**Shri Anand Singh Khati, IRPS** Joint Secretary, Ministry of Earth Sciences, New Delhi	Member From 30th July 2012
7	**Dr.S.K.Shivakumar,** Director, ISRO Satellite Centre, Bangalore	Member From 27th February 2012
8	**Prof. Bhaskar Ramamurthi** Director, Indian Institute of Technology Madras, Chennai	Member From 27th February 2012
9	**Shri S.Anantha Narayanan** Director, Naval Physical & Oceanographic Lab, Kochi	Member From 27th February 2012
10	**Shri S.V.Rangarajan** Director, Naval Science & Technological Lab Visakhapatnam	Member From 27th February 2012 To 30th September 2013
	Dr. C. Durga Malleswar Director, Naval Science & Technological Lab Visakhapatnam	Member From 1st October 2013
11	**Dr.S.K.Das** Advisor, Ministry of Earth Sciences, New Delhi	Permanent Invitee From 27th February 2012
12	**Dr.Nagesh R. Iyer** Director, Structural Engineering Research Centre, Chennai	Permanent Invitee From 27th February 2012
13	**Dr.M.A.Atmanand** Director, ESSO-NIOT	Member Secretary From 21st October 2009

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FROM THE DIRECTOR'S DESK

Greetings from ESSO-NIOT. It gives me great pleasure in presenting the saga of our endeavors and achievements in the form of Annual Report for the year 2013-14. The institution completed two decades of existence and has been responsible for delivering some of the key technologies for the nation and creation of a strong base for ocean technology in the form of capacity building.

Energy and water, prime requirements of the society, have been the priority activities of ESSO-NIOT since its inception. Keeping up with this trend, ESSO-NIOT successfully established a methodology to develop ocean current turbines for low water current speeds, involving computational fluid dynamics studies, small scale model testing and field trial. This endeavor paved a way for further scaling up. As a part of knowledge dissemination, an International Conference on Innovative Technologies and Management for Water Security (INDACON-2014), was organized and conducted successfully at ESSO-NIOT during 12th-14th February 2014 with a very wide participation from students, academicians, scientists and experts from industry.

Beach nourishment on north of Pondicherry harbour based on field studies and numerical modeling was recommended by ESSO-NIOT. Pondicherry government implemented the beach nourishment scheme, which showed a gain of beach width to an extent of 60m. Newly formed beach received positive response from local population. Seeing the success of proposed soft solution, Pondicherry government requested ESSO-NIOT to restore the lost beach near Gandhi Statue.

A mooring system designed by ESSO-NIOT was used in deploying five buoys in the Gulf of Mannar Bio Reserve (GOMBR). This effort earned the appreciation of GOMBR.

As part of shore protection effort long shore sediment transport rate has been estimated for Kadalur PeriaKuppam (KPK) site based on field observations and model studies. Design of the engineering intervention at KPK site and deployment scheme, i.e. submersed dyke using geo-synthetic tube has been finalized.

The programme of coastal observations using High Frequency (HF) radars is progressing satisfactorily. Surface current and wave measurements from 10 remote sites of HF radar are continuously received in real-time.

As more than 70% of the earth is covered by oceans, most of the earth's resources are still unexplored. ESSO-NIOT is involved in developing technologies for the exploration and utilization of ocean resources such as Gas Hydrates, Polymetallic nodules and hydrothermal sulphides. The conceptual design of the deep sea mining machine is nearing completion. An in-situ soil tester with a vibration sinkage facility has been developed and is undergoing laboratory trials. Large casting of Syntactic foam of density 680 kg/m^3 and size 450x450x100 mm^3 was developed, which can be used to develop buoyancy modules for 6000 m depth rating.

The deep water work class ROV ROSUB 6000, developed by ESSO-NIOT, was used for the exploration of hydrothermal sulphides in South Central Indian Ridge region. Real-time live webcasting of the underwater visuals from the SONNE field at Rodriguez Triple Junction was demonstrated for the first time in the country.

Importance of underwater instruments in the area of ocean technology cannot be over emphasized. As a part of the programme to develop indigenous instruments an in-house developed Autonomous Underwater Profiling Drifter was deployed off Cochin in the Arabian Sea. The float completed 130 profiles at a depth of 1620 m and collected good quality data. A drifter with GPRS communication system was developed for coastal current measurements. The indigenous technology developed for Tsunami Test Rig and drifter buoy was given to National Research Development Corporation (NRDC) for commercialization as a part of technology transfer.

The necessity of acoustic based systems in underwater applications is well established and the Marine Sensor Systems group has developed a prototype Buried Object Scanning Sonar system which has been successfully tested in the sea. During the sea trials partially buried objects in sea bed were detected.

Passive acoustic measurements in underwater provide significant information on the ocean environment. The autonomous ocean ambient noise measurement system has been proven in the sea for continuous measurements with real time data reception. Ministry of Defense appreciated this unique achievement and expressed sites of interest for deployment of the system. Towards upgradation of the Acoustic Test Facility (ATF), the Ocean Acoustics group has also established a low frequency calibration setup and made operational at ATF in August 2013. In order to bring ATF as a Nationally Designated Laboratory in underwater acoustics, Inter Laboratory Comparison test for hydrophone calibration has been carried out with National Physical Laboratory United Kingdom, Bundeswehr Technical Centre for Ships and Naval Weapons, Naval Technology and Research, (WTD) Germany and Russian Metrological Institute of Technical Physics and Radio Engineering, (VNIIFTRI), Russia. ESSO-NIOT scientists participated in the calibration carried out at these laboratories.

Real time Ocean observations are vital for any activity along the coast or offshore and ESSO-NIOT has been maintaining 12 OMNI buoy network, 4 coastal buoy network and 4 tsunami buoy network continuously. Towards indigenization, a twin mode communication with INSAT

and INMARSAT for Tsunami system was developed and implemented. The BPR system ITB03 triggered to Tsunami event mode on 21-03-2014 and worked in twin mode successfully. As part of capacity building, the scientists of the Ocean observation systems group participated in the cruise on board US Ship Roger Revelle along with INCOIS, Woodshole Oceanographic Institute, Scripps Institute of Oceanography– USA, NARA – Srilanka, during December 2013 to study the upper ocean process in Bay of Bengal under Air-Sea Interaction Research Initiative (ASIRI) project using Wire Walkers, Underway CTD sensor, ADCP, Bow Chain, Spray Buoy and Vertical Micro-structure Profiler (VMP).

New findings have brought cheers under Marine Biotechnology programme wherein a new species of Streptomyces producing pyrrolo-pyrazine derivatives was isolated from deep sea sediment and cultured at 80 bar pressure in a high pressure and low temperature microbial cultivation system. The group effectively demonstrated open sea cage culture by Capture-based aquaculture of milkfish (*Chanoschanos*) in open sea cages using formulated diet by stocking 5-8 g milkfish seeds which attained an average weight gain of 770 g in 260 days. The group has been working on management of ballast water and an International Conference on Advanced Technologies for Management of Ballast Water and Biofouling (MABB 2014) was successfully organized and conducted during 4-7, March 2014 at ESSO-NIOT. Delegates from various countries such as USA, Netherlands, France, Germany, Singapore and Hong Kong participated.

ESSO-NIOT ships continue to serve the ocean research community by providing world class platforms for technology demonstration and data collection. Preliminary design of replacement vessels of Sagar Purvi and Sagar Paschimi has commenced.

Propelled by the encouragement and support from the Ministry of Earth Sciences and all our well-wishers this voyage continues. ESSO-NIOT will continue to strive hard for the development and demonstration of technology for the exploration of living and non-living resources. We, at ESSO-NIOT, hope to share more happy tidings with you in the coming years.

MAJOR ACCOMPLISHMENTS DURING 2013-14

- Methodology to develop ocean current turbines for low water current speeds, involving computational fluid dynamics studies, small scale model testing and field trials, was successfully established, paving way for further scaling up.

- International Conference on Innovative Technologies and Management for Water Security (INDACON-2014), was organized and conducted successfully at ESSO-NIOT during 12th-14th February 2014 with a very wide participation from students, academicians, scientists and experts from industry.

- The conceptual design of the undercarriage has been completed and functional tests of existing undercarriage in sandy terrain were carried out. Large casting of Syntactic foam of density 680 kg/m^3 and size 450x450x100 mm^3 was developed, which can be used to develop buoyancy modules for 6000 m depth rating.

- ESSO-NIOT has recommended beach nourishment on north of Pondicherry harbour based on field studies and numerical modeling. Pondicherry government has implemented the beach nourishment scheme, which showed a gain of beach width to an extent of 60m. Newly formed beach received positive response from local population. Seeing the success of proposed soft solution, Pondicherry government requested ESSO-NIOT to restore the lost beach near Gandhi Statue.

- Ocean structures team designed a mooring system and demonstrated the design by deploying five buoys during April 2013 in the Gulf of Mannar Bio Reserve (GOMBR). These are functioning well and GOMBR have conveyed their appreciation.

- Successfully completed ROSUB system exploration sea trial for hydrothermal sulphides in South Central Indian Ridge region.

- Real-time live webcasting of the underwater visuals from the site to ESSO-NIOT was performed in SONNE field at Rodriguez Triple Junction (RTJ) and visuals and data collected.

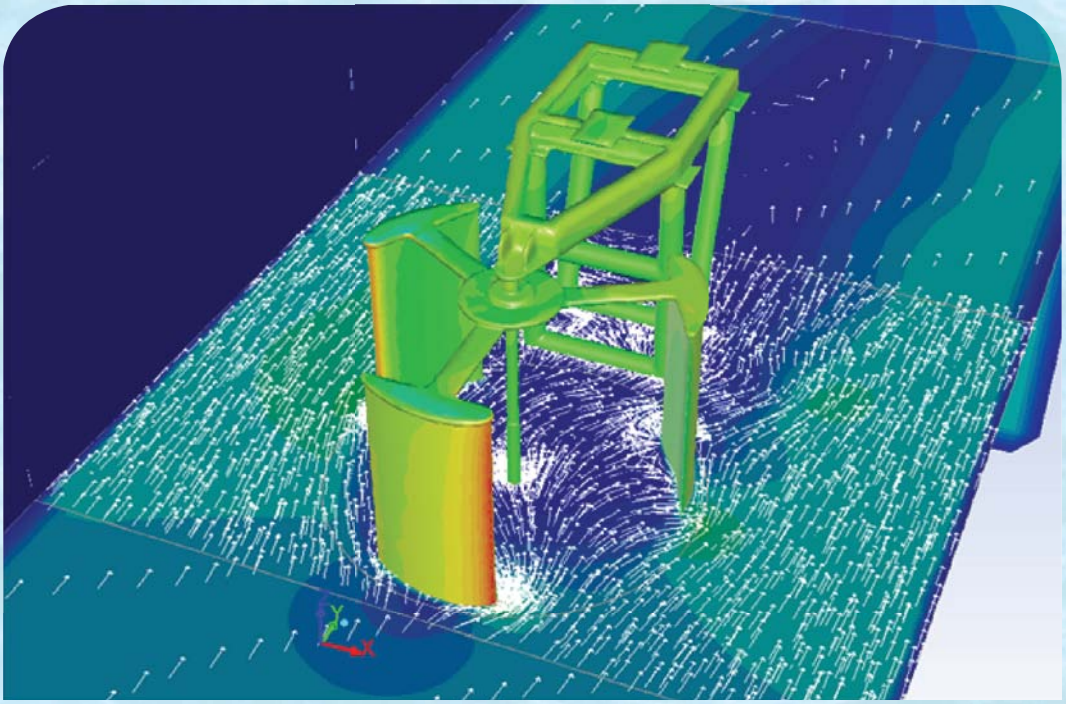
- A low frequency calibration setup has been successfully established and made operational at Acoustic Test Facility in August 2013.
- Inter Laboratory Comparison test for hydrophone calibration has been carried out with WTD Germany and VNIIFTRI Russia. ESSO-NIOT scientists participated in the calibration carried out at these laboratories.
- Indigenized Autonomous Underwater Profiling Drifter was deployed off Cochin in the Arabian Sea and the float completed 130 profiles at a depth of 1620 m, with good quality data.
- Developed Drifter buoy with GPRS for Coastal Current measurements.
- Technology transfer to National Research Development Corporation (NRDC) for commercialization of Tsunami Test Rig and Coastal Drifter Buoy carried out.
- Long shore sediment transport rate has been estimated for Kadalur Peria Kuppam (KPK) site based on field observations and model studies.
- Surface current and wave measurements from 10 remote sites of HF radar are continuously received real time.
- The prototype Buried Object Scanning Sonar (BOSS) system has been successfully tested during the sea trials and partially buried objects in sea bed were detected.
- 12 OMNI buoy network, 4 coastal buoy network and 4 tsunami buoy network have been functional continuously.
- As a part of indigenous development, data acquisition system to collect, transmit meteorological, surface and sub-surface ocean parameters similar to OMNI system was developed, and deployed at AD04 location which is measuring and transmitting 105 parameters in real-time and satisfactorily working till date.
- Twin mode communication with INSAT and INMARSAT for Tsunami system was developed and implemented. The BPR system ITB03 triggered to Tsunami event mode on 21-03-2014 and worked in twin mode successfully.

- A new species of Streptomyces producing pyrrolo-pyrazine derivatives was isolated from deepsea sediment and cultured at 80 bar pressure in a high pressure and low temperature microbial cultivation system.

- Capture-based aquaculture of milkfish (*Chanoschanos*) in open sea cages using formulated diet was successfully demonstrated by stocking 5-8 g milkfish seeds which attained an average weight gain of 770 g in 260 days.

- Preliminary design of replacement vessels of Sagar Purvi and Sagar Paschimi have commenced.

TECHNOLOGY DEVELOPMENT – RENEWABLE ENERGY AND FRESH WATER FROM THE SEA



Predicted flow pattern around the 0.8 m diameter straight bladed ocean current turbine using CFD

Studies on Interface system for the proposed 10 MLD offshore desalination plant with motion simulator built In-house

TECHNOLOGY DEVELOPMENT – RENEWABLE ENERGY AND FRESH WATER FROM THE SEA

The main area of focus of Energy and Fresh Water Group is to conduct research in order to develop technologies for producing freshwater and clean energy from the ocean. Presently, the group is working on the following specific areas:

- Fresh water production using Low Temperature Thermal Desalination (LTTD) process
- Ocean Renewable Energy
- Studies on increasing efficiencies of renewable energy and desalination components

In addition, efforts are on, to transfer the LTTD technology to the society through industrial partnership.

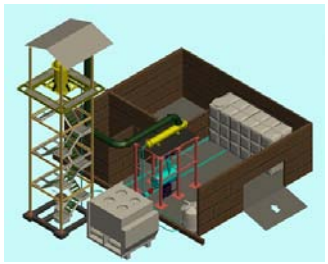
Waste Heat Utilization from Power Plants for LTTD Applications

Studies continue in the LTTD plant set up in the North Chennai Thermal Power Station (NCTPS) using condenser reject heat as feed water to the plant. A Plate Heat Exchanger (PHE) was used in place of the Shell and Tube Condenser (STC) for the first time due to the corrosion on STC tubes and fresh water was successfully generated. The PHE was analysed for its suitability with regard to the available cold and warm sea water flows using heat exchanger design and simulation software by Heat Transfer Research Institute (HTRI) and further performance evaluation is being carried out. Also, the carbon steel piping and fittings of the plant have been lined with Fibre Reinforced Plastic (FRP) in order to mitigate the corrosion due to sea water; and structural members were painted as part of annual maintenance.

LTTD with PHE as condenser

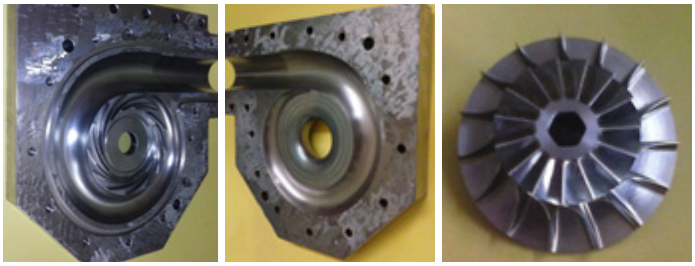
STUDIES ON TURBINES

R134a Radial Inward Flow Turbine for 2 kW OTEC-Desalination Laboratory Setup



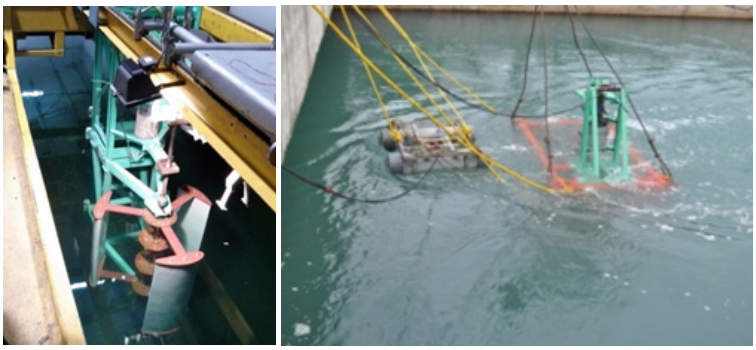
Layout of upcoming OTEC Desalination Laboratory in ESSO-NIOT

The layout of the upcoming OTEC-Desalination Laboratory for simulating the ocean thermal energy conversion cycle and the low temperature thermal desalination process on a smaller scale is ready. Procurement of system components designed for this laboratory is under progress. A 2 kW radial inflow turbine with R134a as working fluid has been fabricated and is currently under final stages of testing. Studies on control systems to regulate the seawater and R134a flow rates and temperatures are being carried out.



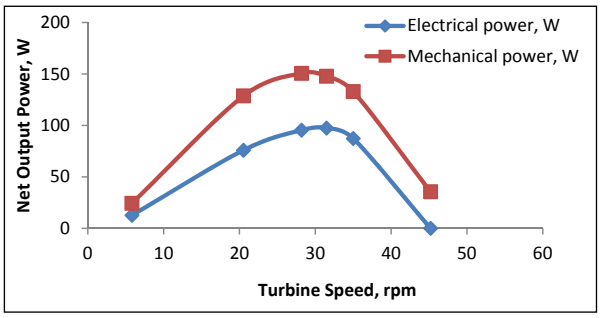
Volute casing halves (left and right) and the rotor (at centre) of 2 kW radial inward flow turbine to work on R134a is ready for assembly

Ocean Current Turbines



0.8 m diameter straight bladed ocean current turbine being tested at towing tank facility (left) and at NCTPS channel (centre and right)

ESSO-NIOT is actively developing technologies related to harnessing energy from ocean currents. With the insight gained from the earlier design and testing, a straight bladed current turbine was designed to generate 100 W at water velocity of 1.2 m/s from a permanent magnet generator coupled to the turbine. The flow over turbine blades and the structure was simulated in 2D and 3D and the performance of this configuration was studied. This was followed by actual fabrication of this configuration, which was tested in towing tank facility at IIT Madras. A torque sensor was used to measure the net torque output and rotational speed of the turbine. This was followed by field testing of the turbine in the condenser seawater outfall channel of the North Chennai Thermal Power Station. The channel is 15 m wide and has water depth of 1.75 m. Water in this channel flows at ~ 1.2 m/s. Testing of this turbine in the laboratory and in the field confirmed that the turbine performance is in line with the design.



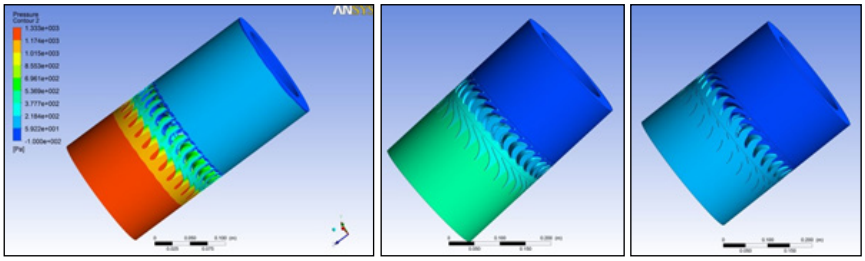
Performance test results of ø 0.8 m straight bladed ocean current turbine in NCTPS channel

In a joint development project with the IIT, Madras, an axial turbine of diameter 1.56 m and with three blades was designed and tested in the towing tank facility, where it generated net mechanical power output of 160 W at incoming water velocity of 1 m/s. Further work on this turbine is under progress. The success in establishing the development methodology as outlined above paves way for further scaling up of ocean current turbines.

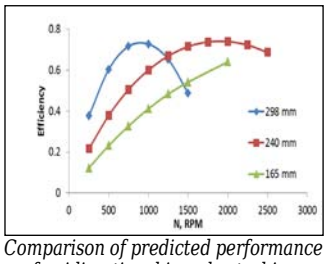
Floating Type Wave Energy Device – Backward Bent Ducted Buoy (BBDB)

In parallel with the CFD studies on unidirectional turbine fitted on BBDB in earlier sea trials, BBDB was prepared for study of its pneumatic performance in open sea. In this study, the orifices of different diameters providing OWC damping equivalent to the turbines of different diameters were used in place of the turbines. Accurate air flow measurement in misty atmosphere around BBDB in sea is a challenging task. For this, these orifices were calibrated in laboratory for estimation of air flow rate from pressure drop taking place across them. Also averaging type air flow meter was fitted in the duct with orifice in order to provide a double check on the air flow rate measurement. The BBDB was deployed off Kamarajar Port with an additional aim to assess its pneumatic performance with single point and multipoint moorings.

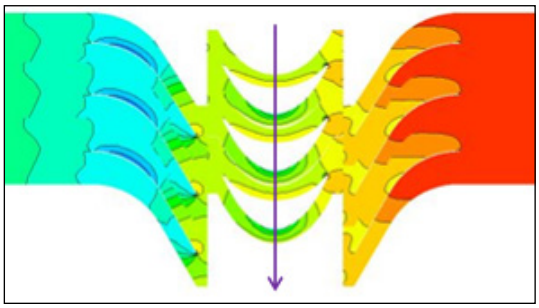
Turbine development for wave energy device



CFD analysis of unidirectional impulse turbines for wave energy with 165 mm, 240 mm and 298 mm diameter



Comparison of predicted performance of unidirectional impulse turbines for wave energy device BBDB with different diamter for the same air mass flow rate (0.2 kg/s)



Pressure contours for a 298 mm diameter fixed guide vane bidirectional impulse turbine

Backward bent ducted buoy equipped with calibrated orifices and air flow meter deployed at Kamarajar Port

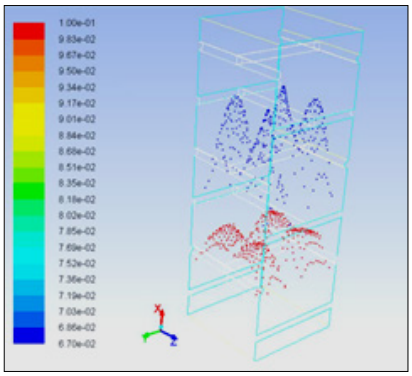
Orifice calibration setup using compressed air built at ESSO-NIOT

ESSO-NIOT is developing the floating wave energy device - Backward Bent Ducted Buoy (BBDB) for smaller coastal power requirements. Open sea trials on BBDB equipped with a 165 mm diameter unidirectional impulse turbine revealed that the sizing of the turbine needed optimization to suit pneumatic performance of BBDB. Hence the performance of this type of turbines with different diameter was predicted applying principles of CFD. Commercial code ANSYS CFX was used for this exercise and frozen rotor method was used for simulating the flow over turbine blades. Similarly performance evaluation of fixed guide vane impulse turbine also is under progress in a joint effort between ESSO-NIOT and IIT Madras.

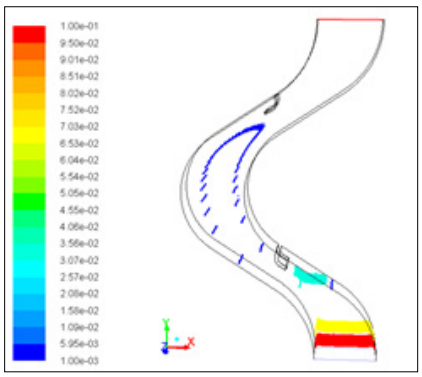
Studies on Heat Exchangers and Demisters

A small experimental setup at NCTPS using condenser reject water was installed and fresh water generated. Various types of demisters have been procured and will be tested at the experimental setup, the performance results will be used to validate numerical predictions, which would be useful in designing higher capacity plants. Currently various parameters are being measured for decisions towards usage of suitable instrumentation for accuracy in measurements towards optimization.

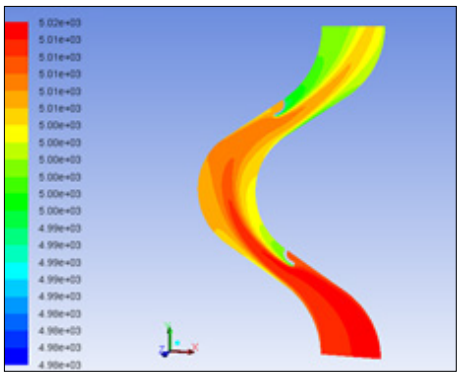
A numerical investigation to predict the performance of a wire mesh and a C-shaped vane type demister in terms of filtering efficiency and pressure drop using CFD based commercial code ANSYS-FLUENT 14.0 was carried out. In this exercise, the Rosin-Rammler diameter distribution and Discrete Phase Model (DPM) was used to simulate the two phase flow of seawater droplets and water vapor inside the demisters. The findings from this exercise can be utilized in designing demisters in the LTTD plants where generation of boiler quality water with Total Dissolved Solids (TDS) at less than 1 ppm is being attempted.



Predicted droplet tracks coloured by diameter in wire mesh demister



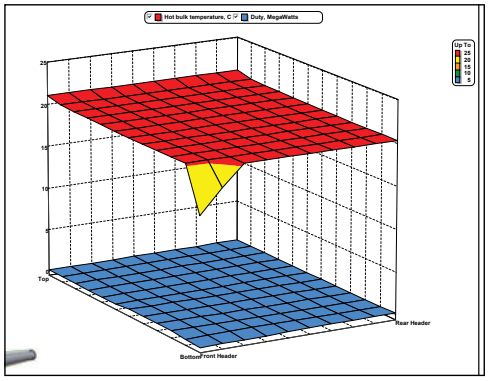
Predicted droplet tracks coloured by diameter in C-shaped vane type demister



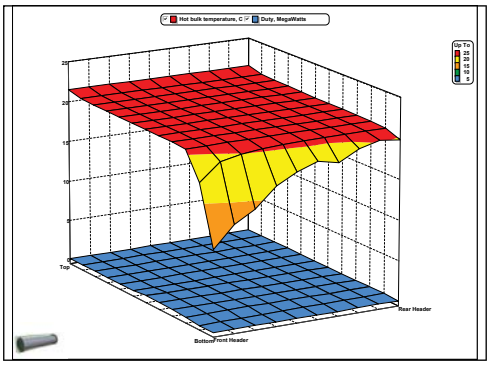
Total pressure contour (for inlet velocity= 8m/s)

Solar desalination - DST sponsored programme

A 6 m^3/hr capacity solar driven multi-effect thermal desalination system was commissioned at Ramanathapuram by M/s K G Design Services Pvt Ltd. in association with ESSO-NIOT under the sponsorship of Department of Science and Technology (DST). Various trials were carried out combining solar and bio-mass steam generators. Parametric studies proved the design performance interns of quality and quantity, operational simplicity and reliability in addition to unique experiences in the operation of the first solar thermal desalination plant in India.



Hot fluid (pure water vapor + NC gases) temperature profile in LTTD condenser



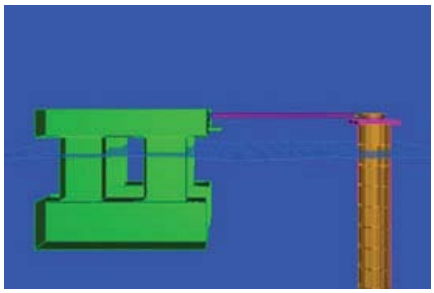
Hot fluid (pure water vapor) temperature profile in LTTD condenser

Setting up of LTTD Plants in Coastal Power Plants and 10 MLD Floating Vessel Mounted Desalination Plant

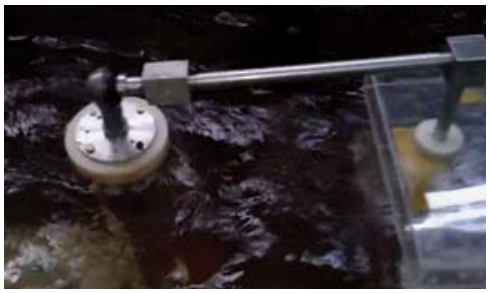
As part of LTTD plants in coastal thermal power stations, several meetings were held with contractor's process design consultant regarding the optimization of power consumption. Process design and preliminary drawings for the civil structure, piping, flash chamber, condenser etc. received from the contractor were reviewed by the group and the group's comments have been sent to the contractor for improvement in the design of the 2x1 MLD LTTD plant at Tuticorin Thermal Power Station in South Tamilnadu. The Non-Condensable (NC) gases effects on the condenser was studied in HTRI software by comparing pure water vapor condensation and mixture of water vapor and NC gases condensation in condenser.

As part of the DPR for the 10 MLD offshore LTTD plant, the first 3 stages of design (out of 5) were reviewed by the group and the group's suggestions for design optimization have been given to the contractor through discussions and hand holding efforts. Preparation of the full design is in advanced stage of completion.

As part of the in-house R&D exercise at ESSO-NIOT, numerical and physical model studies on the dynamic behaviour of the interface system have been undertaken. This interface system connects floating LTTD plant platform to floating conduit housing deep sea water pipes. Simultaneously, experimental studies on interface system using in-house built motion simulator have also been undertaken.

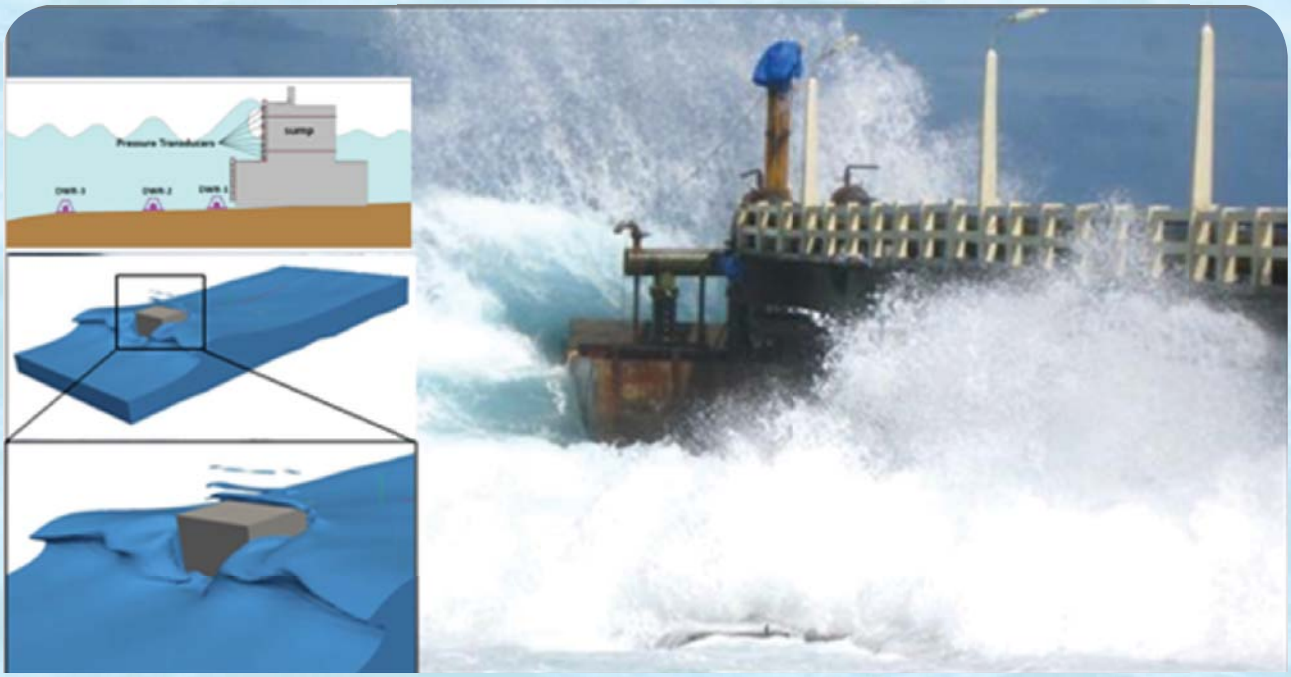


Numerical simulation in MOSES for investigating the behaviour of the interface system



Model test in wave flume for investigating the behaviour of the interface system

OCEAN STRUCTURES



Ocean Structures subjected to High Waves

Cross impacts of hard solution

Proposed soft solution to minimize impacts of hard solution

OCEAN STRUCTURES

ESSO-NIOT has been developing several ocean structural components for various programmes like desalination, mining and data buoys for exploration or exploitation of ocean resources. These include pipelines/risers, moorings in deep water for small buoys as well as large vessels. The need for developing several ocean structural components has been felt for most of the projects handled in ESSO-NIOT. The objective of the group is to provide innovative design solutions through continuous research and demonstration projects to cater to the needs of the institute programmes as well as industry, in offshore installations. The group addresses such needs and the following projects/programmes are being handled by group in XII plan.

- Establishing desalination plants in the Islands of UT Lakshadweep
- Development of technologies for offshore structural components
- Submerged Offshore Reefs for beach restoration at Pondicherry coast.

ESTABLISHING LTTD BASED DESALINATION PLANTS IN LAKSHADWEEP ISLANDS

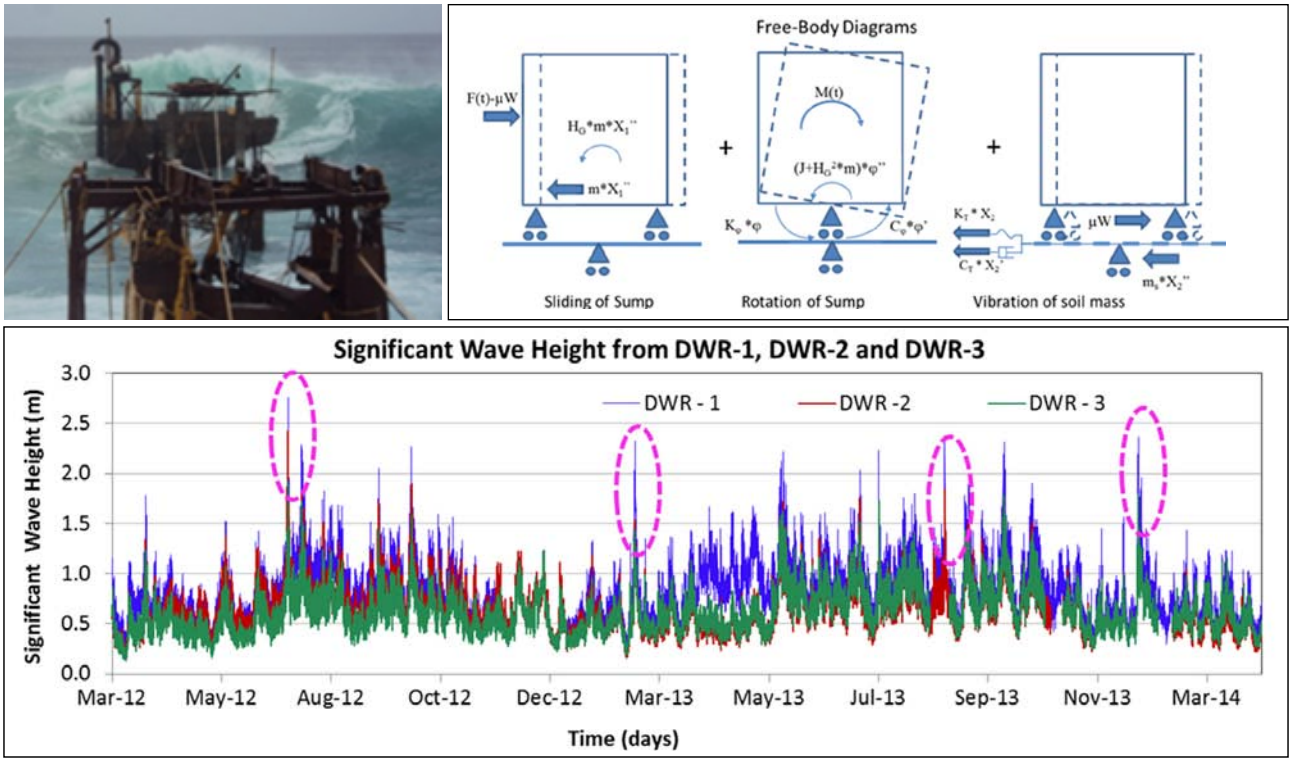
Detailed Project Report (DPR) on Establishing LTTD plants in Lakshadweep Islands (Androth, Amini, Chetlat, Kadmat, Kiltan and Kalpeni) for obtaining approval was provided to Union Territory of Lakshadweep Administration. Technical support was extended for maintenance and continuous operation of the installed plants. Modification on process system undertaken through studies at Agatti and Minicoy plants had improved the quality of water. Specific studies on analysis of condenser tube vibration and vortex induced motion on shallow water region of cold water pipe are being taken up. Deaerator studies for the further improvement of plant performance are being carried out at Agatti plant.

DEVELOPMENT OF TECHNOLOGIES FOR OFFSHORE STRUCTURAL COMPONENTS

Wave Structure Interaction Studies for Estimation of Wave Forces

Wave structure interaction studies to estimate the reliable wave loads on structures are initiated based on the experience of Agatti desalination project, which is subjected to damage due to high wave loads. The objective of this study is to estimate wave loads on structure by measuring the wave pressure on seawater intake caisson, which will be used in design of such marine structures in future. Field studies are being conducted around the caisson at Agatti. Wave and Tidal measurements are collected by bottom mounted directional wave gauges. An extensive array of pressure transducers was fixed on the caisson to record the incident wave pressure. The wave pressure data analysis was carried out and the total pressure acting on the sump had been estimated for the pre monsoon, monsoon and post monsoon seasons.

The response of the intake structure for rocking frequency under wave action was analyzed using recent research work carried by G.Cumomo et al (2010), Wang et al. (2006) and Oumeraci and Kortenhau (1993). A MATLAB code was developed to study the dynamic response of intake



Field and Numerical representation of Wave Structure Interaction study

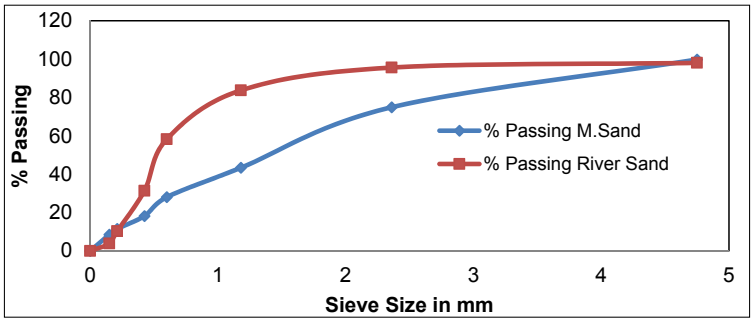
structure under wave impact force for vibration, sliding, uplift and overturning. Numerical model (Open Foam) had been employed to estimate the total forces acting on the structure. Numerical model for standard breakwater case has been tested, where laboratory results are available for comparison. Later, the model had been constructed for the Agatti intake structure, for the measured incident wave condition and bathymetry. The comparison of numerical model results with field observations indicated good correlation and showed its merits in application of this model to prototype structures.

Material studies for desalination and other offshore structures

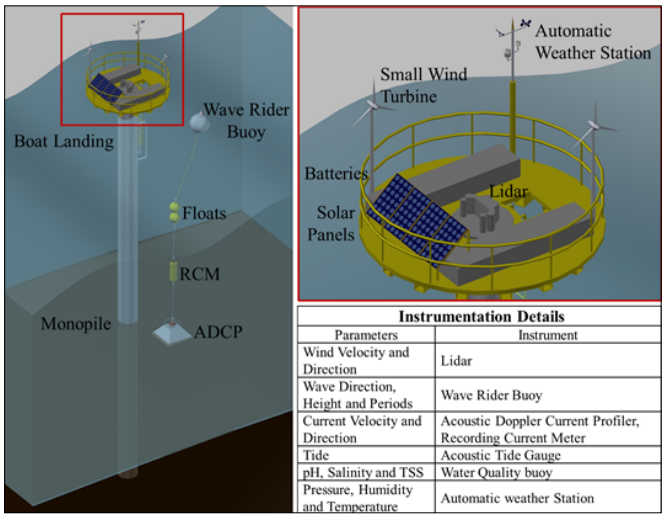
The laboratory and prototype studies for qualifying the Glass Fiber Reinforced Plastics (GFRP) material as an alternative to High Density Poly Ethylene (HDPE) have been completed and qualified based on the test results. It is proposed to deploy qualified GFRP pipes at shallow water region in the Minicoy desalination plant to monitor and verify the performance of GFRP pipe subjected to real sea environment conditions.

The marine structures required for the desalination process consist of sea water intake well, building to house the plant components and reinforced concrete bridge. Considering the ban on transport of river sand to U.T Lakshadweep Islands from nearby States like Karnataka and Kerala it was proposed to use manufactured sand (M.Sand) as an alternative to River sand. Samples of M.Sand have been procured from the state of Kerala and laboratory tests have been carried out to ascertain the properties of M.Sand. It was found out that the properties of M.Sand

are in-line with river sand and an initial trial mix design has been carried out. It is proposed to carry out long term durability studies on concrete using M.Sand exposed to adverse marine environment conditions.



Properties of M.Sand – Alternate to River sand for Marine structures



Instrumentation Details

Parameters	Instrument
Wind Velocity and Direction	Lidar
Wave Direction, Height and Periods	Wave Rider Buoy
Current Velocity and Direction	Acoustic Doppler Current Profiler, Recording Current Meter
Tide	Acoustic Tide Gauge
pH, Salinity and TSS	Water Quality buoy
Pressure, Humidity and Temperature	Automatic weather Station

Layout of the proposed LIDAR based offshore data collection platform

Feasibility studies on fixed and floating platform for offshore wind turbine

India being a developing nation is not able to meet the required energy demands through existing installed capacities. Offshore wind being pollution free would be an ideal solution to meet the increasing demand, as Indian coast is blessed with high wind speeds. Realizing this, Ministry of New and Renewable Energy (MNRE) is in the process of finalizing the offshore wind policy. But offshore wind would be commercially viable only if the increase in substructure cost can be compensated by increased offshore wind speeds. So, it is essential to identify wind potential sites and optimum substructure configuration for Indian conditions.

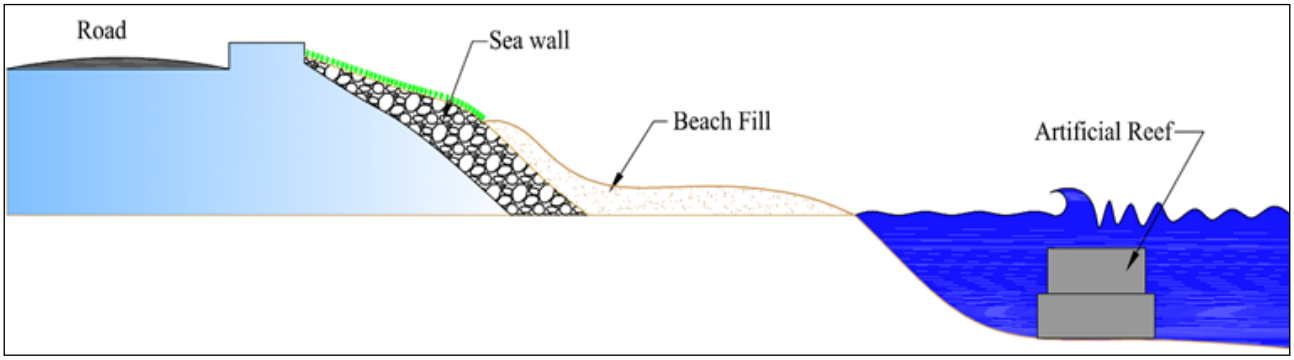
Preliminary Wind Resource assessment studies indicate 3MW Turbine operated at high Plant Load Factor (PLF) among commercially available turbines in the range of 1.5MW to 5MW. Study indicates significant Internal Rate of Return (IRR) of above 12% for offshore wind farms at Rameshwaram and Kanyakumari. To validate these results a LIDAR based Metocean data collection platform is being proposed and the substructure design of the same considering environmental conditions at Jakhau, Gujarat is completed. The critical aspect in design of substructure for offshore wind turbine is reliable estimation of aerodynamics. The aerodynamic loads are estimated using open source code FAST and design of substructure concepts Monopile and Jacket are updated accordingly.

Submerged Offshore Reefs for Beach Restoration at Pondicherry Coast

ESSO-NIOT had recommended to implement beach nourishment on the north of Pondicherry harbour based on the field studies and numerical modeling. Pondicherry government has implemented the beach nourishment scheme, which showed a gain of beach to an extent of 60m. The newly formed beach received positive response from local population.

Performance of beach nourishment implemented at Pondicherry and visit of Secretary, MoES to the site

Seeing the success of proposed soft solution, Pondicherry government requested ESSO-NIOT to restore the lost beach near Gandhi Statue in the Pondicherry town. Beach nourishment with two offshore reefs is proposed for restoration of beach at Pondicherry town based on the feasibility studies and desk studies. A detailed design to restore beach for a coast line of 1.5km has been evolved and ESSO-NIOT is in the process of implementation of the above strategy with the support of external consultant after obtaining necessary approvals from the concerned authorities.

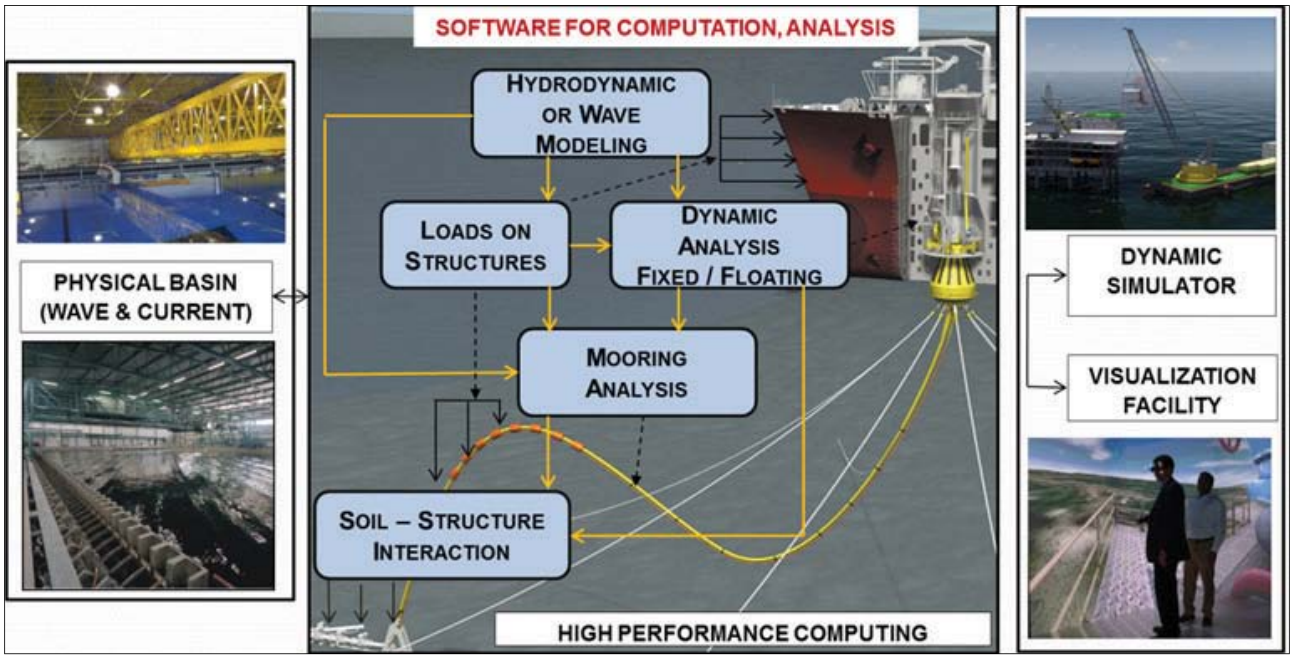


Proposed beach restoration strategy with two offshore reefs off Pondicherry

Development of Numerical Offshore Tank facility for offshore production systems for exploration or exploitation of ocean resources

The preliminary work for the establishment of Offshore Numerical Tank has been completed, which includes the collation of requirements for various components such as the physical basin, software codes for analysis, visualization, simulation and computational facilities. A comprehensive inventory on available software for environmental forcing, hydrodynamic and structural analysis, and 3D visualization / animation tools for offshore dynamics has been carried out. Functional requirements of physical wave basin are drafted based on those of similar

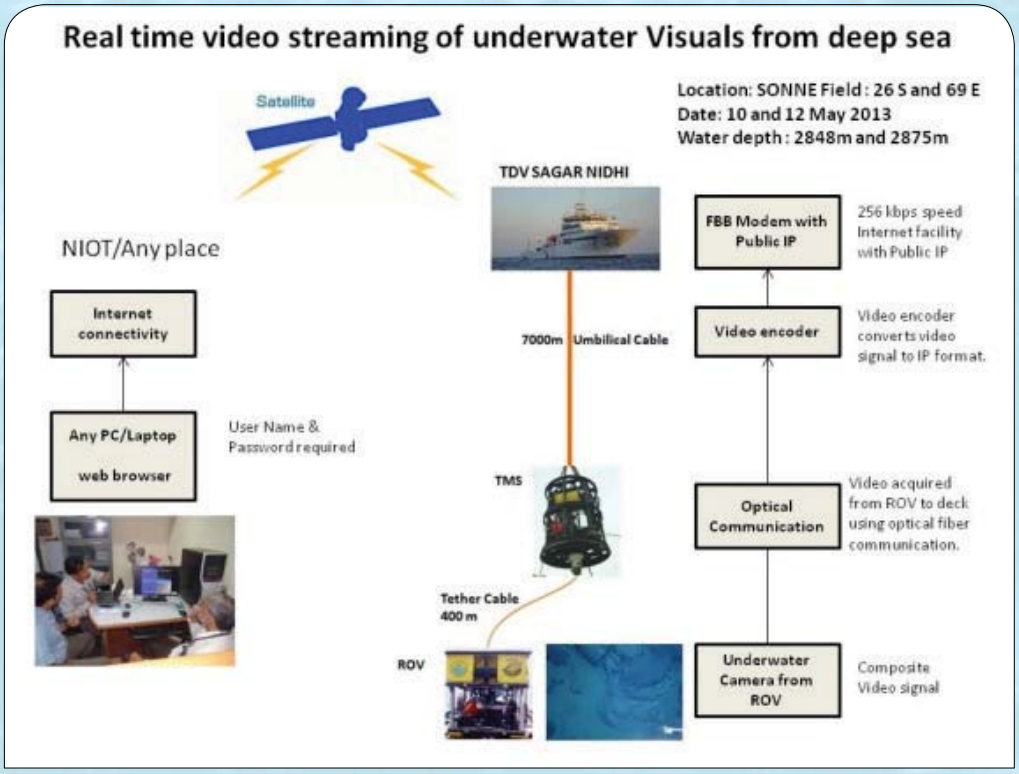
facilities worldwide for testing of offshore installations for the preparation of project report for Offshore Numerical Tank.



Schematic Representation of Offshore Numerical Tank

DEEP SEA TECHNOLOGIES

Undercarriage testing on sandy terrain



DEEP SEA TECHNOLOGIES

The deep sea technologies programme has the mandate to develop technologies for mining ploy-metallic manganese nodules from Central Indian Ocean Basin and concentrates on development various sub-systems related to ocean mining. The group is also involved in the development of technological tools such as Remotely operable vehicles and autonomous coring systems for the exploration of deep ocean resources and offshore applications such as seabed imaging, pipeline and subsea cable inspections.

INTEGRATED MINING SYSTEM (IMS) FOR MINING POLYMETALLIC NODULES FROM 5000-6000 m DEPTH

Configuration and Handling studies on Flexible Riser system for IMS 6000m depth

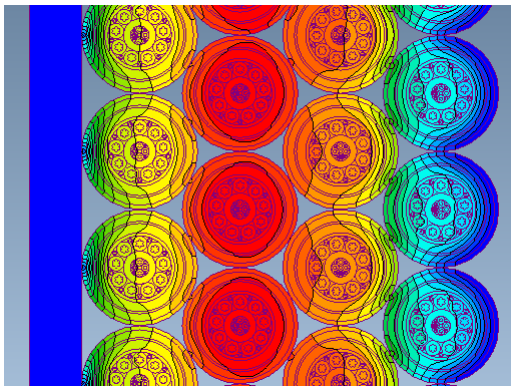
Flexible riser system is proposed in the mining system to transport the crushed nodule slurry from 5000-6000 m depth to mother ship. Based on the in-house expertise technical specification was prepared for configuration and handling studies global tender for flexible riser system to bring-in universal expertise for carrying out the complex operation.

Hose testing for maximum burst pressure

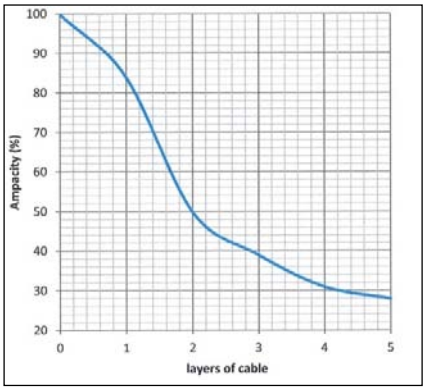
Suitable lay flat hose is identified for the 6000m pumping operation and testing of the sample hoses was conducted in house to study the max pressure withstanding capability.

Analysis of umbilical cable

Heat dissipation capability of sub sea cables wound on reels/winches was studied using Magnet and Thermnet FEA software to estimate the amount of Ampacity reduction in sub-sea cables. Results were compared and validated with the experimental tests on the same type of cable and it will help in limiting the current in the corresponding the layers of cable on the winch.



Thermal Analysis of sub- sea cable wound on winch



Ampacity reduction when wound on winch

Development of Crawler undercarriage unit and Soil mechanics study

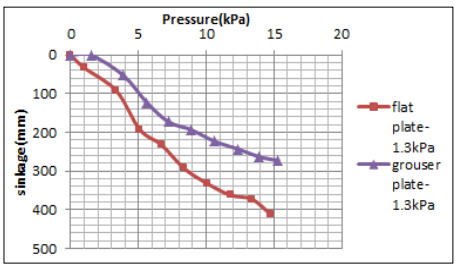
The sandy terrain tests for undercarriage were done to calculate the maximum traction force. A single track test setup was made and driven hydraulically on a sandy bed of size 9m x 3m x 0.5m. Functional tests for calculating the traction force for various speeds and bearing pressures were conducted on the sandy terrain.

Undercarriage testing on sandy terrain

The output from these tests will be utilized for the traction test in Bentonite bed for calculating the sinkage & soil resistance. A suitable size tank for the Bentonite soil was fabricated and the tank is equipped with a soil mixer to prepare the soil bed with uniform strength of 1-3 kPa. Sinkage and pullout tests were performed for flat plates of size 0.5 x 0.5 x 0.012 m and plates of same dimensions with involute teeth of height 140mm attached to it on a Bentonite bed of dimensions 4m x 3m and a depth of about 0.8 m. The pressure –sinkage curve revealed that the grouser plate has less sinkage in soft soil when compared to the flat plate. Sinkage and pull out studies for existing undercarriage have been completed to obtain load bearing capacity of soil and the soil bed will be used for various combination of undercarriage studies.

Undercarriage sinkage and pullout tests

Testing of Grouser plates



Pressure sinkage curves on various soil strengths

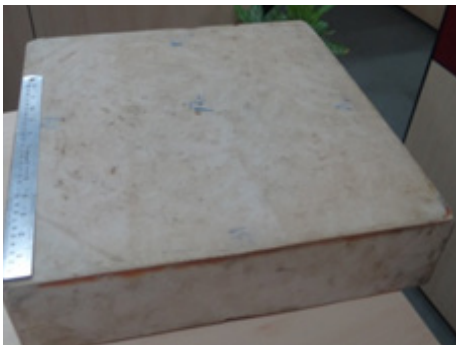
Bentonite tank with soil mixer

Light Weight Material

Efforts are undertaken to reduce the underwater weight of the mining machine. Syntactic foam was developed indigenously from the micro glass spheres. The material can be made in modular blocks or can be cast to a required shape needed. The developed material was successfully tested and qualified in hyperbaric chamber at 600 bar pressure. No water absorption or deformation of the material was observed after the pressure test. The material yielded a tensile strength of

24 MPa and compressive strength of about 55 to 58 MPa. The density of the foam developed is 680 kg/m^3.

Syntactic foam with gel coating

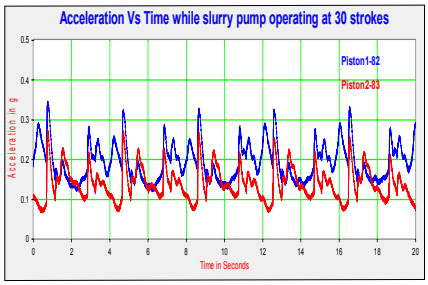


Syntactic foam developed (without coating)

INTEGRATED VEHICLE HEALTH MANAGEMENT SYSTEM

Underwater Health Management System is used for sub-sea applications to measure and monitor the critical parameters of the main system and to give early alarm to the operator in the mother ship regarding the health of the underwater machines. Tests were performed on the sub-components at in-house facility and the signature of the system at different conditions was captured for slurry pump, thrusters, and electrical motor. An Underwater Accelerometer used in the instrumentation of health monitoring system was indigenously developed for 6000 m depth.

Accelerometers mounted on slurry Pump during operations



Acceleration vs Time while operating Slurry pump

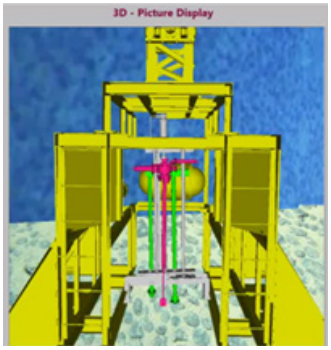
Indigenously developed Underwater Accelerometer for 6000 m depth

Development of upgraded version of In-situ Soil Tester

A Vibration Sinkage Test Apparatus (VSTA) is being developed indigenously which would be incorporated in the already available fully electrical soil tester. Assembly of major sub-components has been

Vibration Sinkage assembly

Sub-sea motor developed for soil tester



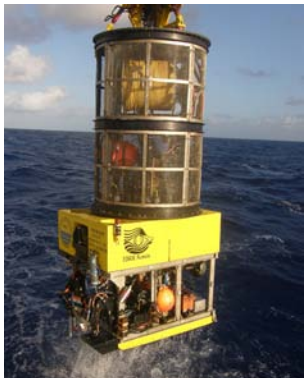
3D real time simulation of soil tester

completed and testing is in progress. A new sub-sea electric motor with the combined cone and vane drive assembly was developed, fabricated and qualified for underwater operations. Integration and assembly in to the main structure of the soil tester and calibration is under progress. A 3D visual real time simulation of soil tester operation during in-situ measurements on the sea bed soil was developed in LabVIEW software.

Inter institutional R&D projects

Deep Sea Technologies is involved in R&D activities in association with various academic and research organisations in India to cater the need of understanding the gaps in deep sea technology to develop ocean mining machine. A few of the projects listed below are under progress.

- Soil-Machine Interaction Studies on Deep Sea-bed Poly-metallic Nodule Mining Systems
- Modelling and Analysis of Sub Sea drive systems
- Studies on Hydraulic Lifting and Plugging of Large solids In Hoses (with Specific Reference to Manganese Nodule Mining using Flexible Riser Concept)
- Development of high strength to weight ratio materials for the body of unmanned underwater vehicle
- Kinematics and Dynamic analysis of different undercarriage configurations
- Studies on Deep Ocean Wave Energy Systems (DOWES)-Power Generation Studies (Phase-I)



RTJ launching at Southern Central Indian Ridge

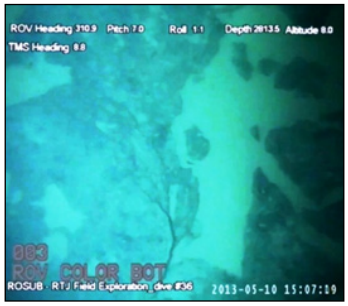
Deep Water Remotely Operable Submersible (ROSUB-6000)

ROSUB-6000 is a work class under water Remotely Operated Vehicle (ROV) with a depth rating of 6000m. The system is intended for exploration of deep ocean minerals such as Polymetallic Manganese Nodules, Gas Hydrates, hydrothermal sulphides etc. Based on the experience gained from previous operations system modifications and improvements were carried out and deep sea exploration was performed at South Central Indian Ridge near Rodriguez Triple Junction (RTJ) site for hydrothermal sulphide exploration in Southern Indian Ocean.

Exploration sea trials of ROSUB 6000 were successfully completed at selected sites near SONNE field at 26°S and 69°E from 15 April to 23 May 2013. ROSUB 6000 was deployed at depths 1512, 200, 2750, 2823, 1310 meters. Videography, oceanographic measurement, still photography and system performance feedback sensing and recording were successfully carried out in SN073 expedition of Sagar Nidhi.

Real time underwater video streaming from Southern Central Ridge exploration site to ESSO-NIOT was demonstrated successfully.

ROSUB system onboard Sagar Nidhi



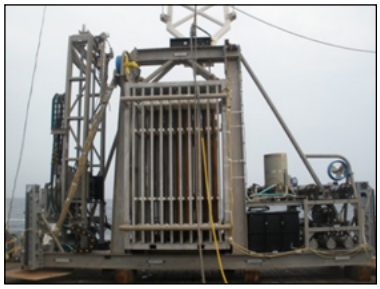
Sea floor image captured at 2814 m depth

Video images from the ROV cameras from the depth of 2814 m were live telecasted to ESSO-NIOT, Chennai at a distance of approximately 4200 km from ORV Sagar Nidhi web casting facility as a first of its kind demonstration.

Further improvement of Sub-sea Power Converter with compact power modules with protection features have been implemented successfully in ROSUB for improving the reliability of the system.

Pillow basalts at dive site

Development of Wire-line Autonomous Coring System (ACS)



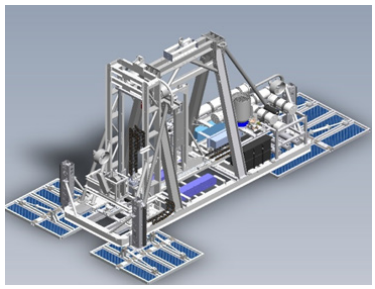
ACS system onboard Sagar Nidhi *Rate valve manifold being tested*

Autonomous Coring System (ACS) has been developed by ESSO-NIOT in collaboration with M/s Williamson & Associates, Seattle, USA for ground truth validation of gas hydrate occurrence in Indian continental margins. System is capable of collecting 100m long core with wire-line technology from ocean basins at a maximum water depth of 3000 m.

ACS has been revamped with maintenance of all hydraulics valve packs, subsea transformer, cable assemblies, drill tools etc. Pressure testing of subsurface power and Variable Frequency Drive (VFD) bottles were carried out with new o-rings in all connectors at hyperbaric test facility of ESSO-NIOT.

A hard ground site in the west coast was identified with the help of NCAOR for conducting deep sea ACS trials. The revamped ACS had been integrated and tested at ESSO-NIOT test facility and from ORV Sagar Nidhi for deep sea qualification sea trials. Vessel sailed for ACS deep sea qualification to the hard ground site south of Cochin offshore during 23 - 31 October 2013 but cruise was called off due to vessel handling system technical issues. Simulation, designing and testing of soft ground feet for ACS has been completed.

Soft feet ground bearing strength test setup

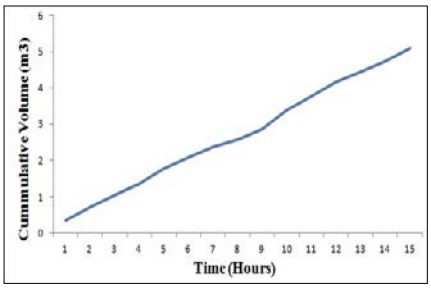


ACS with soft ground foot system design

Gas Hydrate extraction technology

By considering the reservoir settings in identified Indian Gas Hydrates site, simulations were performed using MATLAB and TOUGH + HYDRATE software based on the results from

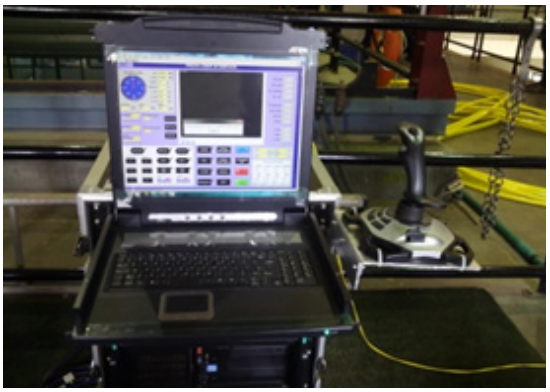
laboratory studies. Results indicate that it is possible to raise the temperature of gas hydrate bearing sediments to the extent required for dissociation by electrical heating. Experiments were performed using the bentonite clay prepared with matching water content and having similar thermal conductivity to the gas hydrate reservoir associated sediment conditions. Extraction results for the given power for 15 hours period is shown in the figure.



Cumulative hydrate dissociation

Shallow Water/Polar ROV

To cater the need of the Indian industry a Remotely Operated Vehicle (ROV) has been designed and developed for shallow water applications like search and recovery, pipeline inspection and visual observation support. It can also be used for polar scientific research in Antarctic and Arctic programs.


Modular surface control cabin

Assembly and Integration of subcomponents such as thrusters, subsea power and electronics, sensors and navigational system were completed. Compact surface control cabin and Deck power converter were realized and tested.

Electro/optic tether termination was designed and realized indigenously for shallow/polar ROV. Realized termination was tested for Electrical, Optical and Mechanical parameters.

Control software was designed and developed for data acquisition and to perform control operation of shallow water ROV. Manual mode control algorithm of vehicle was implemented and tested.

A polar navigation system involving inverted Doppler Velocity Log is designed to make the shallow water ROV amenable for Polar Regions. In-house GPS based dead reckoning mode navigation is developed using Doppler Velocity Log, compass module and developed algorithm for underwater navigation for the challenges in shallow water ROV in adapting high precision Inertial Navigation System.


Shallow water ROV

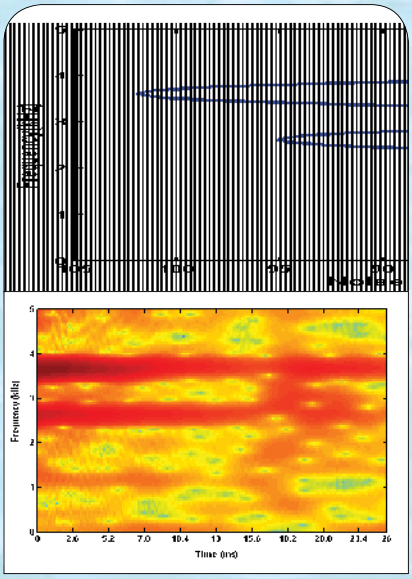
An ice coring tool for polar application has been designed and developed. Integrated dry test of subsea power and was electronics was completed at ESSO-NIOT laboratory.

Manned Submersible

Global tender was floated to identify the suitable joint partner for the design and development of Manned Submersible for the depth rating of 6000 m is under progress. It has 3 crew, diving facility with acrylic view ports. Vehicle personnel sphere will be developed using titanium alloy material with internal diameter of 2.1 m. It has endurance of more than 10 hours at the designated depth of 6000 m. System will be developed with the identified partner within 48 month time period.

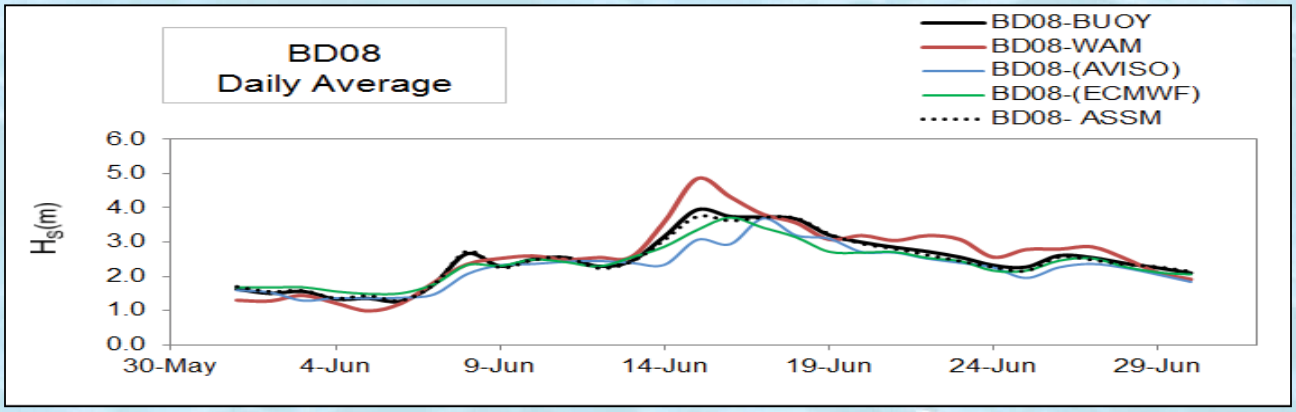
OCEAN ACOUSTICS & MODELING

Ambient noise system at sea during night



Spectrogram and spectrum of biological signature

Low frequency calibration setup at Acoustic Test Facility



Buoy Data assimilation compared with AVISO and ECMWF merged products at OMNI buoy locations (BD08) in Bay of Bengal during 2011.

OCEAN ACOUSTICS

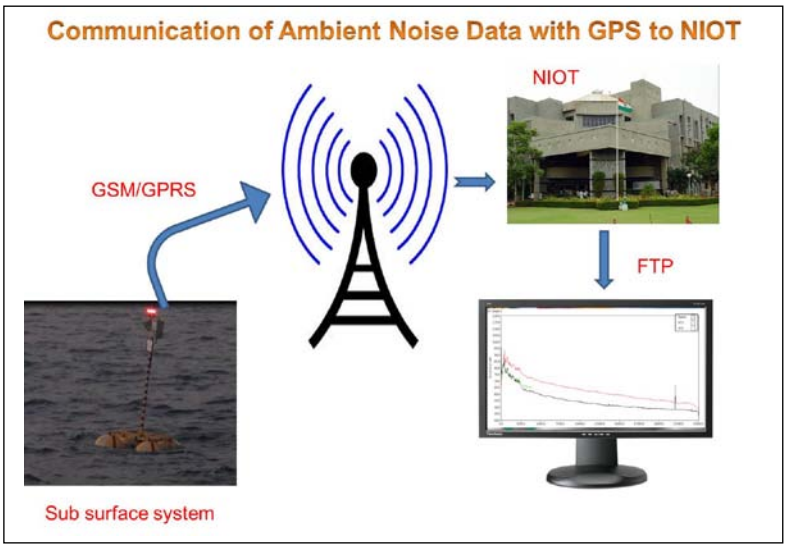
The Ocean Acoustics programme is focussed on the development of acoustic measurement systems, ocean ambient noise analysis, characterization, modeling and applications, sound propagation modeling, and underwater communication. The group also is actively working on enhancement of the Acoustic Test Facility, accredited by NABL (National Accreditation Board for Testing and Calibration Laboratories) for testing and calibration of underwater acoustic transducers that caters to the needs of internal groups and external institutions/organizations.

ESTABLISHMENT OF NETWORK OF AMBIENT NOISE STATIONS ALONG THE EAST AND WEST COAST OF INDIA

A fully automated ambient noise measurement system developed by the group capable of acquiring long term data is being utilized for collecting time series measurements in Indian shallow waters. Ambient noise data communication via General Packet Radio Service (GPRS) was initially demonstrated off Chennai at 16 m ocean depth. The system was deployed during July 2013, after testing in ATF for continuous data acquisition and data communication. The processed ambient noise data was transmitted through GPRS modem and received in real time at ESSO-NIOT as shown in the figure below.

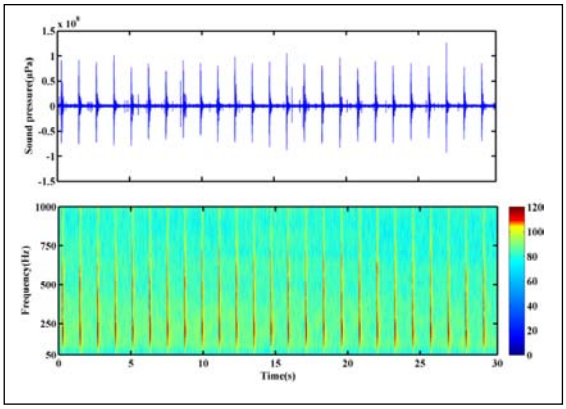
Ministry of Defense, appreciated the achievement of ESSO-NIOT on the development and demonstration of the autonomous ambient noise system and informed ESSO-NIOT, their sites of interest for deployment of the system.

A subsurface system with GSM/GPRS communication was deployed on 7th February, 2014 off Visakhapatnam at a depth of 19 m. The noise data was collected over an extended bandwidth of upto 25 kHz, when compared to the earlier limit of 8 kHz. Data processed as power spectral estimates were transmitted to ESSO-NIOT every 3 hours. The weather parameters such as wind speed/direction, rainfall, air temperature etc. along with the system coordinates and battery voltage were also communicated to ESSO-NIOT. The system was continuously operational in sea for three months and data received at ESSO-NIOT.



Ambient Noise data communication

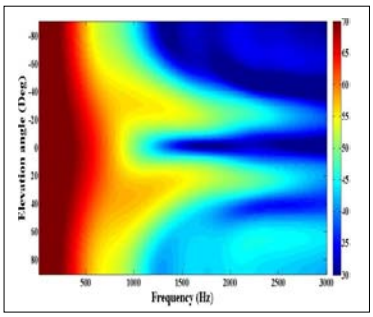
BIOACOUSTICS - EFFECT OF ANTHROPOGENIC ACTIVITY (PILE DRIVING) ON FISHES OFF VIZAG HARBOUR



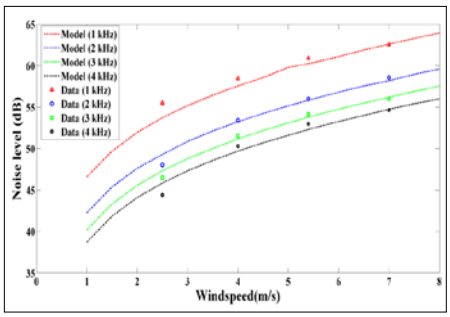
Waveform and spectrogram of noise from impact pile driving off Vizag harbour

Anthropogenic activity commonly occurs in shallow waters and is related to port, harbour, oil and gas platform construction. Sounds from pile driving, results from rapid release of energy when two objects hit one another. Pile driving causes underwater noise that is potentially harmful to the marine environment, particularly to marine fishes. The ambient noise measurement system deployed at 30 m depth off Vizag recorded impact pile driving noise and fish chorus. The frequency bandwidth in pile driving ranges from 50-1000 Hz as shown in the figure and most of the energy is typically below 1000Hz (100-400 Hz). Fishes produced distinct call types. The sound produced by fish species declined immediately after the sound of the impact pile driving.

DEVELOPMENT OF A SHALLOW WATER MODEL FOR PREDICTION OF HIGH FREQUENCY AMBIENT NOISE



Vertical directionality vs angle and frequency for a soft sediment composition



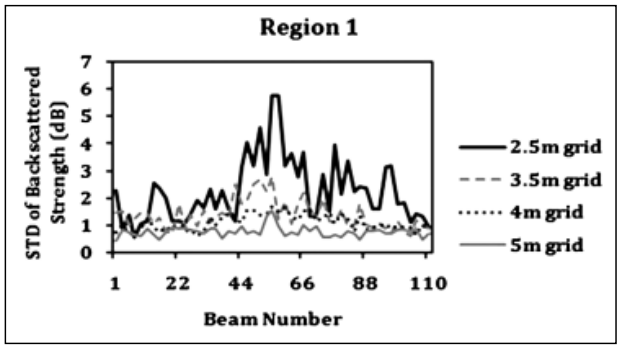
Noise level variation with wind speed and comparison with field measurements.

Measurement of ambient noise for long period of time encounters difficulty considering sensor failure as a result of biological activities and natural calamities. Modelling is an alternative approach to characterize ambient noise field at a particular site. An ambient noise model based on ray theory (**CANARY**-**C**oherence and **A**mbient **N**oise for **AR**ra**Y**s) has been developed to predict the spatial and temporal properties of noise generated due to wind. Spatial properties such as coherence, directionality and ambient noise level due to wind were estimated using the model. Estimated noise properties were compared with field measurements from Cochin site. The modelled results of noise properties compared well with field data with strong correlation. The figures show the modelled vertical directionality for soft sediment composition and the comparison of noise level variation with wind speed.

SEABED CLASSIFICATION/CHARACTERIZATION USING UNDERWATER ACOUSTICS

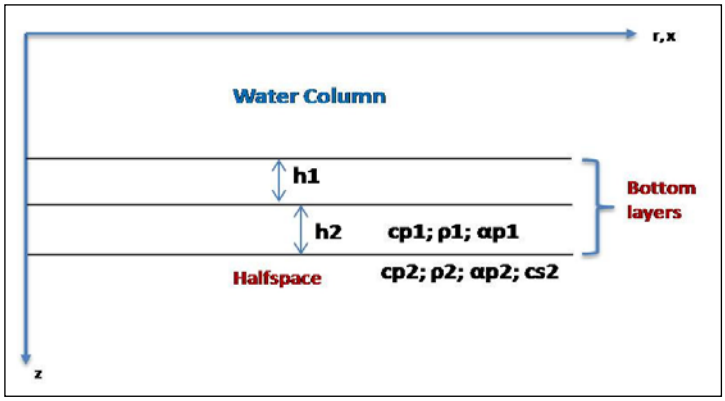
Sea bed classification

The objective is to carry out multibeam data processing for understanding the sea floor features. In multibeam processing, three statistical grid cell methods; mean, maximum and most frequent techniques, each with four grid cell sizes have been applied on backscatter data to reduce the centre beam pattern effect. Gridding offers the solution for smoothening of backscatter value across the swath. From the figure, it is clearly evident that the presence of centre beam pattern effect is reducing with increase in grid cell sizes. Then by comparing the backscatter images obtained from the three grid cell methods, the maximum backscatter value is reduced to an average of 4 dB in mean grid cell method with grid cell size of 5m whereas for other methods the reduction is minimum. Thus the mean grid cell method with 5m grid cell size is the optimum grid cell method that enhances the multibeam data for further spatial analysis to understand the seafloor features.



Standard deviation in backscatter strengths and back-scatter images

Seabed characterization using inversion techniques



Inversion results showing convergence of geoacoustic parameters towards minimum cost function for silty site (left) and sandy site (right).

Model based acoustic inversion techniques are popular in determining the properties of the sea bed. Match Field Processing (MFP) is such an inversion technique that has been applied successfully in characterizing the seabed and layers beneath. Here noise coherence from passive measurements received on a vertical array of receivers has been employed. OASES is the forward model used in MFP, and the model and field parameters have been compared and the error estimate has been quantified based on a cost function. Inversion has been attempted for two locations; off Cochin with silty seabed and off Cuddalore with sandy seabed.

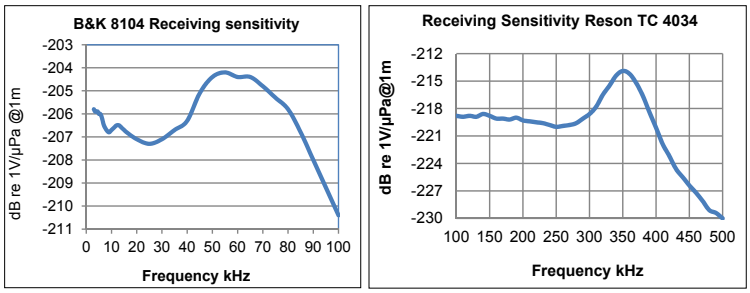
The inversion for the sites with water column, sediment layers and halfspace basement has been attempted with the basement considered to be shear supporting. Sediment layer depths, compressional speed and attenuation, shear speed and density are the various parameters inverted. Genetic algorithm was employed to search over the range of input parameters used

in the model and arrive at the best match. The results for silty and sandy sites are given in the figure.

ACOUSTIC TEST FACILITY

During ILC at WTD71, Germany

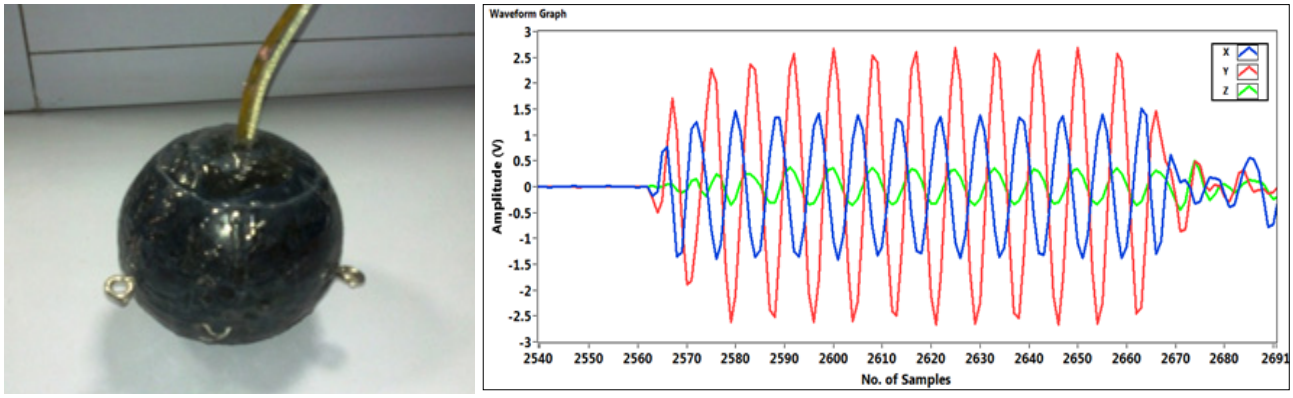
Towards upgradation of Acoustic Test Facility, Inter Laboratory Comparison (ILC) Test for hydrophone calibration with internationally acclaimed laboratories, has been taken up with the institutes National Physical laboratory, UK, Bundeswehr Technical Centre for Ships and Naval Weapons, Naval Technology and Research - WTD 71, Germany Hydrophone and Russian National Research Institute for Physical-technical and Radio Engineering, Measurements (VNIIFTRI), Russia. ESSO-NIOT hydrophone model B&K 8104 and Reson TC 4034 were sent to these laboratories and calibration was carried out. ESSO-NIOT scientists participated in the calibration at WTD Germany and VNIIFTRI Russia and discussed the calibration methodologies. ATF is being utilized external organisations such as by Solid State Physics Laboratory (SSPL) Delhi, CEDICOM, Keltron and in house projects of ESSO-NIOT.



Calibration result B&K 8104 at WTD Germany and Reson TC4034 at VNIIFTRI Russia

DEVELOPMENT OF VECTOR SENSOR ARRAY FOR UNDERWATER ACOUSTIC SOURCE LOCALIZATION AND SIGNAL ESTIMATION (JOINTLY WITH KELTRON ELECTRO CERAMICS, KUTTIPURAM)

Vector sensors measure the acoustic pressure and the particle velocity components, and are normally configured as Vector Sensor Arrays (VSA). This type of sensor has the ability to provide information in both vertical and azimuthal directions. The spatial filtering capabilities of a VSA can be used, with advantage over traditional pressure only hydrophones arrays, for source localization and for estimating acoustic field directionality as well as arrival times and spectral contents, which open up the possibility for its use in sea bottom properties estimation. An Inertial type vector sensor prototype was designed and developed incorporating a piezo-ceramic cylinder for acoustic pressure measurement and tri-axial accelerometer for particle velocity measurement. The prototype has been tested in Acoustic Test Facility, ESSO-NIOT as given in the above figure. The unit has been made neutrally buoyant and spherical.



Vector sensor prototype and data in x, y and z direction

MODELING OF OCEANIC PROCESSES

BUOY DATA ASSIMILATION INTO WAVE MODEL

Numerical wave models in general do not compare accurately with true measurements such as moored buoy measurements due to various assumptions in the model physics, low resolution input such as bathymetry, wind forcing etc. Forecasting of waves with such under-predicted models will have a tendency to show growing modes of errors and deviate from the true measurements. Hence 'Data Assimilation', i.e., assimilating the numerical model with the measurements to steer the model towards the truth is highly essential for accurate assessment of wave parameters.

Wave model

A third generation wave model source code WAM cycle 4 model has been utilized for deriving wave characteristics in the Indian ocean region.The WAM model has been driven by National Centre for Environmental Protection (NCEP) reanalysis winds. WAM model in general under-predicts Hs because of over smoothening of winds due to low resolution wind data sets. Hence Data Assimilation is needed to steer the model towards observations.

Assimilation Scheme

A source code based on sequential algorithm has been developed for assimilating the buoy data from the moored buoy network in Indian seas using 'Optimum Interpolation Technique'. Assimilation characteristics have been explored with respect to hind cast studies in Indian Ocean covering Bay of Bengal and Arabian Sea. WAM model derived wave characteristics have been taken as the model input for Buoy Data Assimilation (BDA).

Assimilation of (Hs) significant wave height (sea and swell) has been carried out. For distributing the corrections at buoy locations into the model domain, covariance structured gain distribution has been followed which is in vogue at ECMWF and efficient in capturing the wind-wave physics.

The following Studies have been conducted using the buoy data pertaining to both old buoy network as well as the new existing OMNI buoy network.

Performance characteristics of Multiple Buoy Assimilation

Neighboring buoy Assimilation - Reduction in RMSE error

Buoy Data Assimilation improves the Hs prediction not only at the location of buoys, but at the neighboring model domain also. The percentage reduction in Root Mean Square Error (RMSE) error due to neighboring buoy assimilation only (without assimilating the self-buoy) was as high as 35% and is more or less in proportion to the magnitude of the Hs deviation (between measurement and model) during the period considered.

Gain structure for different seasons

BDA, following covariance structured gain distribution, efficiently captured the seasonal variation in wind and wave parameters in distributing the corrections. The gain distribution contours were distinct during high wave activity (monsoon season) while they were less distinct during dry season.

Influence Domain

BDA clearly demarcates the individual site specific characteristics of each of its component buoys and the corresponding model domain influenced by each buoy as well. It also predicts the combined domain under the influence of all the component buoys which in turn helps in correctly predicting the updated Hs in the neighboring domain.

WAM-Old Buoy Network

Hind cast studies conducted for different seasons of the year

Significant wave height magnitude during the SW monsoon is almost twice that of the Hs during NE Monsoon season. Though the overall characteristics pertaining to wave height assimilation are similar; the wind reversal during the SW and NE monsoon seasons, together with the varying intensity slightly changes the magnitude of different buoys influence on each other; as expected of the dynamic process.

Spectrum Analysis

Comparison of buoy measured spectrum with WAM model spectrum revealed that the trend in the variation of the spectrum and its peaks are well captured by WAM. High Frequency range is matching well whereas the Peak wave activity is underestimated by WAM.

Assimilation of Sea and Swell components individually

Assimilation of sea and swell Hs has carried out separately. Assimilation of sea waves showed good results whereas assimilation of swell waves did not perform well. Sea and swell separation schemes are different for Buoy spectrum and for wave model spectrum. This has led to discrepancies.

WAM-New OMNI Buoy Network

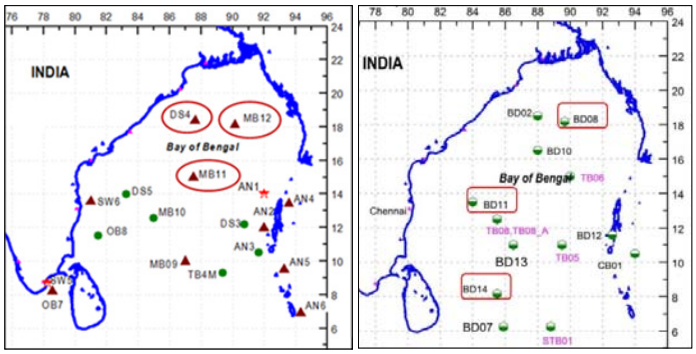
Multiple buoy assimilation in Bay of Bengal has been performed. Hs impr ovement at each buoy station, BD08, BD11 and BD14 and their neighbourhood is quantified. The extent of area updated (improved) in the neighbourhood model domain through multiple buoy assimilation is segregated.

Satellite data Vs Buoy data Assimilation

Beyond the model's capacity, Data Assimilation is the prop for improvement. Two kinds of data can be assimilated, either satellite data or In situ-measurements (such as buoy data). The performance of satellite data assimilation is compared with that of buoy data (in-situ measurements) assimilation for the OMNI buoy network. This is checked by comparing the AVISO (1.0° x 1.0°, 6 hourly) and ECMWF (0.75° x 0.75°, Daily Averaged) satellite merged

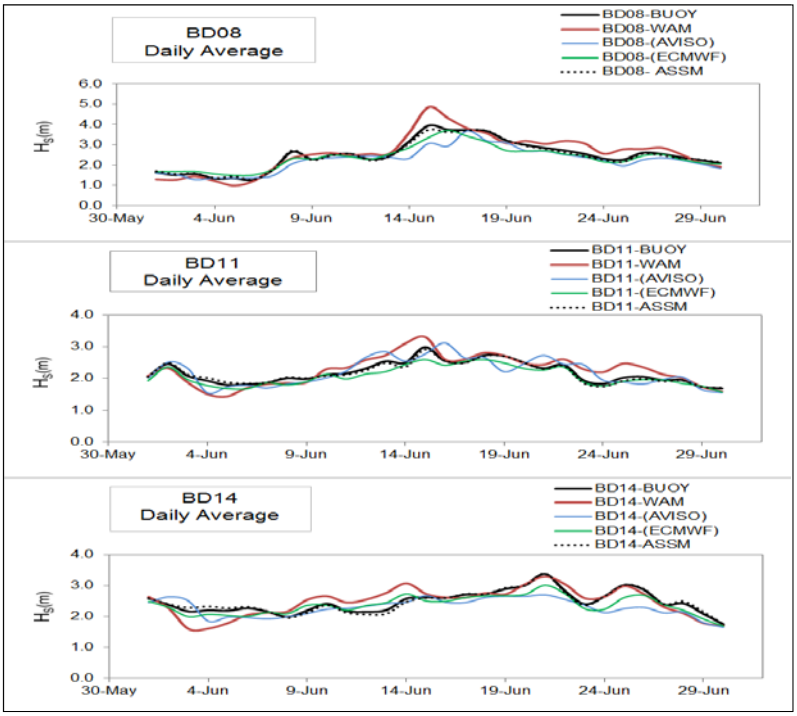
significant wave height prediction with that of WAM prediction updated with buoy assimilated data of ESSO-NIOT.

- The comparison revealed the superiority of the buoy data assimilated model products over the satellite data assimilated products.
- Satellite data assimilation also suffers from its own deficiencies such as its track, pass, its proximity to the location under consideration, its frequency, representation errors, sensitivity and accuracy.
- Buoy Data Assimilation is the best way wherever measurements are available to steer model towards reality.

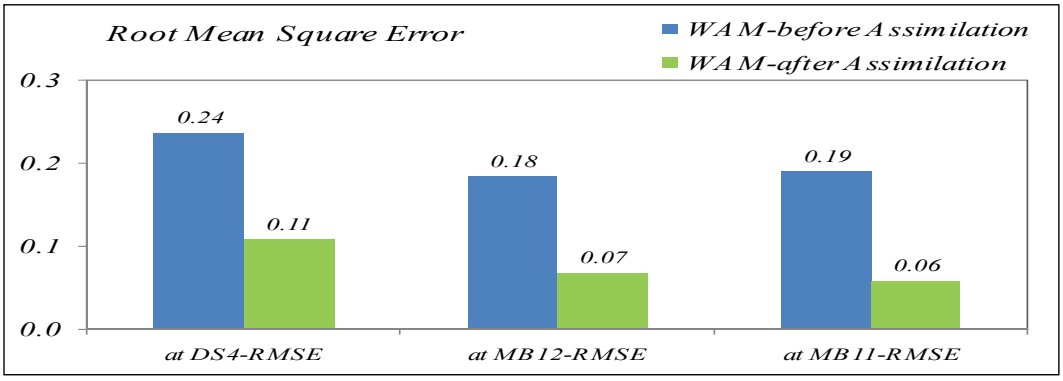


Old buoy Network (left) & New OMNI Buoy Network(right) in Bay of Bengal

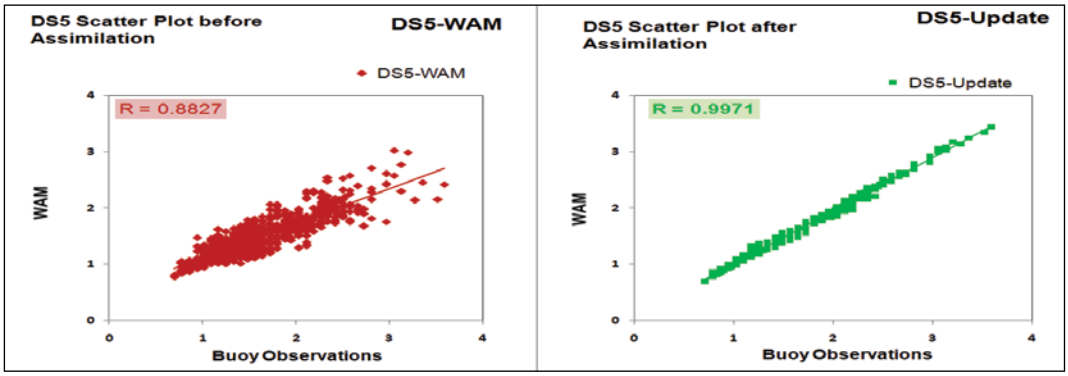
The study has proved that Buoy Data Assimilation is the best way wherever measurements are available to steer model towards reality, with a strong emphasis on the underlying model physics imparted by the assimilation technique used in the present study.



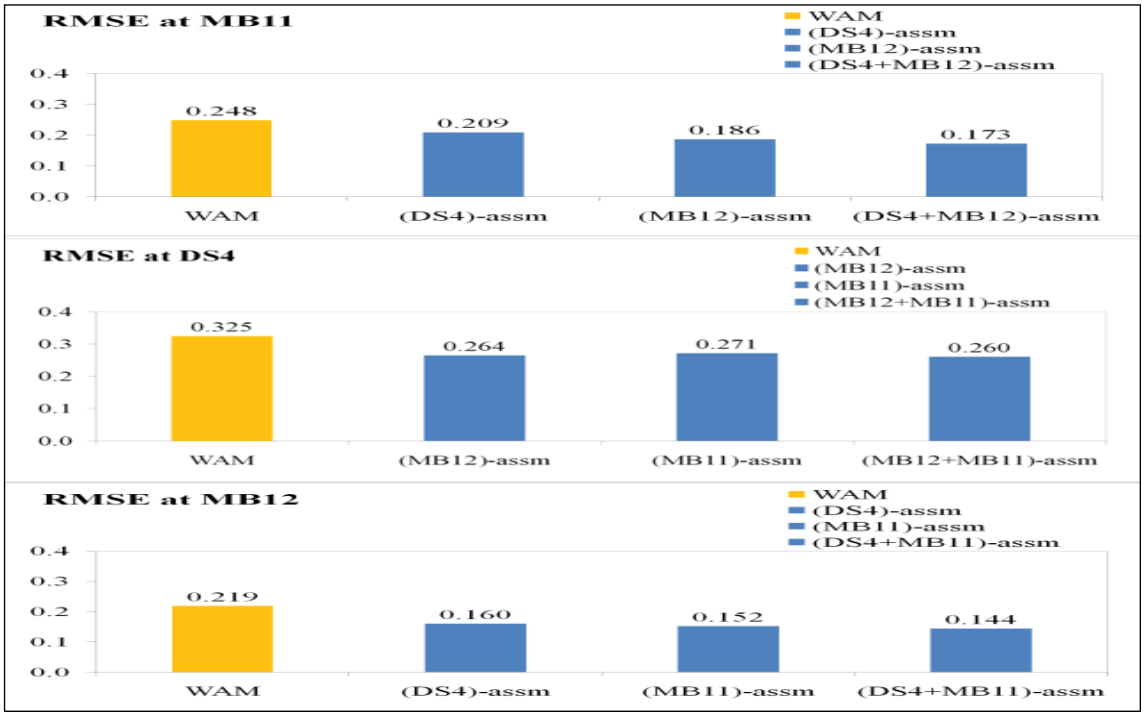
Buoy Data assimilation compared with AVISO and ECMWF merged products at OMNI buoy locations (BD08, BD11 and BD14) in Bay of Bengal during 2011.



Reduction in RMSE with single buoy assimilation for the old buoy network in Bay of Bengal



Scatter plot showing improvement with buoy data assimilation at DS5 off Machilipattinam



Reduction in RMSE due to neighboring buoy assimilation (single buoy Vs Multiple) for the old buoy network in Bay of Bengal

MARINE SENSOR SYSTEMS

Underwater Imaging Systems

MARINE SENSOR SYSTEMS

The Marine Sensor Systems has the following objectives:

- To develop a sophisticated underwater sensor technology for marine applications
- To establish a facility of excellence in order to provide electronic support for the various activities and projects of ESSO-NIOT
- To create infrastructure for reducing the development time and facilitate rapid prototyping
- To develop expertise in Marine electronics related issues

DEVELOPMENT OF BURIED OBJECT SCANNING SONAR (BOSS)

The objective of the project is to develop a standalone system for shallow water applications (up to 10-20 m water depth) to detect objects buried in sea bed up to 5m. In the proposed BOSS system, the transducer, hydrophone arrays and all the electronic sub systems, except the signal processing units will be mounted in a tow body which will be towed behind a vessel over the area where the objects to be detected. The signal processing unit will be in the deck side and the subsystems in the tow body will be connected to the signal processing unit through an Ethernet link. The following subsystems of BOSS have been developed successfully.

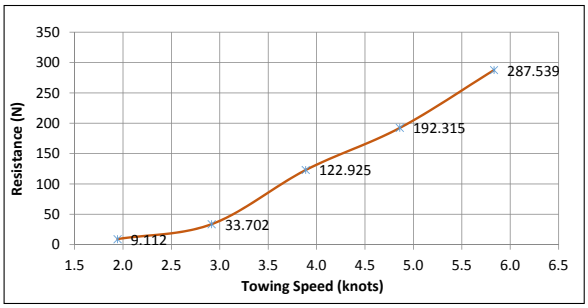
The following subsystems of BOSS have been developed successfully

Development of prototype tow body

An initial prototype tow body was designed and tested at IIT Madras towing tank facility and later the design was modified to reduce the drag force. The new stream lined tow body has been fabricated and tested at the towing tank facility at (IIT-M) for its kinematic behavior up to a speed of 6 knots successfully as shown in the figure.

New Prototype tow body during sea trials

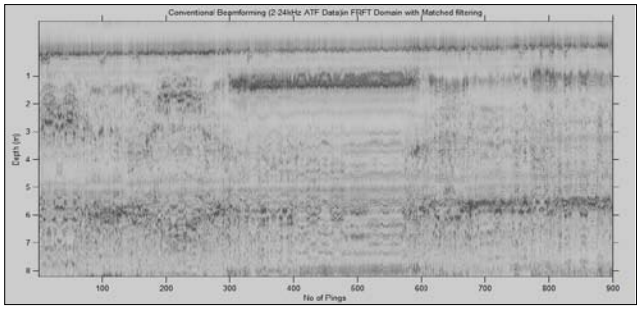
The maximum drag measured during towing is 280 N and the characteristics are shown below. Later it has been successfully tested in the field during the sea trials at Royapuram fishing harbor.



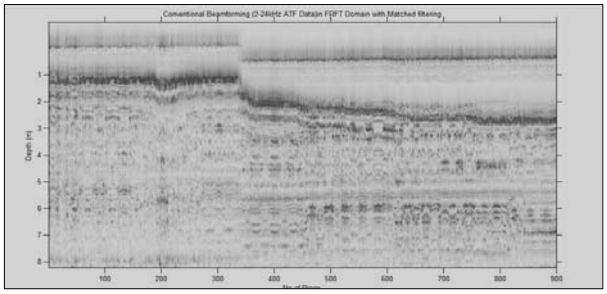
Drag force at different tow speeds

Validation of BOSS system in ATF tank

To validate the BOSS system in ATF tank, preliminary experiments were conducted in ATF tank. Sphere filled with oil and without oil, was imaged separately. As reported in literature, the sphere once filled with oil gave two reflections, in



Sphere with oil

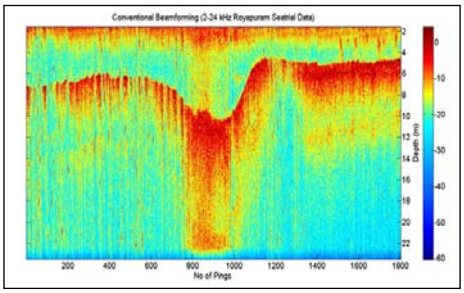


Sphere without oil

the ATF tank tests as expected theoretically due to the difference inv acoustic impedance and are as shown in the above figures.

Sea trial with prototype BOSS

Preliminary sea trial has been conducted with prototype BOSS system at Royapuram fishing harbor with new stream lined tow body. Hydrophone arrays and transducer were mounted in the new stream lined tow body. The sub-bottom profile of boat channel off Chennai.



Sub bottom profile of the boat channel at Royapuram fishing harbor

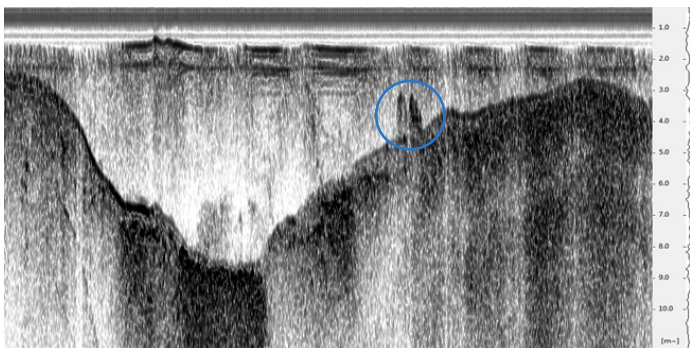
Development of signal processing algorithms

The following suggestions/ modifications in the image/ signal processing aspects by the Critical Design Review (CDR) committee have been implemented and images with better clarity have been generated.

1. Modification of chirp being used for BOSS system.
2. Image Segmentation.
3. Quantification of data for comparison of images.

Canonical correlation analysis for target identification

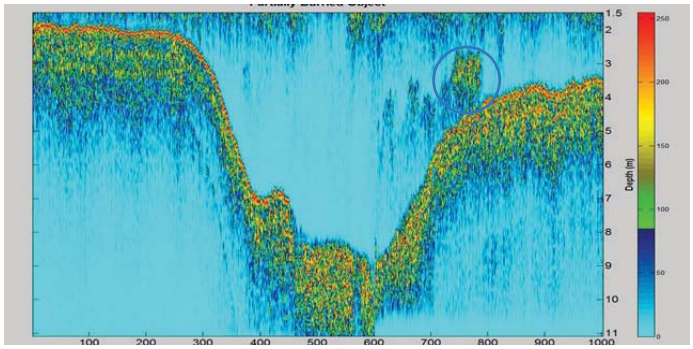
An algorithm has been developed for target identification based on Canonical correlation analysis. The algorithm has been tested with the 16 channel data acquired during the sea trial at Royapuram fishing harbor.



Partially Buried Object detected with COT MDDSS system

Sea trial with partially buried objects

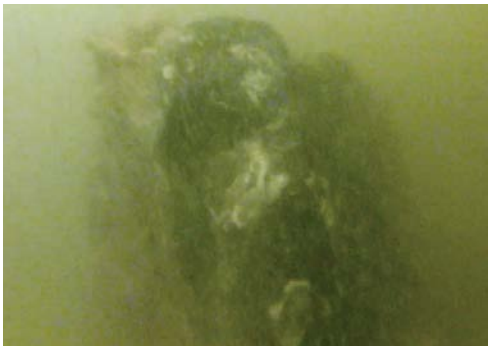
After the ATF experiments, a field trial was carried out at Royapuram fishing harbour, off Chennai. The data obtained with prototype BOSS during the previous field trials indicated the presence of buried objects in the Royapuram harbor off Chennai. In order to have a prior knowledge about the area for further testing of the



Partially Buried object detected with BOSS system

BOSS system, another field trial has been conducted with a commercially off the shelf (COT MDDSS) system at the proposed test site and generated sub bottom images. Objects partially buried in the sea bed were identified during the tests. The profile of the boat channel was also scanned with the COT MDDSS system to have a comparison.

After the trials with the COT system, another field trial has been carried out with prototype BOSS system at the same location and the profiles are compared. As obtained with COT MDDSS system, partially buried objects (marked in blue) are detected at the same location with the BOSS system as well. These are partially buried stones of ~1 m x 0.5 m size which have been confirmed with divers as shown in the following figures.



Partially buried object detected and confirmed using an underwater camera

DEVELOPMENT OF OIL SPILL DETECTOR

A prototype oil spill detector has been successfully developed and the initial tests have been carried out in ESSO-NIOT's test facility. The detection system consists of a UV laser source which is used to create the fluorescence, a CMOS (Complementary Metal Oxide Silicon)camera with polarizer, a UV filter and a signal processing unit. CMOS camera is targeted downwards to capture the primary colors (RGB) such as red, green and blue of oil and water. Digitized signal from the camera is being processed by the signal processing unit and based on the fair comparison between RGB values of oil and water, the presence of oil spill has been detected. Moreover, a collimated laser source had been fitted with 15 degree prism in order to expand the fluorescent area during night times to differentiate oil and water.

ESTABLISHMENT OF ELECTRONIC SUPPORT FACILITY

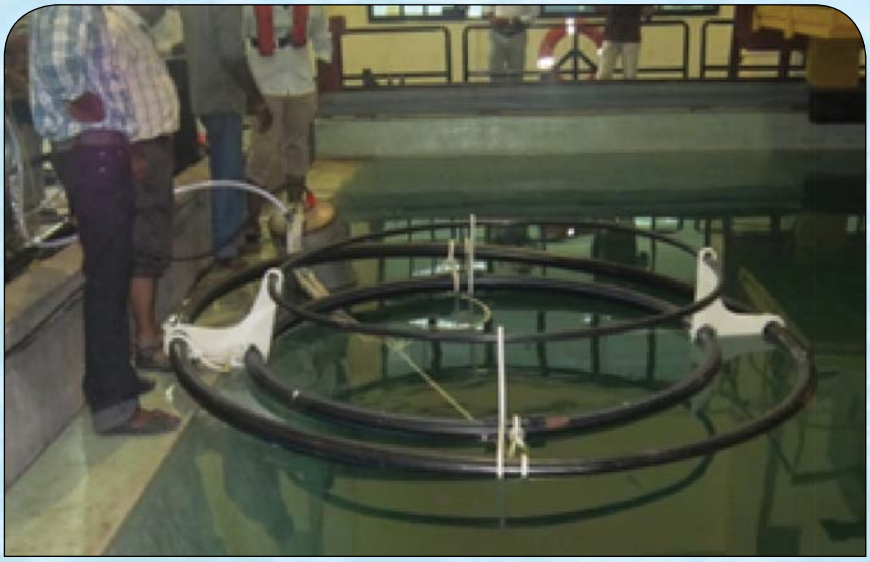
Additional software for shock and vibration test facility: A stepped sine vibration control software and automatic report generation software have been added to the existing Shock and vibration test facility. All the commissioned facilities like environmental chamber, shock and vibration test facility etc are being effectively used by different groups of ESSO-NIOT.

PRESSURE SENSOR WITH BUILT IN ANTI BIO FOULER

The design of the pressure sensor with built in anti bio fouler has been completed and prototype tests are being carried out in the Acoustic Test Facility at ESSO-NIOT.

OCEAN ELECTRONICS

Ship based Automatic Weather Station



Automatic Sub-Surface Floating Fish Cage

Autonomous Underwater Profiling Drifter

Coastal Drifter

OCEAN ELECTRONICS

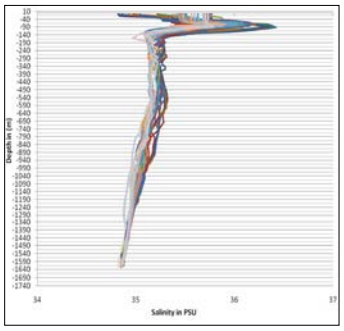
Ocean Electronics group has a mandate to develop ocean observation systems and demonstrate for applications in the ocean. The group is involved in the development of Deep Ocean Bottom Pressure Recorder (DOPR), Autonomous Underwater Profiling Drifter (AUPD), Drifter buoy, Acoustic Modem and technologies with INSAT communication.

AUPD float track

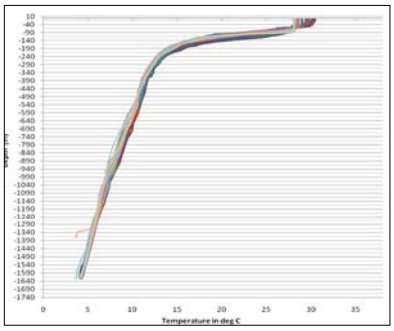
Autonomous Underwater Profiling Drifter (AUPD)

Successfully completed the indigenization of Autonomous Underwater Profiling Drifter (AUPD) technology and a patent has been filed First AUPD through trial production was deployed on 16th May 2013 at 09°59.843'N, 70°29.840'E. The AUPD float has successfully performed the CTD profiling once in every two days up to the depth of 1620m. The float has provided 135 profiles till Feb 2014.

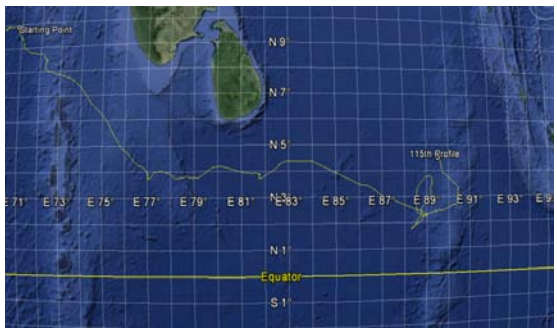
Pradyu – Development of Drifter with INSAT Communication



Salinity Vs. Depth



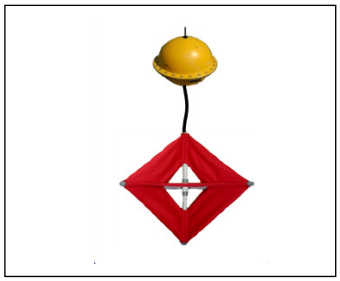
Temperature Vs. Depth



AUPD float track

Coastal Drifter Buoy

Coastal drifter having 30cm dia surface float and suitable micro star type of drogue has been designed and developed meeting the Drag Area Ratio (DAR) requirement on drifters for coastal applications.



Coastal drifter buoy with GPRS modem and micro star drogue

Coastal Drifter track Off-Ennore and Rathnagiri

It was built with smart GPS receiver module, General Packet Radio Service (GPRS) modem for

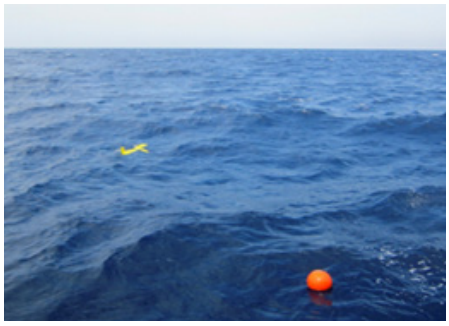
high data rate communication and battery pack having endurance of 3 years. The proto type coastal drifter was deployed off Ennore, Tamilnadu and off Rathnagiri, Maharashtra coast during February, 2014.

Tsunarec

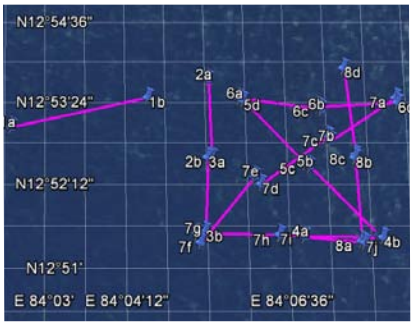
Sea trials of first proto type of Indigenous deep ocean pressure recorder was conducted during 2011. Second proto type of deep ocean pressure recorder is ready for deployment and laboratory tests are being carried out.

Glatse – Technology Demonstration of Glider Systems

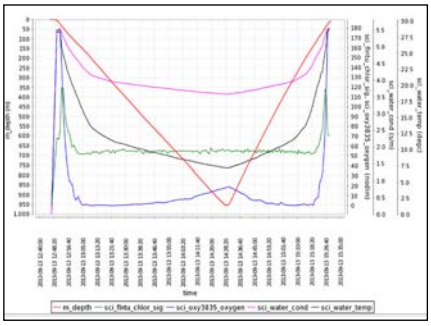
Sea trial of Glider was performed off Chennai on 13/09/2013 and 950m dive was conducted after functional testing. The glider was programmed for 500m dives in various directions to cover 50km^2 from 13-15, September 2013.



Glider connected with buoy



Glider waypoints

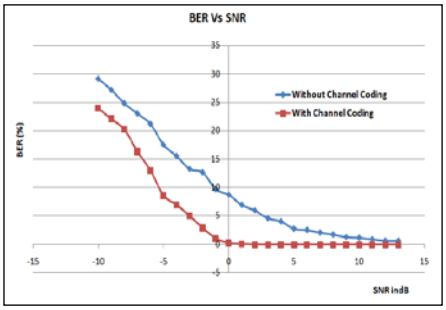


Conductivity, temperature, oxygen and chlorophyll plots against depth

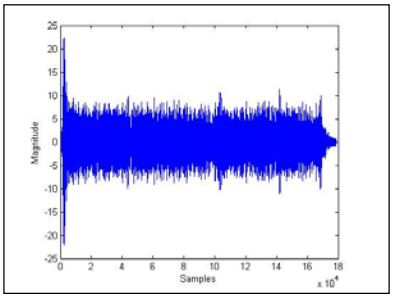
Acoustic Modem

Underwater communication finds wide applications in Oceanographic data collection, Disaster prevention, Underwater Networks, AUVs etc. Based on the recent advances in wireless communication, Multicarrier modulation in the form of Orthogonal Frequency Division Multiplexing (OFDM), has been adopted as the modulation technique for the development of underwater acoustic modem. The communication scheme was tested in ATF. Lake trial test conducted in Idukki for testing the underwater communication scheme during May, 2013. Channel coding introduced in the scheme

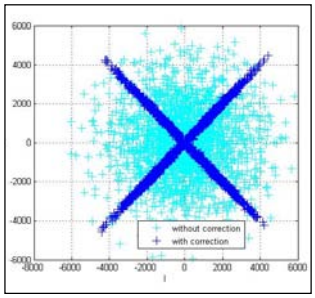
Acoustic Modem Internal PCB Assembly



Performance with Channel Coding



Transmitted signal



Received data constellation plot

to reduce the Bit Error Rate (BER) and tested in simulated environment. DSP based hardware development is in progress.

Testing off Chennai

Automatic Sub-Surface Floating Fish Cage

An Automatic Sub-surface floating fish cage (ASFFC) has been developed jointly by the Ocean Electronics (OE) and Marine Biotechnology (MBT) for rearing the fish in captivity at the open sea conditions. The concept of submerging the cages during the adverse sea conditions is the recent advancement in the sea farming nations to safeguard the cages as well as the live stock in it during unfavorable climatic conditions. The group has developed and fabricated prototype fish cage system and the submerging test was conducted off Chennai during July, 2013. Design of the actual size (9m) fish gauge system is in progress.

Ship-based Automatic Weather Station (SAWS)

Shipboard AWS systems are used for collecting time series measurements of meteorological parameters such as Wind speed and direction, Air pressure, Air temperature and Humidity. The group has installed the hardware in order to improve coastal met observations using ships of opportunity. Data is collected as per WMO (World Meteorological Organization) standards and real time data is transmitted to shore using INSAT DRT satellite. The wind speed is compensated with ship speed using GPS calculated “speed over ground” parameter. Algorithm developed and implemented for True Wind speed and Direction calculations.

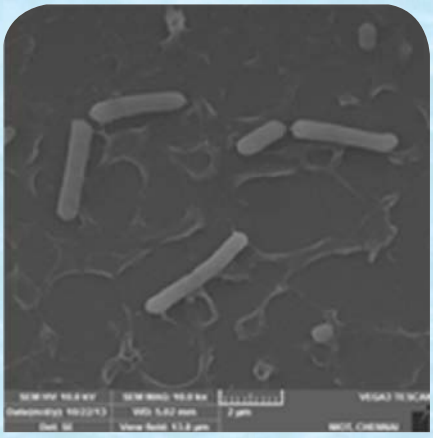
SAWS installed in M.V Caravel Pride ship

MARINE BIOTECHNOLOGY

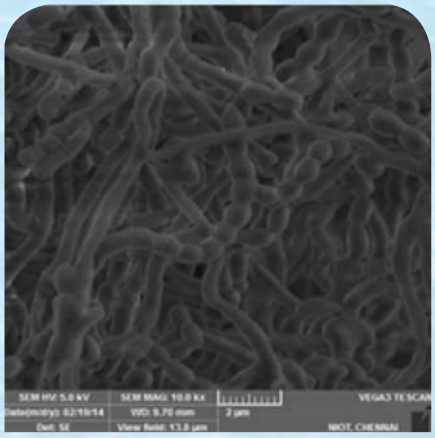
Feeding cobia – Olaikuda

Cobia culture in sea cages

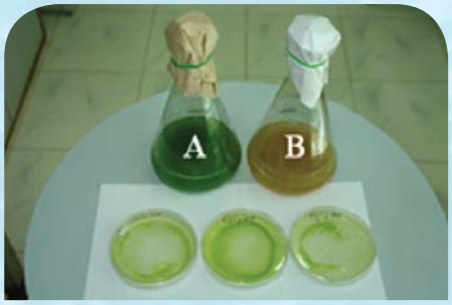
A part of milkfish harvest



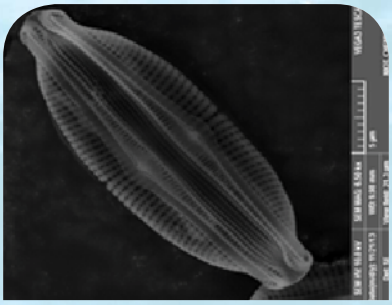
Acinetobacter sp. isolated from 2100 m depth - SEM



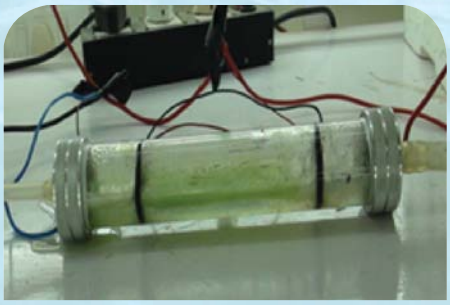
Acinetobacter sp. isolated from (2000 m) depth - SEM



Protoplast: Chlorella sp. (A) & Dunaliellasalina (B)



Amphora sp. (ANCOST- 48) - SEM

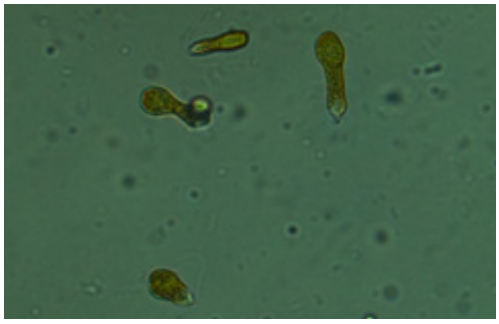


Online - flow through electro-flocculation

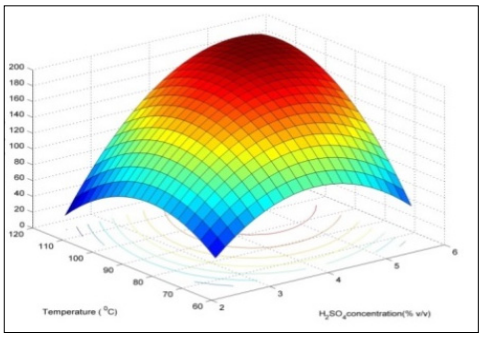
MARINE BIOTECHNOLOGY

Marine Biotechnology (MBT) is primarily focusing on three major activities viz. Marine Algal Biotechnology, Marine Microbial Biotechnology and Open Sea Cage Culture. “Seawater quality monitoring along Indian coast” is one of the multi-institutional project being carried out at the field unit “Andaman and Nicobar Centre for Ocean Science and Technology (ANCOST)” at Port Blair. A programme on “Advanced Methods for Biofouling Control” is being carried out in collaboration with the Bhabha Atomic Research Centre, Kalpakkam. A new programme on Establishment of Ballast water Treatment Technologies Testing Facility has been proposed during this plan period.

MARINE ALGAL BIOTECHNOLOGY



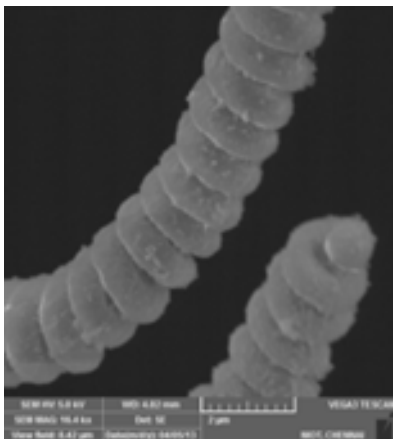
Hetrokaryons PF-1 (60x)



RSM-Bioethanol production from seaweed

A comparative study on different methods of lipid extraction (Solvent, Supercritical Fluid and Ultrasonic) was completed and a maximum lipid extraction of 11.7% was recorded in the solvent (methanol and chloroform) extraction method in combination with grinding and ultrasonic treatments. Trials on ultrasound assisted extraction of algal lutein from microalgae was completed and a maximum lutein yield of 8.26 mgL-1 ± 0.57 mg.g1 was achieved with solvent mixture of ethanol: tetrahydrofuran (3:1).

A hybrid of Chlorella sp. and Dunaliella sp. was developed by protoplast fusion. Higher biomass (1.63 ± 0.04 g/L) production was recorded in the hetrokaryons PF1 when compared to the parental strains Chlorella (0.69 ± 0.10 g/L) and Dunaliella sp. (1.03 ± 0.05 g/L).



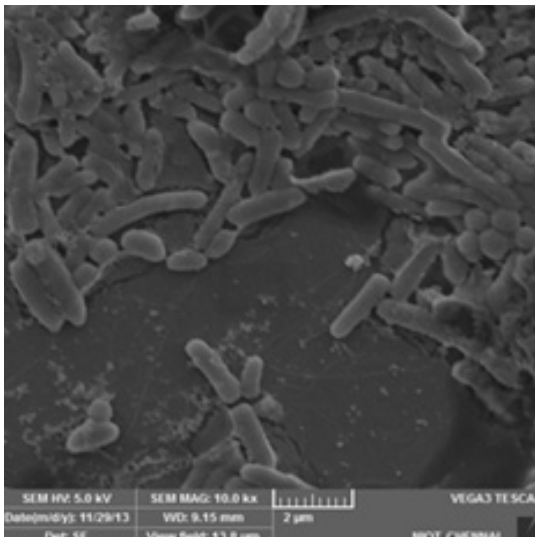
Arthrospira sp. - SEM

Simultaneous production of c-phycocyanin and zeaxanthin was attempted in 4 marine cyanophyceans viz. Arthrospira platensis, Trichodesmium sp. Synechocystis pevalalkii and Synechococcus sp. and a maximum production of c-phycocyanin and zeaxanthin was recorded in A. platensis. Chlorella growth factor (CGF), a nucleotide-peptide complex with wide pharmacological properties was extracted from Chlorella vulgaris. The crude CGF extract from wet Chlorella biomass contained 46.4% protein, 5.4% DNA, 4.3% RNA, 6.9% carbohydrate and 7.0% lipid. Experiment on production of

bioethanol from seaweed (Sargassum cinereum) biomass was attempted. Various pretreatment methods for release of sugars from seaweed biomass were examined and a maximum production of 5.8% bioethanol dry seaweed biomass was recorded in the preliminary studies.

An online electroflocculation system with perforated flow through electrode cell with flocculation efficiency of 99.0% was developed and tested. To minimize the power loss during AC to DC conversion in the AC powered electroflocculation, a direct DC powered solar electroflocculation system was developed and tested. Scaling up of the system for large volume is in progress.

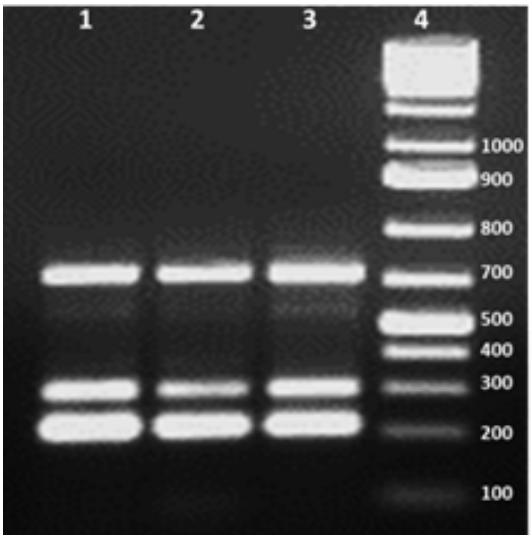
MARINE MICROBIAL BIOTECHNOLOGY



Oceanobacillus sp. isolated from 2000 m sediment - SEM

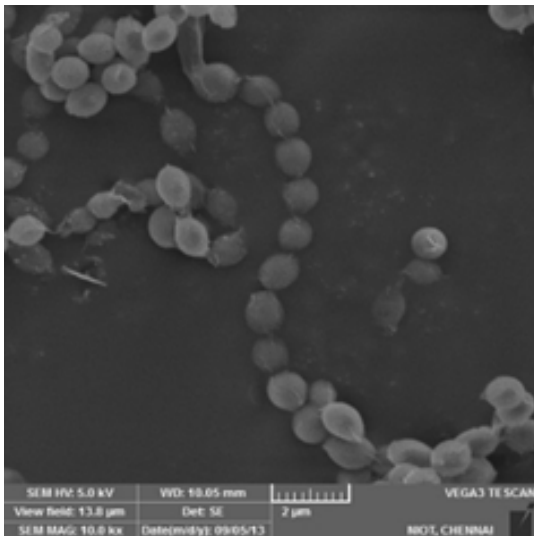
A new species of Streptomyces was isolated from deep sea sediments collected off Chennai. Streptomyces sp. was cultured at 80 bar pressure in a high pressure and low temperature microbial cultivation system. The pyrrolo-pyrazine derivatives extracted from Streptomyces sp. showed broad spectrum antimicrobial activity against Gram-negative and positive bacteria in addition to anticancer activity in ACHN and HeLa cancer cell lines. Five biosurfactant producing bacteria were isolated from 2000 m depth marine sediment. Oceanobacillus sp. exhibited highest emulsification index with a maximum biosurfactant production (12.0 g/L) on the 10th day.

A carotenoids producing Streptomycetes sp. was isolated from 2000 m depth marine sediment. Growth conditions for optimal production were standardized and a maximum carotenoid production of 2.8g/L was recorded. A novel growth medium (Enterococcus faecalis enrichment medium) was formulated to enrich the growth of E. faecalis within 2 hrs of incubation. A multiplex PCR kit was developed for the real-time detection of five major virulent genes in E. faecalis (gelE, asa1, hyl, ef0591, ef3314 and aadA) from environmental, clinical and food samples. L-asparaginase biosynthesis gene (ansA) from Nocardiopsisalba was heterologously expressed in E. coli and a threefold increase in the L-asparaginase production over the native strain was achieved.



Virulent genes of E. faecalis - Agarose gel electrophoresis

Metagenomic analysis of deep sea sediment bacteria collected from 1400 and 2000 m depth in Bay of Bengal and Andaman Sea was completed. A total of 89 lakhs 16S rDNA metagenomic sequences were generated through high throughput next generation sequencing. The data analysis revealed that more than 40% of the total sequences were not yet reported in any database. Massive numbers of 46,000 OTU's (operational taxonomic units) were observed for all the samples. Actinobacteria, Firmicutes and Proteobacteria were the dominating phyla recorded.



Streptomyces sp. isolated from 2000 m sediment- SEM

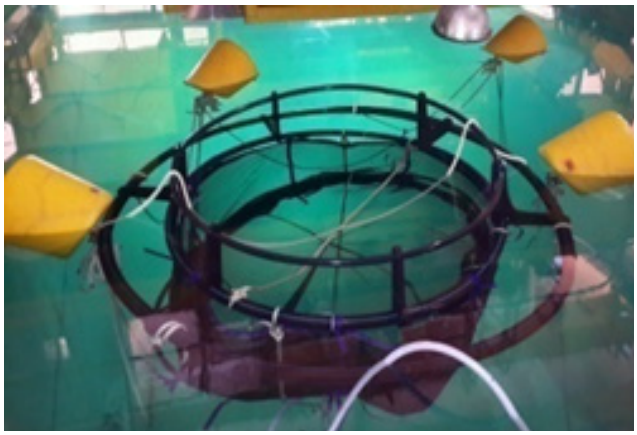
OPEN SEA CAGE CULTURE

Capture-Based Aquaculture (CBA) of milkfish (*Chanoschanos*) in open sea cages using formulated diet was successfully demonstrated in Okaikuda. The milkfish seeds (5-8 g) were reared to 770 g within 260 days and a total of 3.5 tonnes of milkfish was harvested. Cage culture of sea bass (*Lates calcarifer*) from 0.22 g to the marketable size of 750 g was successfully demonstrated in open sea cages deployed at North Bay, Port Blair, using formulated pelletized feed. The culture of hatchery produced marine finfishes pompano (*Trachinotus blochii*) and the fast growing cobia (*Rachycentron canadum*) was successfully demonstrated with a total harvest of 3.0 tonnes in the sea cages at Olaikuda. An average body weight of 4.0 kg was achieved in 8 months from its initial stocking size of 30 g with an excellent growth performance of 15.4 g/day in cobia. As part of the disease prevention and health management, the major bacterial pathogens of these cultured marine finfishes in sea cages were isolated and identified by partial sequencing of 16s rRNA. Cost economic analysis of open sea cage culture of sea bass was evaluated considering all nuances of the cage farming and Indian sea conditions. A prototype submersible cage developed in collaboration with Ocean Electronics group was tested in static and open sea conditions.

SEAWATER QUALITY MONITORING ALONG INDIAN COAST

The physico-chemical and biological analysis of water and sediment samples in and around Port Blair Bays during low and high tides were analysed for four seasons, namely, non-monsoon, pre-monsoon, monsoon and post-monsoon from seven stations viz., Flat Bay, Minnie Bay, Junglighat Bay, Haddo Harbour, Phoenix Bay, Aberdeen Bay, Open Sea in Port Blair Bays and one station in Wandoor.

Dr. Shailesh Nayak, Secretary - MoES, inaugurating milkfish seed stocking



Prototype submersible cage being tested in the Acoustic Test Facility

ADVANCED METHODS FOR BIOFOULING CONTROL

The cyprid larvae of the barnacle, Balanus reticulatus, were reared in the laboratory for standardizing settlement assays. Studies on the lethal and sub-lethal effects of chlorine on barnacle larval development revealed that at a concentration of 0.5 - 1.0 ppm chlorine, the larvae showed reduced swimming activity as well as inability to moult. Experimental results proved that Acidified Sodium Nitrite (ASN) is able to keep the Reverse Osmosis (RO) membrane free of biofilm, without causing any damage to the membrane.

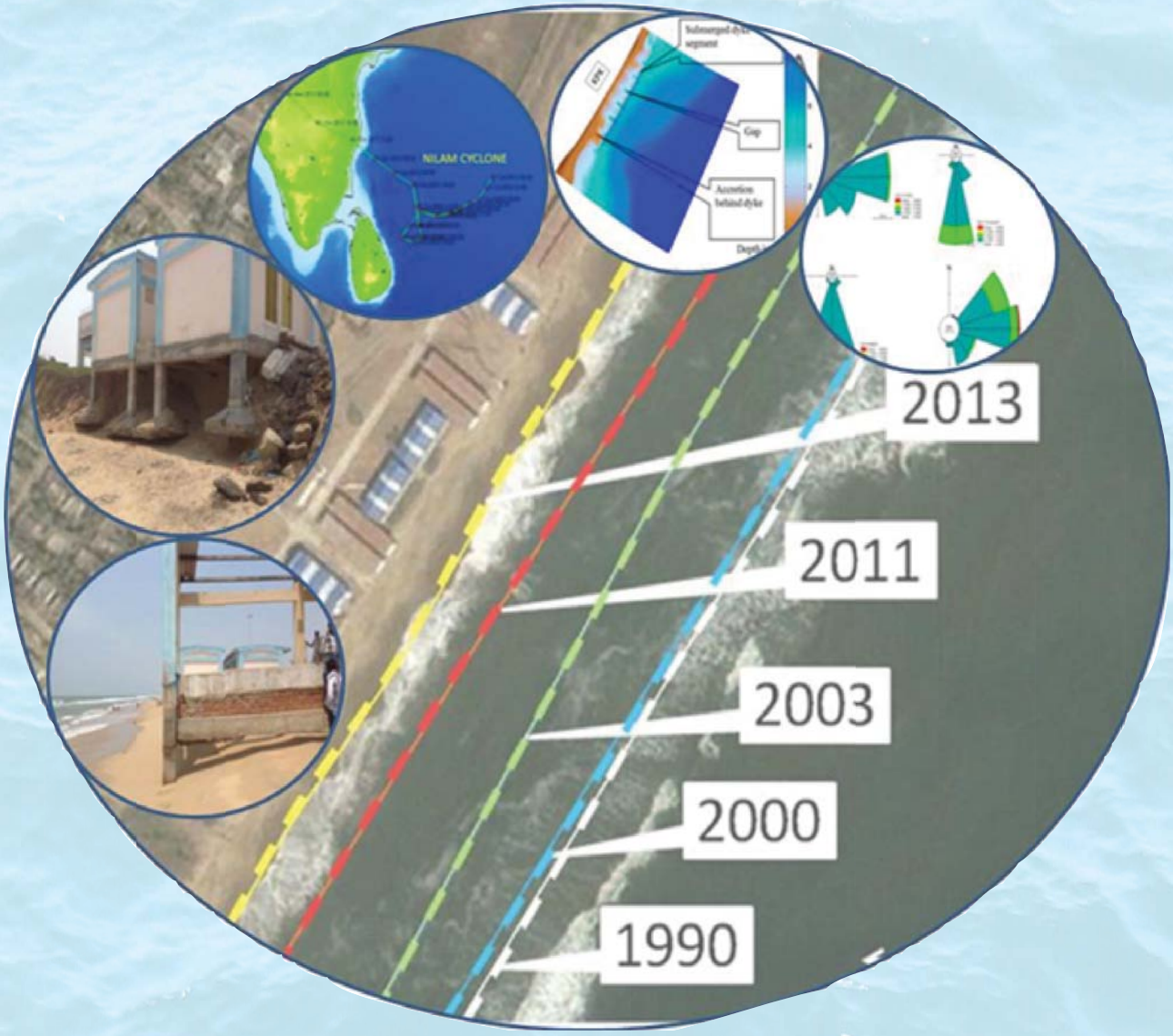
Comet assay of caged mussels exposed to chlorination indicated that there was no damage for the mussels collected from unchlorinated site, while there was moderate to extensive damage to mussels exposed to chlorine. Laboratory studies on chlorine toxicity to mussels indicated increase in DNA damage with increase in contact time and concentration of chlorine. A protocol has been established for comet assay using the diatom, Chaetoceros lorenzianus. Chlorine damaged cells of C. lorenzianus genetically. Towards development of ultrasonication system for biofouling control, the transducers have been procured and the preparation of an immersible case for an array of transducers is in progress.

ESTABLISHMENT OF BALLAST WATER TREATMENT TECHNOLOGIES TESTING FACILITY

An establishment for testing and validation of ballast water treatment systems developed by various manufacturers in India and abroad has been proposed during the 12th Plan period. The land based technology testing facility will be located at the Sea Front Site in Pamanji and Vagarru villages of Vakadu Mandal, Nellore district, Andhra Pradesh. The process of accreditation of the Ballast Water Lab for testing and validation of ballast water treatment system is in progress by the National Accreditation Board for Testing and Calibration Laboratories (NABL), New Delhi. Training on Measurement of Uncertainty was imparted

to 4 members of staff (technical). Preparation of Quality Manual (QM) is under progress. Calibrating Instruments for calibration of major equipments under NABL scope are under the process of procurement.

COASTAL AND ENVIRONMENTAL ENGINEERING



Observations and field measurements exhibiting the impact of coastal erosion at KadalurPeriyakuppam (KPK), TamilNadu

COASTAL AND ENVIRONMENTAL ENGINEERING

Coastal and Environmental Engineering (CEE) group aims to bring the state of the art technology in coastal/offshore infrastructure development through field observation, numerical modeling and engineering intervention. The major projects handled by CEE group are as follows:

- Demonstration of Shore Protection Measures through Pilot Projects
- Technical Criteria Atlas
- Engineering Investigations for the 'Kalpasar' Project of Government of Gujarat and
- Establishment of Coastal HF Radar Network under Tsunami Early Warning System

SUSTAINABLE SHORELINE MANAGEMENT (SSM)

Erosion of KPK village front after Madi Cyclone (Dec. 2013)

Marine Geotube

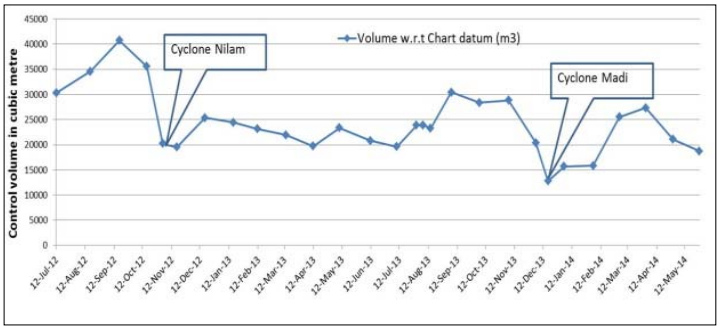
The objective of the project is to develop options for sustainable management of coastlines and improvement of the environmental quality with potential stakeholders. One of the priority sites for this purpose is the coastal stretch of Kadalur Periyakuppam (KPK) located south of Kalpakkam to the south of Palar river mouth. The site is severely deteriorating during each cyclone and is unable to fully recover during the accreting season resulting in net erosion. Studies are also undertaken at Kovalam to determine the biological growth on geosynthetic tubes in order to check whether they are environmental friendly.

Numerical modelling studies were carried out using DELFT-3D and MIKE21-LITPACK for normal and cyclone conditions at KPK. Based on the results, a segmented submerged breakwater of 3.5m height, 200m long segments with 60 m gap for a length of 1.7km is proposed at 4m water depth which is expected to enable beach buildup. State Coastal Regulatory Zone Authority has approved the project and forwarded to Ministry of Environment and Forest for final Environmental clearance.

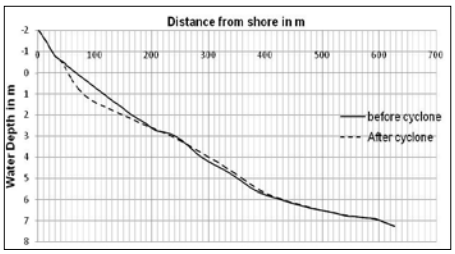
The details of field observations and numerical modeling are given below:

- Monthly beach profile is being carried out for KPK site at 200 m stretch with16 transects since September, 2012.
- Daily Littoral Environmental Observation (LEO) is being carried out in front of three villages of KPK since October, 2013.

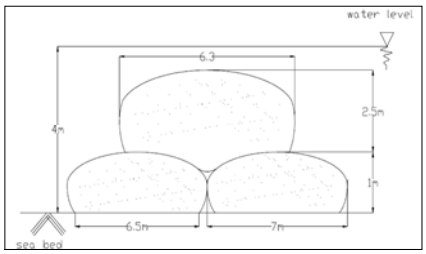
- Erosion/Accretion has been studied by using software SANDS™.
- Float track study is being carried out fortnightly off KPK since, October, 2013.
- MIKE21-LITPACK model was utilised to assess the littoral drift, shoreline evolution and beach profile evolution and validated with observed data.



Monthly Variation of volume of sand above chart datum over a specified area



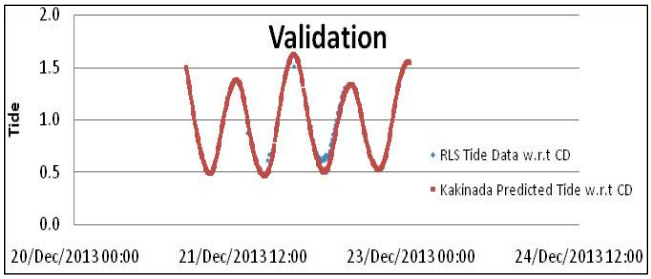
Cross shore Profile variation at KPK after cyclone from DELFT 3D model



Proposed Submerged breakwater cross section

TECHNICAL CRITERIA ATLAS (TCA)

The plan project 'Technical Criteria Atlas' is envisaged with an objective to provide ready reference for parameters like tide, wave and water level in terms of return period/ extreme values along the Indian coast. The regional model setup of tide is under progress which focuses on Gulfs and estuaries.



Validation of tide measurement

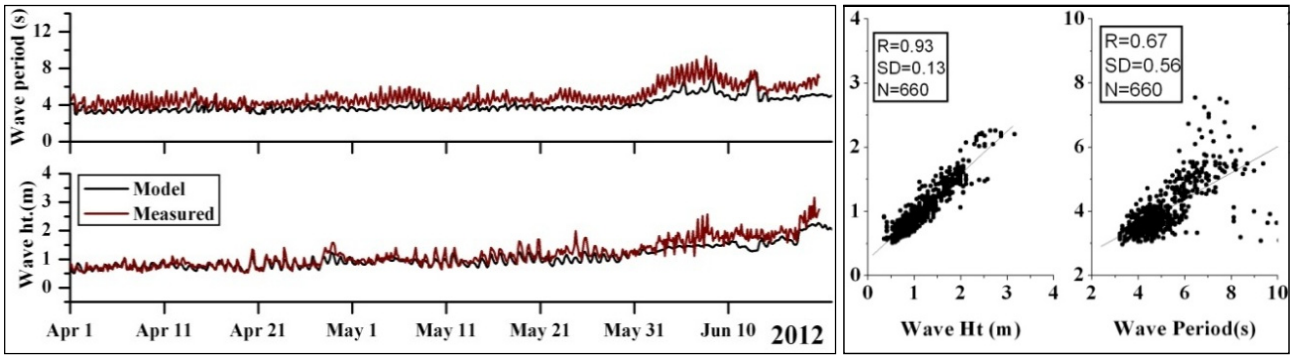
Tide-gauge installed at Pakala, AP

The regional storm surge model at frequent cyclone passage areas are under progress utilizing the available cyclone track information. The wave model is in its final stages with 15 years product run using wind data from European Centre for medium range Weather Forecasting (ECMWF) for the period 1998 to 2012. The in-house development of web application and hard copy of wave atlas are under progress.

OUTCOME

Regional tide model setup with Delft3D package has been implemented for Gulf of Khambhat Coast. The bathymetry from ESSO-NIOT surveys has been adopted for the model. The model is validated against measurements.

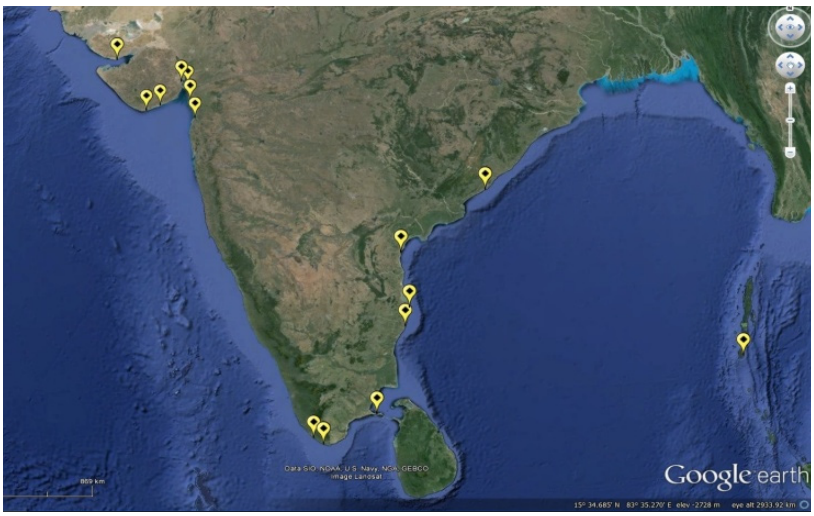
Carried out the product run of wave model with ECMWF wind input for the period January 1998 to December 2012. The average, sea and swell components of wave parameters are available at 0.1x0.1degree grid at every 1hour over an area of 0-25°N, 60-92°E.



Validation of wave model at mid-channel-Diu during the year 2012

The in-house development of web application as well as hard copy of the Wave Atlas is under progress. The atlas proposes to bring out the annual and monthly averages of significant wave height, wave period and wave direction, the annual and monthly rose vector plots and joint occurrence tables at selected locations along Indian coast.

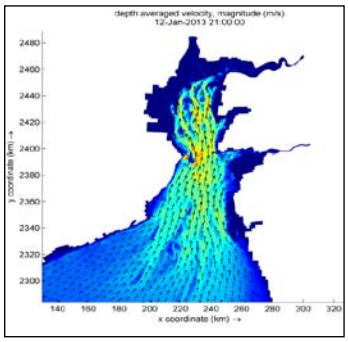
Established met stations along with tide gauge at Pakala (Ongole) and a tide gauge at Tikkavanipalem (Visakhapatinam) in Andhra Pradesh. Two tide gauges are installed along Tamilnadu coast and one at Kerala.



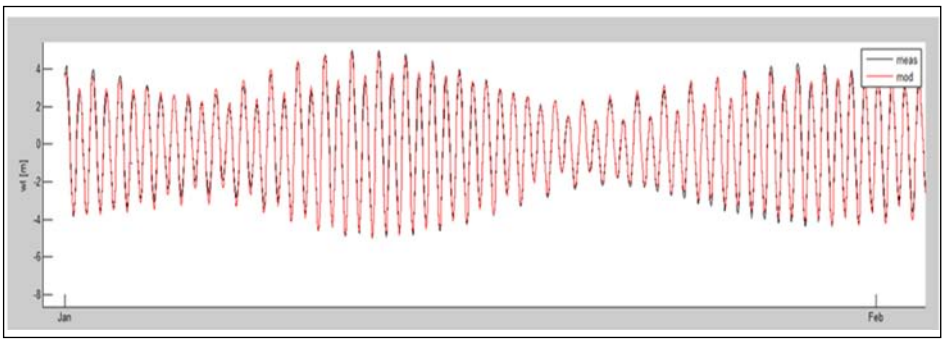
Tide gauge network

ENGINEERING INVESTIGATIONS FOR THE KALPASAR PROJECT OF GOVERNMENT OF GUJARAT

The project Kalpasar for State government of Gujarat aims at construction of a dam across Gulf of Khambhat (GoK) to impound the water of Narmada river which otherwise drains into Arabian Sea. ESSO-NIOT has been identified as the nodal agency to undertake all engineering investigation and modeling requirements. The analysis of geophysical, geotechnical and met-ocean data (surface wind, air pressure, surface current, wave etc.) is completed and the dam axis was finalised. The numerical modeling for assessing the effect of dam on the hydrodynamics and morphodynamics of gulf is under progress.



Simulated surface current at GoK



Simulated and observed water level comparison at Dahej during January 2013

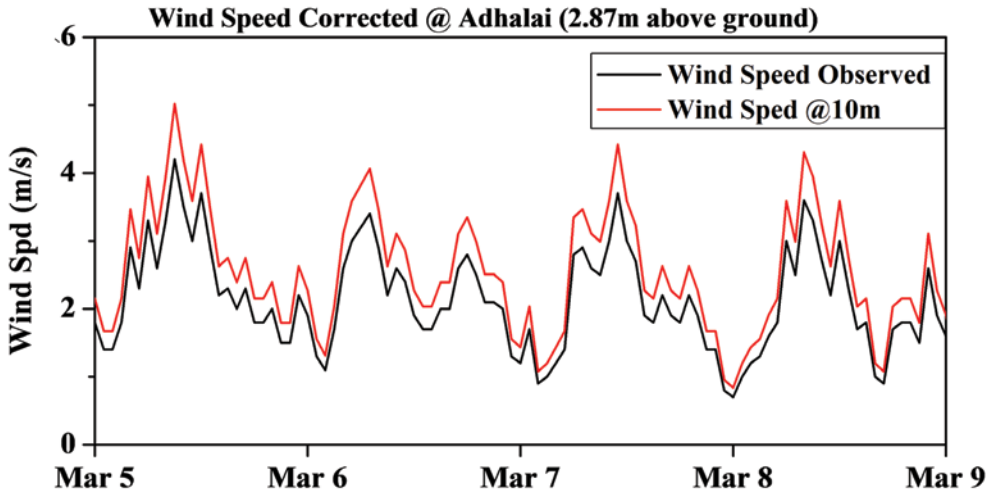
Hydrodynamic model for Gulf of Khambhat has been setup using DELFT-3D flow module with ESSO-NIOT surveyed bathymetry data and Gebco08 bathymetry data. Sensitivity analysis has been carried out for various friction values with different resolutions of grid. Open boundary is forced with tidal constituents derived from Topex Poseidon derived data through delft dashboard.

Post processing scripts are prepared for analysis and to compare the water levels, tidal constituents, velocities and drogue trajectories. Results obtained are found to be in reasonable agreement with measured data.

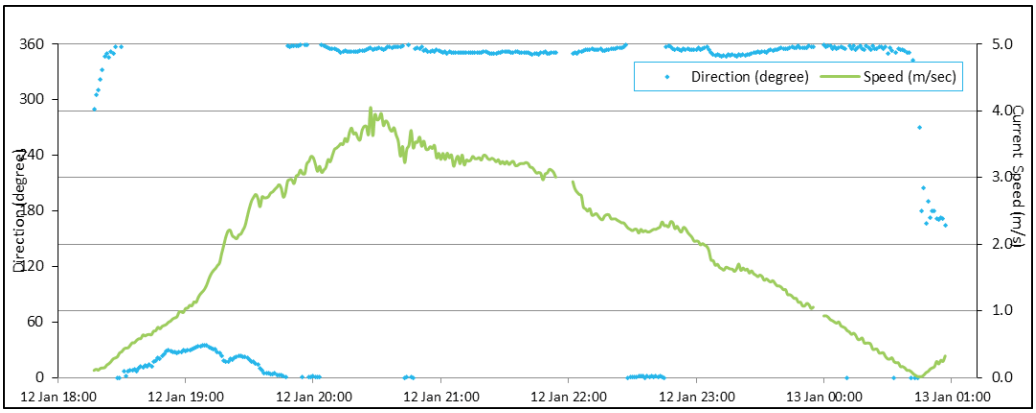
Hydrodynamic model for pre and post dam scenarios have been setup for a period of one year to analyse the impact of dam on tidal propagation in the Gulf.

Wave model has been setup with SWAN integrated into DELFT-3D. It is coupled with hydrodynamic model to consider for the wave current interaction. The wind file has been gridded from the NCEP data and boundary conditions are derived from Wave Watch-III model.

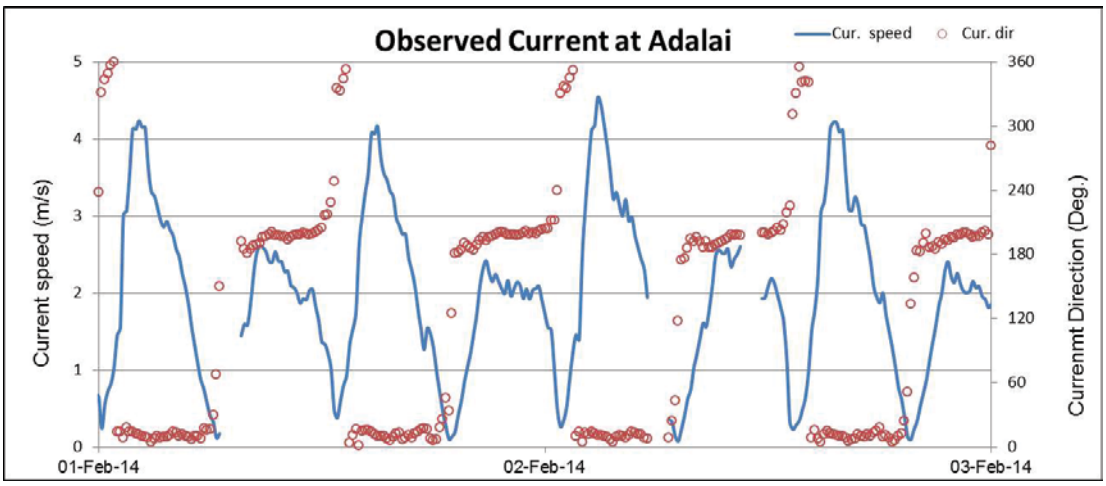
The detailed quality control of met-ocean data (air pressure, surface wind and tide) collected from 20 automatic weather stations along the coast line of GoK and the mid-channel observations of wave and current are completed. The atmospheric pressure measured at various locations is reduced to mean sea level and surface wind data is reported to a standard height of 10m above the ground.



Quality control of surface wind and air pressure to standard reporting levels at GoK



High Surface current observed during float track study in GoK



Maximum current speed observed at Adhalai in the northern GoK

ESTABLISHMENT OF COASTAL HF RADAR NETWORK UNDER TSUNAMI EARLY WARNING SYSTEM

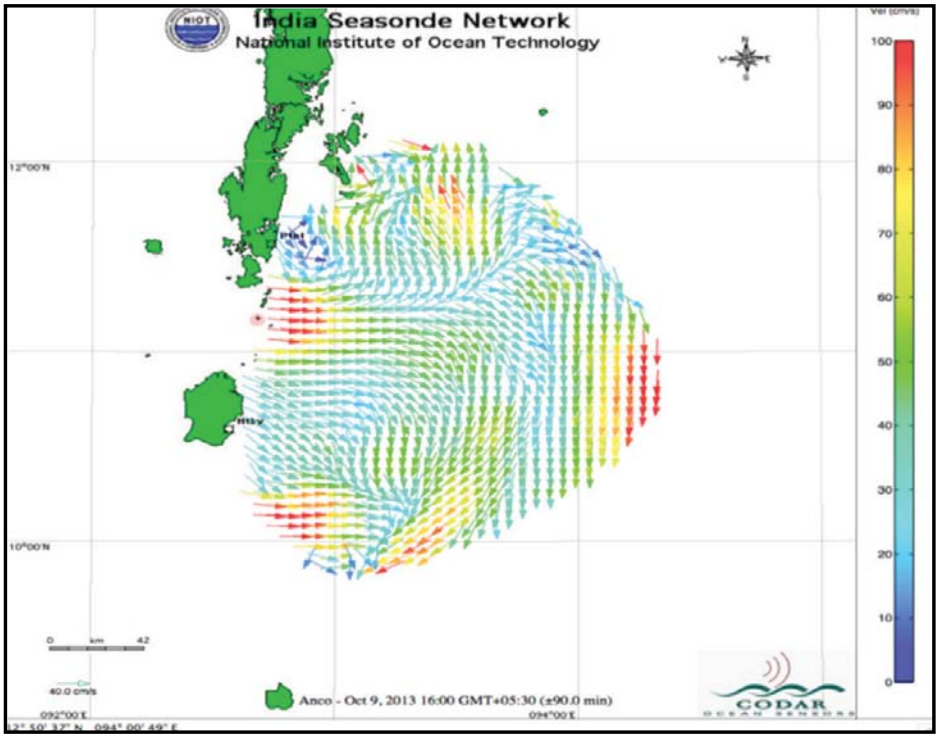
As part of the ESSO-NIOT TEWS project, HF Radar are installed and maintained at ten remote sites and two central sites viz. in Chennai and Hyderabad. All systems are working continuously with minimum downtime. The surface currents during cyclone Phailin which originated near the Andaman Islands were captured by the two radar installations at Port Blair and Hut-Bay. Percentage of data received is given in below Table.

- Gopalpur site is being restored after the damage suffered from cyclone Phailin.
- Surface current measured during initial stages of the Phailin cyclone off Andaman island and is shown in the figure.

SITE (INSTALL DATE)	CUDA (MAR 2008)	KALP (MAR 2008)	MACH (MAR 2008)	YANM (MAR 2008)	WASI (Feb 2009)	JGRI (Feb 2009)	GOPA (Nov 2009)	PURI (Nov 2009)	PTBL (MAY 2010)	HTBY (MAY 2010)
2013 Apr	0	0	17	23	95	99	94	68	28	0
2013 May	0	0	58	70	96	81	92	91	0	0
2013 Jun	35	37	24	57	78	0	99	56	0	0
2013 Jul	84	100	63	26	94	17	82	0	79	73
2013 Aug	98	85	77	10	78	0	94	0	90	96
2013 Sep	98	100	94	0	88	0	74	0	95	94
2013 Oct	98	94	77	0	95	0	25	0	96	86
2013 Nov	99	98	32	16	97	0	0	0	43	86
2013 Dec	85	100	100	89	94	0	0	0	46	98
2014 Jan	100	100	100	87	89	29	0	0	0	97
2014 Feb	98	97	100	82	93	97	0	0	0	98
2014 Mar	99	92	100	86	98	100	0	0	86	94
Apr 2013 to Mar 2013	96	75	70	45	91	35	47	18	47	68

	Percentage Received Data >= 70%
	Percentage Received Data >= 50% but < 70%
	Percentage Received Data < 50%
	Site damaged due to fire accident
	Site damaged due to Cyclone Phailin
	Site down due to unavailability of spare and AMC

Data reception at ESSO-NIOT Chennai central site from April 2013 to March 2014



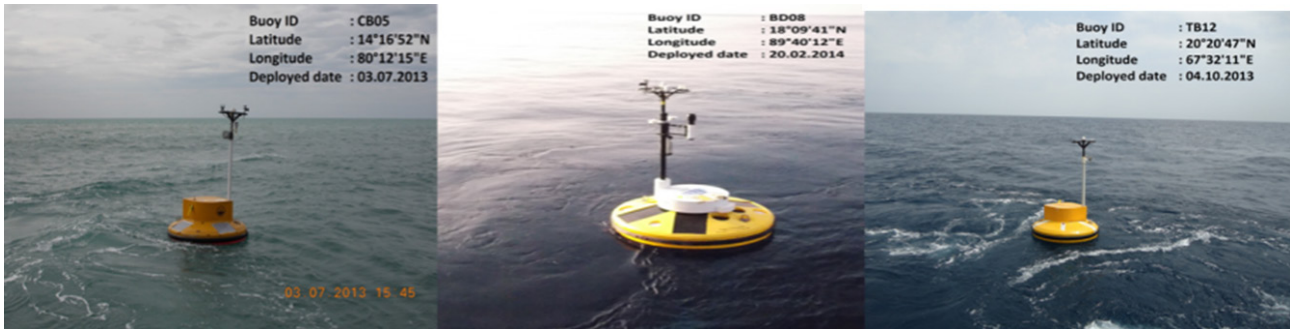
HFR measured surface current after the cyclone Phailin (October 9, 2013) at Port Blair

OCEAN OBSERVATION SYSTEMS

Coastal buoy system interfaced with INSAT and GPRS communication

OCEAN OBSERVATION SYSTEMS

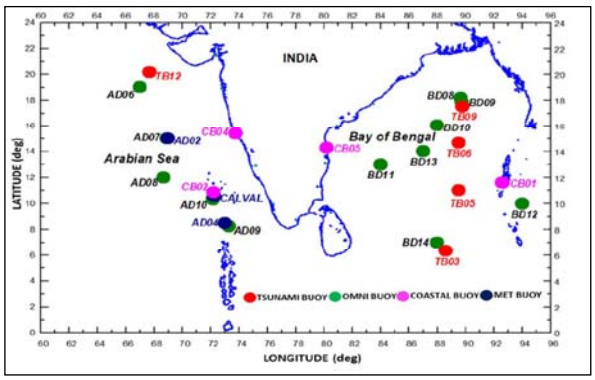
The Ocean Observation Systems (OOS) programme has the mandate to establish and maintain moored buoy network for measurement of met-ocean parameters in Indian Seas to monitor the marine environment and to improve weather and ocean forecasts.



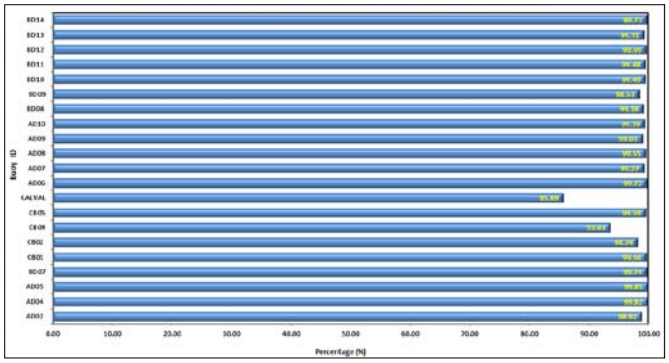
Moored buoy systems at sea

MOORED DATA BUOY PROGRAMME

The group has been successfully maintaining 12 OMNI buoy network in deep seas wherein the buoys have subsurface oceanographic sensors apart from surface met-ocean sensors. Also four coastal buoys have been functioning satisfactorily. The OOS group has completed 57 deployments/ retrievals for which 12 cruises of 184 shipdays covering 20000nm (nautical miles) with 1925 man-day during the period April 2013-March 2014.

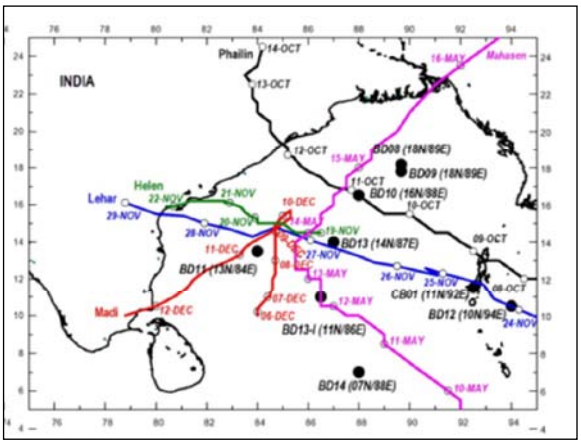


Moored Buoy Network in Indian Seas



Percentage of Met-Ocean & OMNI buoy data from Apr 2013 to Mar 2014

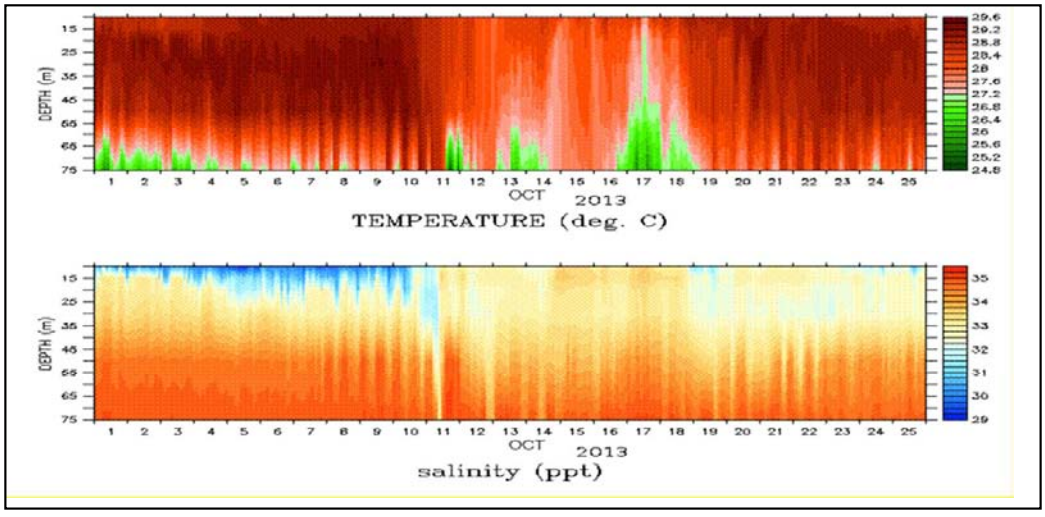
During this period, 12 OMNI buoys & 9 Met-Ocean buoys were working and the overall data availability is 95.31%. Considering the challenges faced, complexity involved and communication losses, this is a very good performance when compared to global experiences of similar such buoy programmes.



The moored buoy network during the passage of various cyclones

CYCLONIC RESPONSES IN THE BAY OF BENGAL

The OMNI buoys could capture the response in the ocean during the five cyclonic disturbances formed during the north-east monsoon and the one during the summer transition period. Among this the most significant one was the very severe cyclonic storm Phailin, with an observed lowest ever recorded pressure of 920 hPa, by an instrument in the Bay of Bengal. The OMNI buoys were within the eye of the cyclonic storm, with the observed well marked low in the atmospheric pressure and sudden decrease in wind speed during Phailin, Viyaru, Helan, Madi and Lehar cyclonic storms. The network of seven OMNI buoys along with two coastal buoys in the Bay of Bengal could capture some of the cyclonic disturbances from the evolution phase itself, so that it could support organizations like IMD to predict the track and intensity of the cyclone more accurately. The difference in the response of the ocean to the cyclonic forcing with the change in season is another subject of interest, with the presence of strong stratification in the Bay of Bengal with the availability of heavy river discharges during the summer monsoon season. The observed clockwise movement of the buoy, along with the inertial current excited by the cyclone is a challenge for the mooring. But the buoys never failed due to its well tested design, even during worse weather conditions.



Temperature and Salinity variations during Phailin Cyclone at BD10_16.5N/88E in October 2013

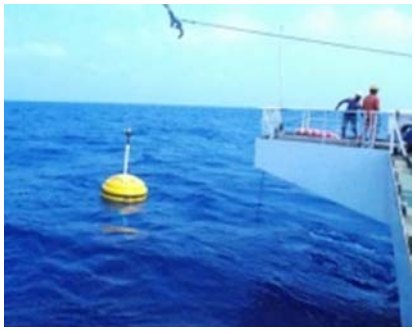
Technical Advancements in Buoy Technology

Comparing globally available such moored buoy systems, the OMNI buoy system is one of the most technically complex unit equipped with suite of sensors including MRU and ADCP which

collect and transmit voluminous data. Globally low power Iridium is used for buoy applications. But in India approved satellite communication is INMARSAT, which consumes more power for which high power batteries are accommodated in buoy systems. Inorder to have indigenized communication INSAT communication has been incorporated in the buoy system successfully.

Met – Ocean Buoy interfaced with INSAT and GPRS communication

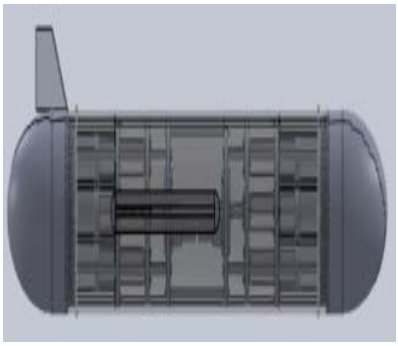
Met Ocean buoy was interfaced with dual transceiver system (GPRS and INSAT) which was deployed in all coastal buoys. The main data transmission components consist of a data logger, a GPRS modem, INSAT transceiver and a receiving server. Every three hours (UTC) the raw data are collected by the sensors and processed by CPU and stored in the data logger. The data are sent through GPRS modem using GSM network as well as through INSAT communication to the data reception centre.



Newgen (New generation) Buoy

ESSO-NIOT has discus shape mooring buoy for the measurement of atmospheric, ocean and Tsunami data collection. To increase the life time and to collect redundant data, a new buoy has been designed after numerical analysis for stability and the same has been compared with the stability of existing discus buoy. The recently developed new generation buoy was deployed in Bay of Bengal at the 17.5N/89.5E (TB09) location and performing well.

Design and Development of Laboratory Scale Underwater Glider

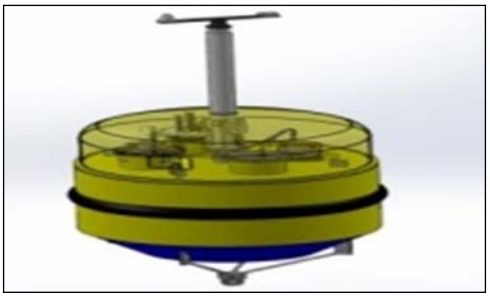


Development of Laboratory Scale Underwater Glider is underway for long term ocean observations. Present systems of Gliders use either bladder or piston type Variable Buoyancy System (VBS) to change the buoyancy and a moving mass mechanism for precise pitch control. In the present development, the buoyancy and the pitch are controlled by two buoyancy modules. Each module is independently actuated by a high torque motor. General Arrangement and subsystem drawings are completed and the initial prototype is being made.

Automatic Identification System (AIS)

A prototype passive monitoring system has been developed in house for marine grade applications. AIS was successfully deployed at CB04 location in Goa coastal waters. The system captured information about the vessel passing around the buoy location. In the second phase

of its development it is planned to transmit real time vessel passing information to ESSO-NIOT shore station through GPRS/ INMARSAT techniques.



pCo2 Buoy Design

Mechanical design of a pCo2 buoy is completed and manufacturing is underway. This design is mainly aimed at Co2 measurements in surface and subsurface. The present development would be carried out in collaboration with IITM, Pune.

Buoy position tracker using INSAT

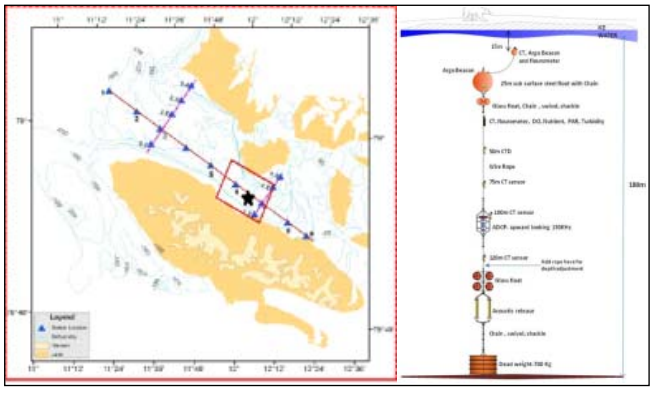
A standalone buoy position tracker has been developed using INSAT communication for replacement of ARGO position tracker. In order to ascertain perfect installation of the buoy, a position tracker has been developed and implemented using a standalone Mobile Satellite System (MSS) Transmitter. The MSS transmitter will get the GPS position from the satellite and transmit through the INSAT 3C geo stationary satellite using S band frequency at every one hour.

Syntactic foam Project in collaboration with IIT Madras

The aim of this project is to develop the syntactic foams that are highly buoyant, non-hygroscopic and could withstand high hydrostatic pressure so that it could be used for marine applications. Syntactic foams are lightweight composites consisting of hollow spheres (glass/ceramic microspheres) embedded in a polymer matrix (epoxy matrix). Optimized composition of glass microspheres and epoxy resin for targeted density of 0.6g/cc was achieved and samples were prepared. Samples would be tested for deep sea water and hyperbaric testing.

Arctic Observation – IndARC Mooring

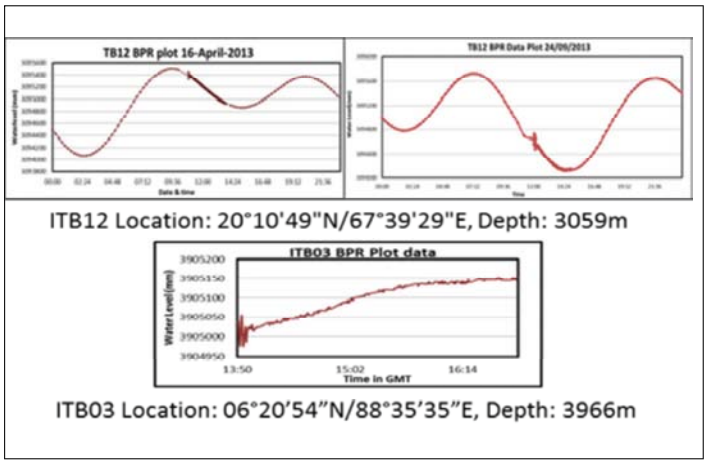
The need to continuously monitor ocean parameters for extended periods to understand ocean dynamics, was the driving force that led to the deployment initiative of mooring in the arctic region. This mooring plan was evolved considering the constraints in reaching location during winter and bad weather conditions in the Arctic region. Proposed Mooring configuration is capable of measuring parameters such as speed and direction of currents, physical parameters like conductivity (salinity), temperature, turbidity, DO and Chlorophyll jointly with NACOR and INCOIS and planned to be deployed in July 2014 at Kongsfjorden Fjord in Arctic Ocean.



IndARC mooring design

TSUNAMI BUOYS

Tsunami systems are continuously functional in the sea and they have captured the event transmitting data in real time. Events captured by Indian Tsunami buoy systems (16th April 2013, 24th September 2013 and 21st March 2014).



Three tsunami events were captured by ESSO-NIOT ITB12 and ITB03 buoy system. ITB12 BPR captured the change in water level and triggered to tsunami event mode on 16th April 2013 and 24th September 2013 following an earthquake event occurred at South Western Pakistan (Lat:28.107°N, Long:62.053°E and Lat:27.06°N, Long:65.6°E) with a magnitude of 7.9 Mw(mB) and 7.7 Mw(mB) respectively. ITB03 BPR also triggered to Tsunami event mode on 21st March 2014 13:50 GMT following an earthquake event occurred at Nicobar Islands, India Region, after the occurrence of the Earth quake.

Twin mode communication

As the complete tsunami buoy system is being indigenized, the Indian satellite (INSAT) technology is attempted for telemetry of tsunami buoy data in real time. Also this is a strategic planning of data security and cost reduction of data transmission. There is a limitation of using INSAT in tsunami mode and so INMARSAT has been used for tsunami mode and INSAT for health monitoring mode. The buoy ITB03 was deployed with this facility on Aug 2013 and this buoy captured the tsunami events on 24th March 2014. This technological achievement greatly reduces the cost involed in the data transmisison and it ensures data security.

Indian Tsunami Buoy System (ITBS) BPR Dead Weight

A new BPR release system was developed and fabricated for ITBS in tandem with Low power Integrated Data Acquisition System (LIDS) considering the need for an indigenized system. Sea trials would be conducted on the developed prototype in the open ocean to check the functionality.

SUPPORT TO INCOIS

Support is extended for Ocean observation network programme of MoES to ARGO Floats, Drifters, RAMA buoys, SAIC Tsunami Buoy programme at ESSO-INCOIS and onboard the Ship during cruises.

VESSEL MANAGEMENT CELL

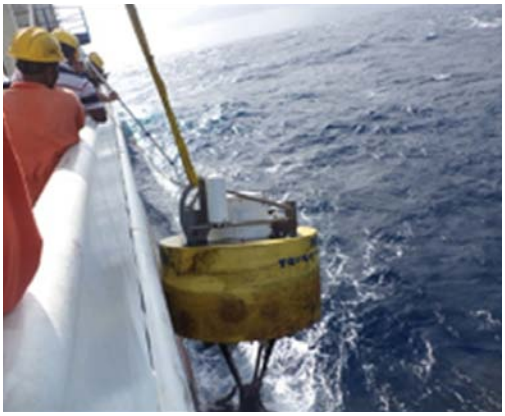
VESSEL MANAGEMENT CELL

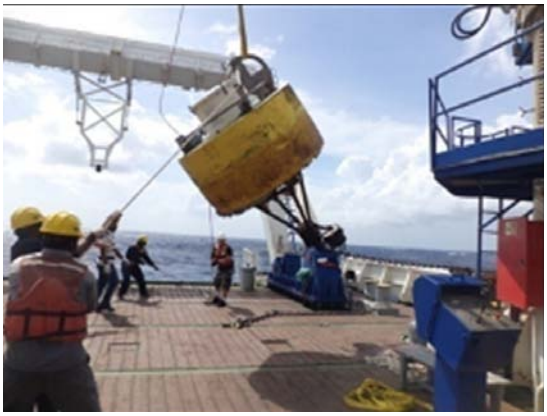
The main function of Vessel Management Cell (VMC) is Operation, Maintenance and Management of MoES vessels. Technical management, Overall control, Program Planning and Implementation for Coastal Research Vessels Sagar Purvi and Sagar Paschimi, Sagar Manjusha and Technology Demonstration Vessel Sagar Nidhi are carried out.

Installation of Fleet Broad Band (FBB) facilitated live webcasting during Deep water Sea trials of ROSUB 6000 onboard Sagar Nidhi.

The TDV 'Sagar Nidhi' caters to the ongoing and the new programmes of the MoES such as the deep sea mining, Remotely Operable Vehicle, Ocean Observations Systems, surveys to support the Technology Demonstration Programmes and to act as support platform for the various research activities of the Ministry, universities and research institutes across the country. Coastal research vessels 'Sagar Purvi' and 'Sagar Paschimi' continue to be used for the implementation of the Coastal Ocean Monitoring and Prediction System (COMAPS) and Integrated Coastal and Marine Area Management (ICMAM) programmes of MoES VMC is actively involved in cruises related to Southern Ocean Expedition and coordination with the scientific team through offshore and onshore support. VMC is also working on the development of new technology for cost effective and efficient management of vessels and clad welding of ships propeller shaft is one such.

VMC continuously assesses the performance of its ships. The performance of Sagar Nidhi's Dynamic Positioning system is carried out through reliability assessment. .

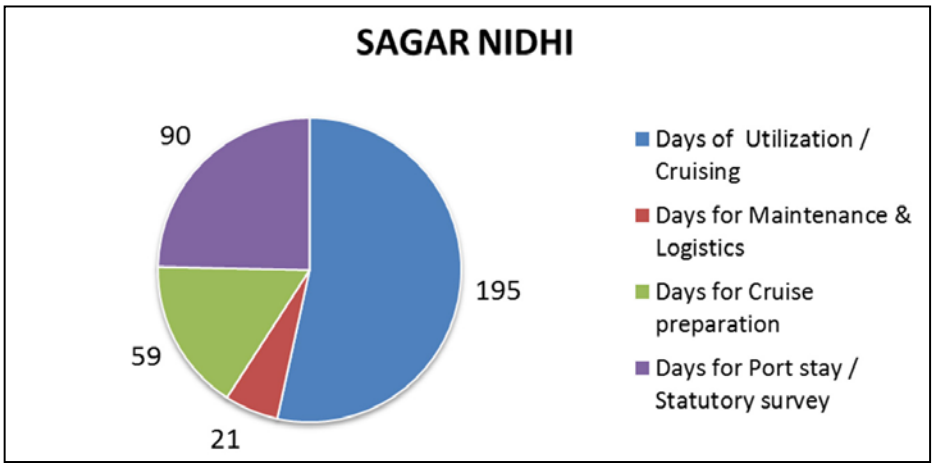




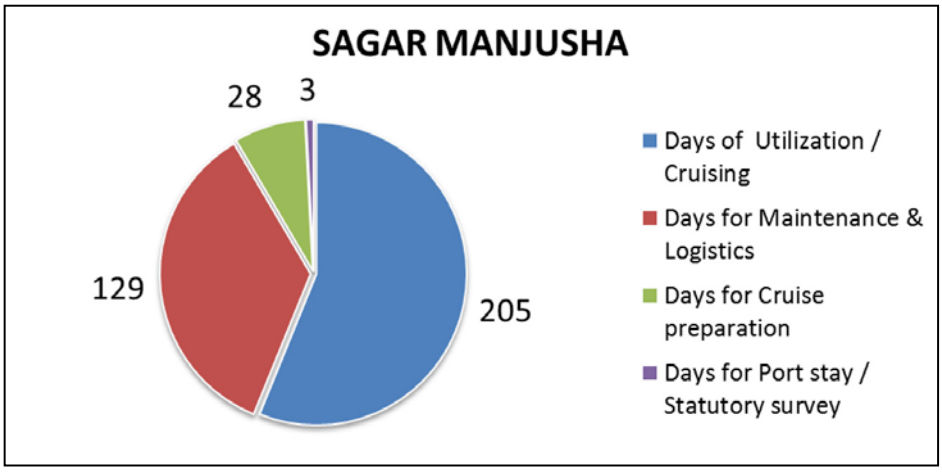
Deployment and retrieval of SAIC-INCOIS buoys

VESSEL UTILISATION REPORT

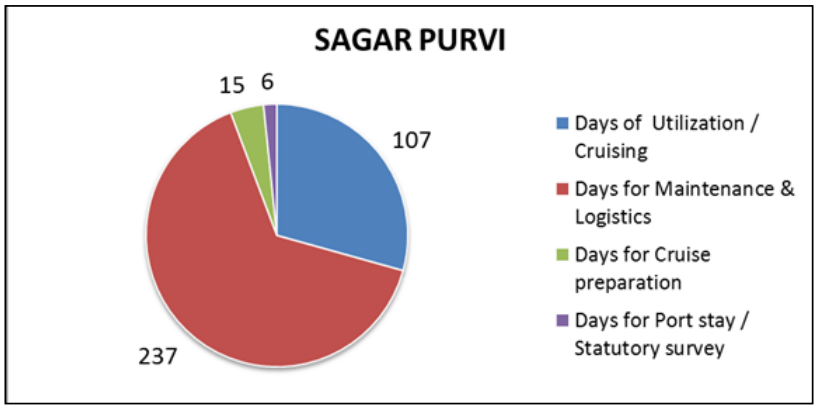
Vessel	Days of Utilization / Cruising	Days for Maintenance & Logistics	Days for Cruise preparation	Days for Port stay / Statutory survey	No. of Cruises undertaken
Sagar Nidhi	195	21	59	90	12



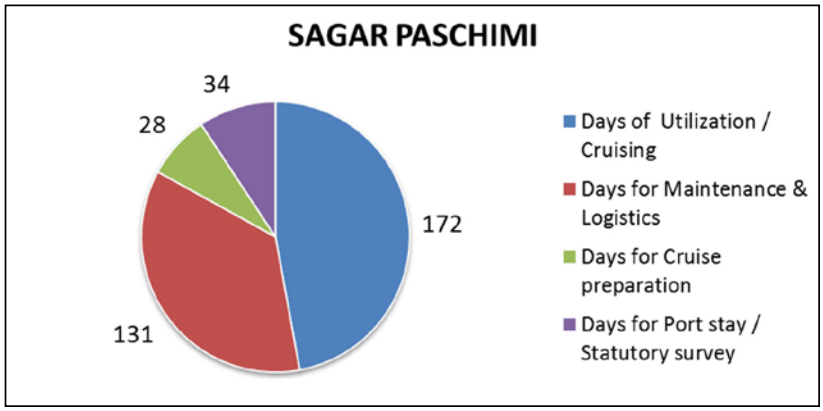
Vessel	Days of Utilization / Cruising	Days for Maintenance & Logistics	Days for Cruise preparation	Days for Port stay / Statutory survey	No. of Cruises undertaken
Sagar Manjusha	205	129	28	03 (Annual Survey)	25



Vessel	Days of Utilization / Cruising	Days for Maintenance & Logistics	Days for Cruise preparation	Days for Port stay / Statutory survey	No. of Cruises undertaken
Sagar Purvi	107	237	15	6 (Bad Weather)	18



Vessel	Days of Utilization / Cruising	Days for Maintenance & Logistics	Days for Cruise preparation	Days for Port stay / Statutory survey	No. of Cruises undertaken
Sagar Paschimi	172	131	28	34	25



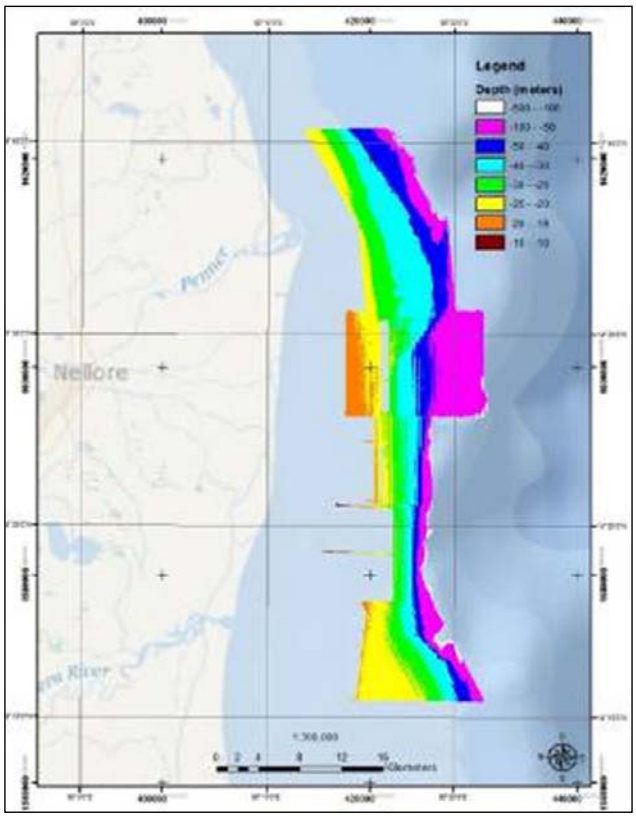
ACQUISITION OF TWO COASTAL RESEARCH VESSELS (CRVS) FOR ESSO-NIOT, MOES

The work order for "Concept Design Consultant for two CRVs" was placed to IMU Visakhapatnam on nomination basis as per the direction for MoES. Configuration for installation of Multibeam and Single beam Echosounders / ADCP and the hull form were finalized PMCC meeting held at ESSO-NIOT in May, 2014 . A tender document is being prepared by IMU, Visakhapatnam in consultation with VMC and will be put up to next meeting of PMCC.

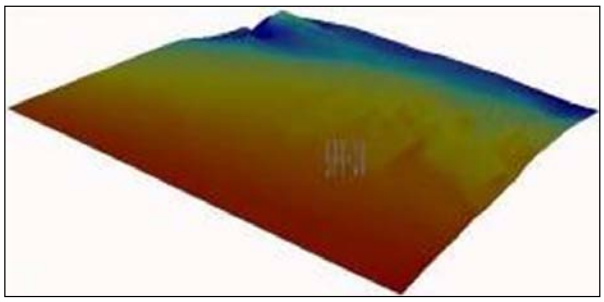
Geoscientific Studies of the Exclusive Economic Zone of India

MoES has entrusted ESSO-NIOT with swath bathymetry survey and core sample collection in the East coast of India, where water-depths range from 10 metres to 500 metres with the following objectives:

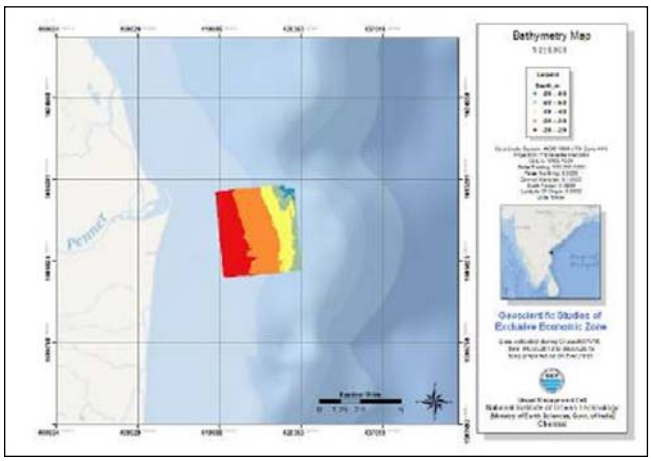
- To carry out swath bathymetry survey using Multi Beam EchoSounder (MBES) and to prepare comprehensive seabed topographic map.
- To carry out systematic sediment sampling and analysis to assess the potential of seabed resources within the EEZ.
- To improve our understanding of seabed morphology and paleoclimatic regime of Indian Peninsula.
- Creation of marine geoscientific database for dissemination to the scientific community against approved MoES projects.
- A survey coverage of approximately 400 sq.km achieved and 18numbers of sediment core samples (having varying lengths from ~20 cm up to a maximum of ~2m) were collected. Data processing was completed for SPV10 cruise data set.



MBES survey coverage achieved during 2013-14, plotted with a cell size of 20m using raw data collected onboard Sagar Purvi



Processed 3D output of the data collected onboard Sagar Purvi during cruise#SPV10, gridded with a cell size of 2m



Map prepared using processed output (gridded with a cell size of 2m) of the data collected during cruise#SPV10

CARBON DI OXIDE OCEAN SEQUESTRATION TECHNIQUES

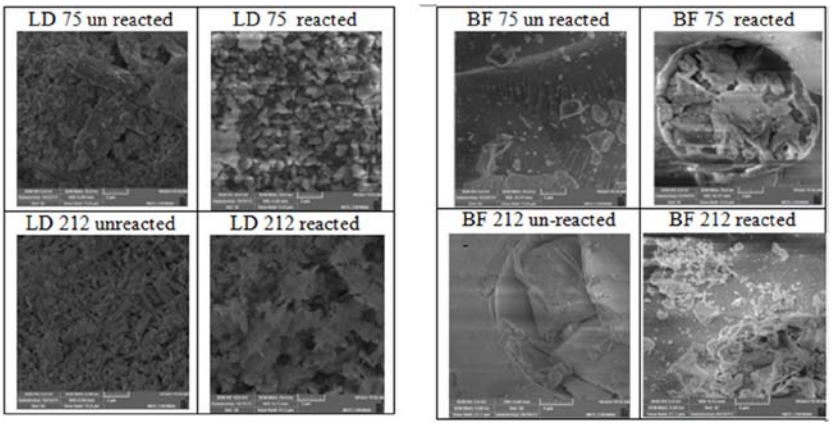
The increasing atmospheric carbon dioxide concentration and the concerns about global warming are motivating the worldwide studies on carbon dioxide sequestration and its influence on the changes in the earth climate system such as sea level rise; changes in snow cover, atmospheric and ocean circulation patterns, etc. Studies are initiated at ESSO-NIOT to understand the mechanisms in the following general areas:

- Carbonation of industrial waste, such as slags;
- Deployment of artificial reefs with blocks made out of carbonated product
- Micro algal growth studies in presence of carbon dioxide and flue gases from the industry.

A laboratory facility is established to conduct detailed studies. In addition, studies on carbon dioxide capture technology are also conducted in collaboration with IIT, Kharagpur. The work is being processed through the new initiatives on the Climate Change Studies program of the Ministry.

CARBONATION EXPERIMENTS

Approximately 7% of the total anthropogenic carbon dioxide emissions into the atmosphere are contributed by Steel industries. Carbonation experiment was focused on Linz Donawitz converter and Blast Furnace slags where high percentages of calcium (40%) and magnesium oxides (9%) are available to convert as carbonate with CO2 for ocean utilization. Industrial visit to Vizag steel plant was taken up to understand the steel making process, slag utilization and flue gas release points. Linz-Donawitz (LD) converter slag and Blast furnace slag was obtained from Vizag steel plant to carry out carbonation experiment at ESSO-NIOT.



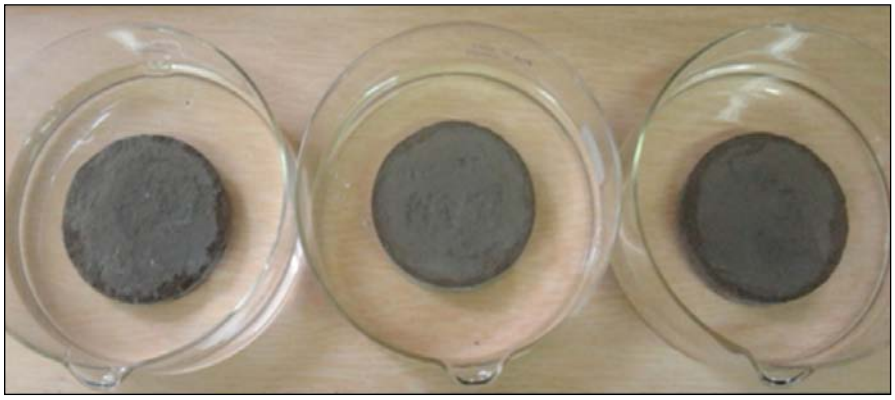
Scanning Electron Microscope images of Linz Donawitz converter slag and Blast Furnace slag

The median (D50) size of the particle, with respect to the cumulative weight (%) is 203 µm and 650 µm for the Linz-Donawitz converter and blast furnace slags respectively. The concentration

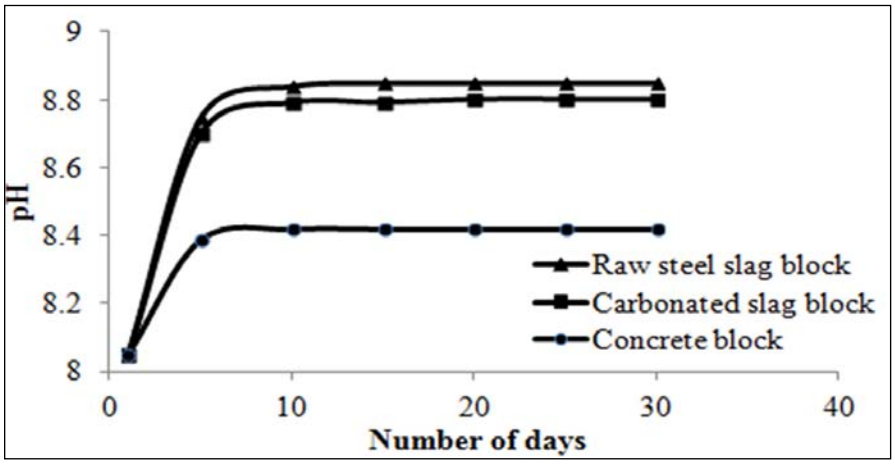
of 212-425 µm size particles in Linz-Donawitz converter slag is maximum and about 80.29% by weight is in 75-600 µm particles. The concentration of 600-1000µm particles is maximum in blast furnace slag and about 87.9% by weight is in 425-2000µm particles. The structural morphology of the sample before and after carbonation reaction with a Scanning Electron Microscope revealed the formation of rhombo-hedral shaped carbonates for an initial slag particle size of 0-75µm and of Scaleno-hedral shaped carbonates for 212-425 µm size.

ARTIFICIAL BLOCKS PREPARATION

The un-reacted steel slag and carbonated slag are used to replace the gravel in the concrete and cast as blocks for studies on their structural stability, wettability in seawater and pH change of seawater due to immersion of blocks, to determine the feasibility of the use of these blocks for the artificial reefs. For sea water with an initial pH of 8.05, an increase in pH of 0.3 is observed in 30 days due to immersion of concrete block, compared to the increase of nearly 0.8 for the immersion of raw slag block and carbonated slag block. This may be due to the initial dissolution of calcium oxide in the sea water for the time duration of measurement of 30 days. Further studies on the use of the carbonated slag as a substrate for marine growth are being planned.



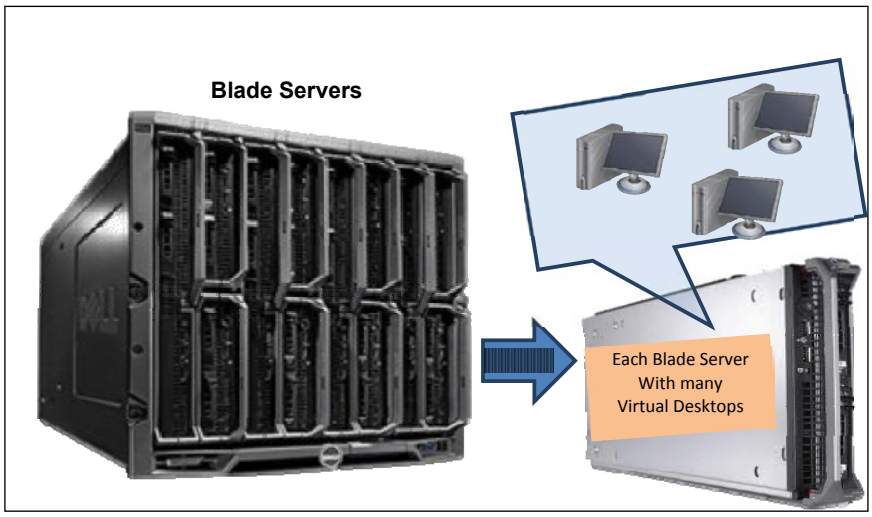
Concrete Block *Raw Steel Slag Block* *Carbonated Slag Block*



Blocks of concrete, raw steel and carbonated slags: change in pH of seawater due to immersion

COMPUTER MAINTENANCE CELL

Computer Maintenance Cell (CMC) of the ESSO-NIOT was established in the year 1997, with the objective of providing computational infrastructure facilities for the Institute. CMC administers, manages and supports the needs of different projects/ departments within the institute, apart from in-house software development and maintenance, catering to about 500 users through a campus-wide single mode Optical Fiber Cable Local Area Network with an aggregate bandwidth of 1 Gbps between switch nodes. National Informatics Center's 1GBPS National Knowledge Network along with a 25 Mbps leased line from Internet Service Providers ensure uninterrupted service to the user community.



The core infrastructure facilities include an 80 core SGI Altix 4700 HPC and several high end servers with wide variety of operating systems like Windows, Unix, Linux, Centralized OS for intranet portal, web & mail services, FTP Storage and Application servers running key applications on 24 x 7 basis. Storage facilities include EMC 20 TB, HP 4 TB and StorTrend 14 TB to support large volume of data. The data centre is equipped with 8 numbers of Blade servers that are sliced into multiple virtual server instances with the help of VMware and are configured to handle multiple tasks. The modernization of data centre with blade servers has significantly reduced the space and latency in application processing time in addition to providing the option of dynamic movement from one server to another without any downtime or compromise in operation or processing.

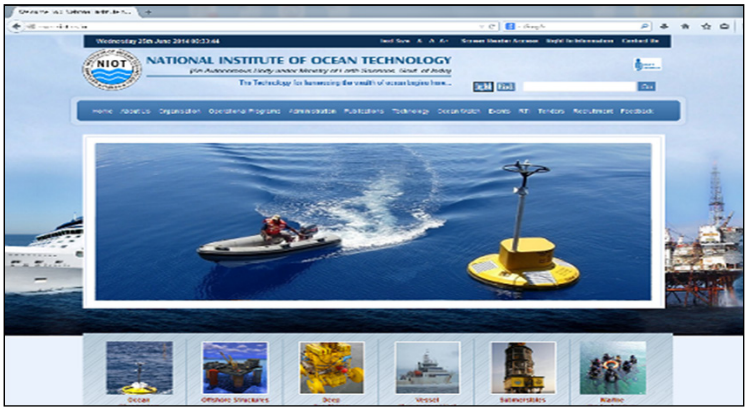
CMC also handles procurement of computing and storage needs for the institute and also maintains the video conference, tele-presence, webcast facilities of the campus and provides support for computer based presentations. Wi-Fi facilities are provided in the Guest House, Meeting halls and for conferences and workshops. In-house software applications are developed and maintained to support Establishment & Personnel department, Stores & Purchase department and Finance & Accounts department covering activities such as Leave management, indenting, approvals, payroll and accounting.

An Integrated Office Automation System (IOAS) has been initiated for computerization of a majority of the administrative activities of the various sections of the Institute, such as, stores

and purchase, finance and accounts, human resources, estate and personnel, etc. As part of the contract issued for the implementation, detailed Software Requirement Specifications (SRS) for the activities are drawn up and the code is being developed.

Major Accomplishments during the year:

- Up-gradation of ESSO-NIOT website.
- Internet leased line was upgraded from 18 Mbps to 25 Mbps



Major software applications used by various departments and supported by CMC			
Drafting and Modelling	**Analysis**	**General Purpose Software's**	**Project Monitoring / Administrative**
Pro-E	Mike 21	MathCAD	Primavera
Mike C Map	Plaxis	Lab View	Micro Soft Project
AEGIS AutoCAD Surfer	STAAD Pro	Matlab	Oracle
Solid Works Grapher	Arc-GIS	Code Vision	SAP-2000
ITI Simulation	Ansys, CFD – Fluent	Conrad	
	Moses, Orcaflex		
	OpenFoam		
	Surface Modelling Simulation X		
	HTRI		
	LMS Sysnoise		

CAMPUS DEVELOPMENT

As part of Campus development work, to cater to the requirement of Research & Development activities of different groups at ESSO-NIOT Campus, the following Civil & Electrical activities are in progress.

Storage yard Extension at Ocean Observation System Integration Bay, Common storage yard, Extension of Vessel Management Cell for office facilities and the temporary structure integration bay for Deep Sea Technology group are in progress.

VMC Extension

OOS Extenstion

Integration Bay

Storage Yard

Approach Road

Laboratory complex at A&N

Modification of HT/LT (Electrical) Infrastructure work is in progress to increase the supply to 1200 kVA for meeting the power demand of ESSO-NIOT. RCC culvert for the approach road with LED Street lighting (as a part of power conservation measure) has been successfully completed and opened for usage. Laboratory complex and staff quarters at Andaman office of ESSO-NIOT are nearing completion.

Common facilities

The Project Display Hall is under construction to display and demonstrate the activities/ projects of ESSO-NIOT. The parking shed for ESSO-NIOT vehicles and the playground for volley ball & Shuttle badminton have been developed as a part of staff recreation and are in use.

The Project Display Hall-Work is in Progress

Model Energy audit was conducted at ESSO-NIOT campus and steps which are adaptable are being taken to improve the energy efficiency. Enriched solid waste management system has been installed for Horticulture usage.

LIBRARY

Library plays a vital role in providing research materials and facilities for Scientific staff in a variety of fields spanning the engineering and life sciences of ESSO-NIOT. The primary objectives of the library are to acquire, preserve and expand the collection of the reference materials and provide the necessary support for the advancement of the frontier works being undertaken by ESSO-NIOT.

Library has a valuable collection of about 5078 numbers of books on science and technology, covering books, journals, technical papers, NHO Maps, Standard publications, CD-ROM's, Hindi books and other materials, providing information to its scientific community. An online tool is provided for searching and tracking of the resources through the Intranet, Samudra, for users of the institute and the Andaman and Nicobar for Ocean Science and Technology (ANCOST) Centre, at Port Blair. A total of 86 volumes, including 38 titles in English and 48 titles in Hindi are added during 2013-14.

A view of the collections at the library

A view of the scientists utilizing the library

The annual subscription for 22 printed journals, 117 international online journals as part of a consortium of the institutes under Ministry of Earth Sciences (MoES), 6 Hindi Magazines and inter library lending arrangements are made with the libraries of IITM, British Council and Anna University to augment the strength of the document collections. The collection of scientific articles posted under the Digital Repository Services of Ministry Website provides wider dissemination of ESSO-NIOT publications within the scientific community.

IMPLEMENTATION OF OFFICIAL LANGUAGE AT ESSO-NIOT

In Service Hindi Training

During the year under report, four members of staff qualified in Hindi Praveen and eight staff members in Hindi Pragya of Hindi Teaching Scheme. Six of them were given cash award. Another six have been sponsored for various training programmes of the Hindi Teaching Scheme.

Conduct of Official Language Implementation Committee meetings

Official Language Implementation Committee meetings were held on 1-7-2013, 8-10-2013, 30-12-2013 and 26-2-2014 during the year 2013-14 and decisions taken therein were implemented.

Hindi Fortnight Celebrations

- ESSO-NIOT celebrates Hindi fortnight every year. During 2013-2014, Hindi fortnight was celebrated with enthusiasm between 16th and 27th September 2013.
- Competitions were instituted separately for Hindi speaking and non-Hindi speaking employees, seven for the former and eight for the latter. The staff participated in them with elan and the meritorious were awarded prizes.
- Two workshops on Hindi as an Official Language namely, "Importance of Hindi in the field of Science" by Dr.D.D.Ozha and "Noting and Drafting" by Dr.S.Devidas were conducted on 20.09.2013 and 25.09.2013.
- Two staff members were deputed on 30/07/2013 to Indian Oil Corporation Nungambakkam, Chennai to attend workshop on online submission of Quarterly Report of Official Language.

Hindi Fortnight Celebrations

Technical Workshops

Technical workshops in Hindi are being held regularly every Quarter. The following were the ones held during 2013-2014:-

- "Why Acoustics for Ocean "and "Modeling & Data Assimilation" on 12.06.2013.
- "Overview of buoy mooring system"& Electronic Data Acquisition & Processing on 23.12.2013.
- "Tsunami Detection System","Automatic Subsurface Fish Cage" & "Kalpasar Observatory System" on 12.03.2014.

Inspection by Committee of Parliament on Official Language

The second sub committee of Committee of Parliament of Official Language inspected ESSO-NIOT on 21st January, 2014 under the chairmanship of Shri Satyavrat Chaturvedi, Honourable Member of Parliament (Rajya Sabha). The valuable suggestions given by committee on progressive use of Official Language Hindi have been noted and are being implemented.

Participation of the second sub committee of Committee of Parliamentary of Official Language

Hindi Articles in TOLIC Magazine

TOLIC published articles on “Modern Hindi Literature” by Smt. Nidhi Varshney, Scientist-C and “Modern Litterateur - Jai Shankar Prasad” by Smt. Rambha Singh, Project Senior Executive in the Rajbhasha Pratrika released during the year.

Making stationery items, name plates, display items in bilingual

Stationery items, name plates, display items etc have been made bilingual and departments have been advised to ensure that these are made bilingual in future also.

Participation in TOLIC meeting

ESSO-NIOT represented itself in the TOLIC meetings held on 03.05.2013 at SERC Taramani, Chennai and 28.10.2013 at IITM Chennai by deputing two Official dealing with the progressive use of Hindi.

TRAININGS / MEETINGS ORGANIZED

A four-day technical training program on 'Marine studies for coastal infrastructure projects' for senior professionals of Power Finance Corporation (PFC) and Tamil Nadu Electricity Board (TNEB) was conducted from 25th – 28th June 2013. Training covered studies for infrastructure requirements for technical feasibility of marine handling facilities and statutory requirements like environmental clearances.

Fourth expert committee meeting for finalization of optimum moored buoy network, location and parameters to be measured was conducted on 11th July 2013. The committee appreciated the improvement shown in the technological aspects and the efforts taken by the group towards the Buoy Network Maintenance and satisfied with the performance of sensors and continuous buoy data availability.

Japan Agency for Marine-Earth Science and Technology (JAMSTEC) Meeting

The following broad areas were identified during the meeting between ESSO-NIOT & JAMSTEC on 22nd October 2013 at ESSO-NIOT:-

- OOS training on calibration of sensors for meteorological and oceanographic observations
- Testing and calibration of pressure sensor for water level measurements for tsunami buoys
- Training on interpretation and understanding of tsunami triggered data
- Training on operation, development of deep sea floor observatory and early detection of tsunami
- Support and design of mooring for southern ocean and development of newer materials for deep sea applications

Interaction with the JAMSTEC delegates

Parliament Committee Visit

Visit of the Parliamentary Standing Committee

The Parliamentary Standing Committee on Science & Technology, Environment & Forests, visited ESSO-NIOT on January 7, 2014 and reviewed the performance. The committee appreciated the work carried out by ESSO-NIOT stating that it is commendable and excellent.

CONFERENCES / WORKSHOPS ORGANIZED

A **One day workshop on Underwater Technology UTW 13** was organized by ESSO–NIOT and IEEE OES India Council on 21 October 2013 as a precursor to UT15 Conference in India. Leading national and international scientists working in the area of Underwater Technology were invited to deliver lectures. About 100 Professionals and students working in this area in different Research & Development Organizations and Educational Institutions participated in the same and derived benefit from the interaction with the renowned experts. Dr. Shailesh Nayak, Chairman Earth System Sciences Organisation inaugurated the workshop. The inaugural session was attended by representatives from research institutes from India and abroad like ESSO-NIOT, IIT Madras, JAMSTEC, Ocean Engineering industries, Directors of many research organizations and senior scientist from Ministry of Earth Sciences.

Twelve lectures were delivered by leading national and international scientists working in the area of underwater technology on the following themes.

- Deep Sea Technologies & Ocean Mining
- Underwater Vehicles
- Underwater Acoustics
- Ocean Observations

Seventeen posters by graduate and post graduate students were selected for display during the workshop. Three best student paper awards were presented.

Prof. Tamaki Ura announced the award of IEEE OES UT 15 to India to be conducted at ESSO-NIOT during 23 – 25 February 2015. It was also informed that India can bid for hosting Oceans 22 in the year 2022.

UN Workshop under the auspices of the United Nations, in support of the Regular Process for Global Reporting and Assessment of the state of the Marine Environment including Socio-economic aspects, was conducted at ESSO-NIOT during 27-28 January 2014 and was attended by international and national experts.

Participants of UN Workshop

A few countries which could not attend participated through video conferencing. A video conference bridge which enables 20 participants from any part of the globe to participate, was set up for UN workshop, for the first time at ESSO-NIOT and well appreciated by the participants.

International conference on Innovative Technologies and Management for Water Security (INDACON 2014) was conducted successfully at ESSO-NIOT on 12th – 14th February 2014. Dr. Shailesh Nayak, Secretary, MoES participated in the inauguration over video conference. Total 56 papers besides a number of key note addresses on various aspects of water technologies and management were presented and deliberated as part of 50th anniversary of International Indian Ocean Expedition. The conference saw a very wide participation from students, academicians, scientists and experts from industry. A poster presentation competition and best paper competition for students was also organized during the conference. Exhibition was inaugurated by Prof. M. Ravindran, former Director, ESSO-NIOT, Chennai. Several industries in desalination field displayed their exhibits during the conference.

Inauguration of Exhibition by Prof M.Ravindran, Former Director, NIOT

Exhibition stalls by Industries at INDACON-2014

International Conference on Advanced Technologies for Management of Ballast Water and Biofouling (MABB 2014)

ESSO-NIOT organized the International Conference on Advanced Technologies for Management of Ballast Water and Biofouling (MABB 2014) during March 4-7, 2014, to address the two specific but closely related issues of Ballast Water Management (BWM) and Biofouling. The goal of the conference was to provide a meeting ground for researchers and others working in the areas of BWM, marine bioinvasion, biofilm, biofouling control etc. The conference was inaugurated by Prof. K. Vijayaraghavan, Secretary, DBT in the presence of Shri. Amitava Banerjee, Chief

Release of abstract and souvenir of MABB 2014

Surveyor, DG Shipping and Dr. Shailesh Nayak, Secretary, MoES, the Patron of MABB 2014. The conference saw a wide participation from students, academicians, scientists and experts from the industry. There were a total of 115 participants, including 11 international participants from seven different countries. A total of 98 papers were presented during the nine technical sessions and one industrial session. In a special brainstorming session, the experts from various fields expressed their views on BWM and Biofouling problems. The conference enlightened the relevance of BWM and Biofouling control measures and was beneficial to the industries and scientific communities across the world.

STAFF RECREATION CLUB/STAFF WELFARE ACTIVITIES

Picnic organized by SRC

Staff Recreation Club (SRC) aims to promote the various skills of individuals through recreational and relaxation programs. SRC organized one day picnic, various sports activities and competitions, which made memorable with huge participation of staff and family.

- The annual sports competitions conducted under more than 25 events during July - August 2013 and distributed 250 certificates and prizes.
- Painting competition was conducted for children as part of Independence Day and Republic Day celebrations. Prizes and certificates were distributed under various categories and painting kits were distributed to all participants.
- SRC has organized a one day picnic to Mahabalipuram on 19th October 2013 with more than 150 people including 30 children.
- A talk entitled "Introduction to Happiness" was organised on 19 Nov 2013 with a focus on yoga and breathing techniques to release stress and to increase positive energy.

REPUBLIC DAY CELEBRATION

Republic Day Celebration

The 65th republic day was celebrated at ESSO-NIOT on 26th January 2014 which witnessed the wholehearted participation of staffs and family. The occasion was graced with two invited guests,

Dr. S.Prabhakar (Chairman, Indian Desalination Association (South Zone)) and Ms. Annebeth Rosenboom (Chief, Treaty Section, United Nations Office of Legal Affairs). A painting competition for kids and general quiz for the staffs and family were also conducted and distributed the prizes.

INDEPENDENCE DAY CELEBRATION

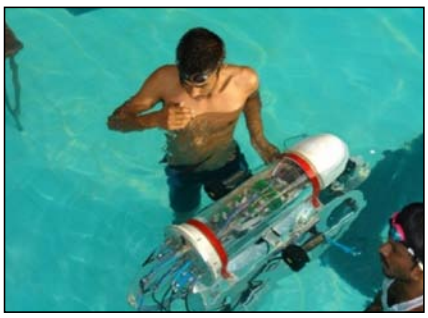
The Independence day was celebrated on 15th August 2013. Sports events such as running, musical chair, painting etc. were conducted for adults and children and prizes were distributed to the winners.

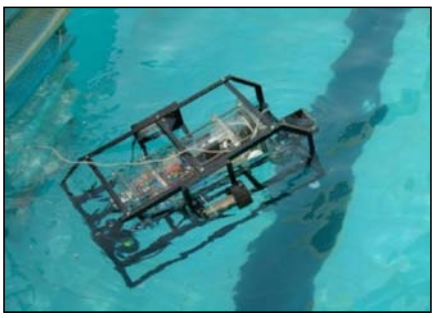
Prize distribution

Competition during Independence day

THIRD NATIONAL COMPETITION ON STUDENT AUTONOMOUS UNDERWATER VEHICLE (SAV*e*-2014)

Dr. M. A. Atmanand, Director, ESSO NIOT announced 3rd National competition on Student Autonomous underwater Vehicle (SAVe -2014) on 15th August 2012. Out of 27 teams registered, 14 teams submitted their Preliminary Design Reports (PDR). The National Committee evaluated the students based on detailed Conceptual Design Report and the following five teams presented their working AUVs and demonstrated on 3rd February 2014 at the swimming pool of Sports Development Authority of Tamil Nadu, Chennai.





AUV demonstated by teams

Indian Institute of Technology, Madras won the SAVe 2014 competition

1. Delhi Technology University, Delhi
2. SRM University, Chennai
3. Ambedkar Institute of Advanced communication Technologies & Research, New Delhi
4. Indian Institute of Technology Madras, Chennai
5. Indian Institute of Technology Kharagpur, West Bengal

Chief Guest, Commodore Amar K Mahadevan, Naval Officer In-Charge (TN&P) graced the occasion and appreciated the efforts taken by students. Indian Institute of Technology Madras was the winner of SAVe Competition 2014. ESSO-NIOT would sponsor the winning team to participate in the International Competition to be held at San Diego, USA during July 2014. The success of this competition is, India has eight AUVs having different configuration. This is a major contribution by students in the field of Underwater Technology.

ISO CERTIFICATION

ESSO-NIOT has obtained ISO 9001:2008 certifications for the administrative sections such as Planning and Management, Finance and Accounts, Stores and Purchase, Establishment and Personnel, Estate and Maintenance, Library, Director's Secretariat, Computer Maintenance, Security, Transport and Logistics and HRD. The recertification audit was successfully completed and certification has been obtained till November 2015.

VISIT OF DISTINGUISHED SCIENTISTS

Technology Day Celebration

National Technology Day was celebrated at ESSO NIOT Chennai on 11th May 2013. Shri.Avinash Chander, Distinguished Scientist, Chief Controller R&D (Missiles and Strategic Systems), Defence Research Development Organization honored the occasion as Chief Guest and gave the Technology Day lecture. The Chief Guest visited the different labs and planted a tree to commemorate the occasion. Various technologies related competitions were organized for Scientists and Technicians and prizes were distributed.

Lab visit by the Chief Guest

ESSO NIOT Foundation Day

ESSO NIOT Foundation day was celebrated on 5th November 2013. Dr.T.Ramasami, Secretary, Ministry of Science and Technology, Govt. of India, graced the occasion as Chief Guest. An Exhibition was organized for school children in addition to lab visits. The celebration included tree plantation by Chief Guest and release of NIOT Newsletter.

Visit of Chief Guest to lab

Corrosion Research Day Celebration

The second Corrosion Research Day Celebration was jointly organized at ESSO-NIOT on 21st September 2013 in coordination with Confederation of Indian Industry (CII) – Corrosion Management Committee (CMC) & Faraday Council of Corrosion (FCC) and NACE Gateway India Section – NIGIS South Zone. More than 100 students from different schools such as Atomic Energy Central School, Kalpakkam, Kendirya Vidyala, Kalpakkam and Government Hr. Sec. School, Pallikaranai participated in Elocution Competition and 6 Video on Corrosion awareness were shown by students from engineering colleges. Best 3 entries in both the categories were awarded with certificates and prize. The program was well appreciated by Dr.Baldev Raj, Dr.M.A.Atmanand, Dr.Kamachi, Mr.R.Narayanan & the CII – CMC members.

Competition held during Corrosion Research Day Celebration

AWARDS WON DURING 2013-14

FICCI Water Award

On August 6, 2013, Hon'ble Shri. Montek Singh Ahluwalia, Deputy Chairman, Planning Commission, Government of India, and Ms. Naina Lal Kidwai, President, FICCI, gave away the FICCI Water Award to KGDS, ESSO-NIOT and DST, a first prize in the innovation category for solar desalination.

NIGIS Meritorious Corrosion Award

Dr. R. Venkatesan, Group Head – Ocean Observation Systems, ESSO-NIOT received the prestigious NIGIS Meritorious Corrosion Award for the year 2013 by NACE USA - India section during CORCON 2013 at New Delhi on 2nd October 2013.

NIGIS Meritorious Award received by Dr. R. Venktesan

Best Reviewer Award

Dr.A.Ganesh Kumar, received the Best Reviewer Award, Bioresource Technology Journal, Elsevier Publications, 2013.

MoES Award

The following staff of ESSO-NIOT have received the MoES awards for the year 2012-13 during the Foundation Day of Ministry of Earth Sciences (MoES), held on July 27, 2013 at New Delhi.

- The **"Certificate of Merit"** young Scientists / Engineers Award in the field of Ocean Sciences and Atmospheric Sciences have been awarded to:

  Mr.Tata Sudhakar, Scientist 'E'
  Mr.Aruna Kumar Avula, Scientist 'C'

- The **"Best Employee Award"** have been received by the following staff:

  Mrs.Mary Leema Thilakam, Scientific Assistant Gr.'B'
  Mrs.K.R.Anuradha, Senior Executive
  Mr.C.Jothi, Technician Grade-B
  Mrs.S.Vasanthi, Junior Executive
  Mr.M.Vinodh Kumar, Multi-tasking staff

PATENTS FILED

Authors Name	Title	Patent filed appln No. / dt
Muthuvel P, Gnanaraj A.A, Sasikala T, Deepak C.R, Atmanand M.A	Portable In-situ Soil Testing Device	1609/CHE/2014, 26th March 2014

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- S.A. Sannasiraj, M. Kalyani, E. Dinesh Kumar, K. Harini, G. Latha and V. Sundar, *"Inter Comparison of Wave Height Observations from Buoy and Altimeter with Numerical Prediction"*, **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014),** 05-07 February 2014, CSIR-NIO Goa, India. (It is Accepted for Publication in Indian Journal of Geo-Marine sciences, IF:0.563)

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- Ganesh Kumar A, Venkatesh S, Dharani G, Kirubagaran R, *"Solid state fermentation of agricultural residues for the production of antibiotics"*, Biotransformation of Waste Biomass into High Value Biochemicals, S.K. Brar et al. (eds.), **Springer Publications** ISBN 978-1-4614-8004-4, Vol 139 -162, 2014.
- Ganesh Kumar A, Senthil Kumar S, Dharani G, Kirubagaran R, *"Solid state fermentation of agricultural wastes for the production of biocatalyst"*, Enzymes in value addition of wastes. Satinder Kaur Brar and Mausam Verma (eds.) **Nova Publications** ISBN 978-1-62948-986-5, 51-75, 2014.

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S.No	Authors	No. of sequences
1.	Vishnu Priya P, Verma P, Vijaya Raghavan R, Dharani G, Ashok Kumar S, Kirubagaran R,	67
2.	Senthilkumar S, Rasheeda M.K, Rajaprabhu G, Sendhilkumar R, Santhanakumar J, Suresh C, Ganesh kumar A, Vijayakumaran M, Dharani G, Kirubagaran R,	37
3.	Meena B, AnbuRajan L, Venkateswaran P, Mehmuna Begum, Dheenan P.S, Vinithkumar N.V, Dharani G, Kirubagaran R,	14
4.	Ganesh Kumar A, Kirubagaran R, Lakshmi Vijayakumar, Venkatesh S,	9
5.	Saravanan N, Verma P, Sendhilkumar R, LimnaMol V.P, Dharani G, Kirubagaran R	9
6.	Bukari D.B, Gopal D, Kareem A, Kumar S, Vijaya Raghavan R	5
7.	Rasheeda M.K, Rajaprabhu G, Gajendra Joshi, Sendhilkumar R, Santhanakumar J, Suresh C, Ganeshkumar A, Vijayakumaran M, Dharani G, Kirubagaran R,	4

AMINO ACIDS (AA) SEQUENCES SUBMITTED TO NATIONAL CENTRE FOR BIOTECHNOLOGY INFORMATION, NATIONAL INSTITUTE OF HEALTH, USA.

S.No	Authors	No. of sequences
1.	Meena B, Anburajan L, Venkateswaran P, Mehmuna B, Dheenan P. S, Vinithkumar N. V, Dharani G, Kirubagaran R	4
2.	Anburajan L, Meena B, Vinithkumar N.V, Kirubagaran R, Dharani G	2
3.	Josephine A, VijayaRaghavan R, Dharani G, Kumar T.S, Thilagam G.M.L, Peter D.M, Thirupathi K, Sucheta S, Divya S, Ahmed S, Sharma A, Jayapriyan K.R, Dheenan P.S, Vinithkumar N.V, Vijayakumaran M, Kirubagaran R	24

PAPERS PRESENTED IN CONFERENCES

International Conferences

- Saravanan R., Jyothi Prakash A., Shyamala Varthini D, Phani Kumar S.V.S., Ramana Murthy M.V, *"Design of Glass Fiber Reinforced Plastic Pipe for Shallow Water Applications"* **International Conference on Water desalination Treatment and Management, Jaipur, India,** February 2013.
- Vijaya Ravichandran, Ramesh R, Muthukrishna Babu S, Ramadass G.A, Ramanamurthy M.V, Atmanand M.A, *"Field Scale Model Tests for Determination of Pullout Capacity of Suction Pile Under Varying Loading Conditions"*, **Proceedings of the first Asian workshop on Physical Modeling in Geotechnics,** June 2013.
- Ramesh N.R , Thirumurugan K , Rajesh S, Deepak CR , Atmanand M.A, *"Experimental and Computational Investigation of Turbulent Pulsatile Flow through a Flexible Hose"*, **Proceedings of the Tenth ISOPE Ocean Mining Symposium, Poland,** pp 246-252, September 2013
- Muthukrishna Babu S, Ramesh N.R, Muthuvel P, Ramesh R, Deepak C.R, Atmanand M.A, *"In-situ Soil Testing in the Central Indian Ocean Basin at 5462 m Water Depth"*, **Proceedings of the Tenth ISOPE Ocean Mining Symposium, Poland,** pp 190-197, September 2013.
- Thirupathi K, Lakshmi P, Kirubagaran R, Atmanand M.A, *"Design and optimization of temperature controller for high pressure rated modified CSTR system"*, **IEEE International conference on Signal Processing, Computing and Control (ISPCC),** September 2013.
- Venkatesan R, Simi Mathew, Vimala J, *"New Observations Of Subsurface Thermal Saline And Current Structure For The Arabian Sea From Omni Buoys"*, **29th Session of the Joint WMO-IOC organized by Data Buoy Co-operation Panel (DBCP),** during 23rdSeptember 2013-1st October 2013 at Paris, France.
- Kirubagaran R, *"Biofuel as an alternative energy source"*, **Presented during the MoES / ESSO – CCCR Meeting held at New Delhi,** October 2013.
- Chithra K, *"Multi Carrier Wireless Communication In Reverberant Underwater Channel"* **International Conference on Emerging Trends in Communication, Control, Signal Processing and computing applications, Naval Research Board DRDO, Bangalore,** October 10-11, 2013.
- Nidhi Varshney, Janarthanan C, Muthuvel P, Ramesh N.R, Deepak C.R and Atmanand M.A, *"Virtual Modelling and Navigation Controls of Underwater Mining Machine"*, **12th Symposium on Ocean Electronics, CUSAT, Kochi,** pp 202-207, during 23-25, October 2013.
- Sanjana M C, Latha G and Gopu R Potty, *"Sensitivity Analysis of model parameters in geoacoustic inversion"*, **International Symposium on Ocean Electronics (SYMPOL- 2013), CUSAT, Kochi,** during 23-25, October 2013.

- Srinivasan R, Suseentharan V, Chiranjeevi Vivek.G, Thangavel C, Gowthaman V and Tata Sudhakar, *"Development of Autonomous Catamaran based Observation System for Collecting Meteorological/Oceanographic parameters at Gulf of Khambhat-Gujarat"*, **International Symposium on Ocean Electronics (SYMPOL- 2013), CUSAT, Kochi,** during 23-25, October 2013, pp 250-255.
- Najeem S, Sanjana M C, Latha G, Nithyanandam K, *" High resolution vertical directionality estimation using ambient noise data of shallow Arabian Sea"*, **International Symposium on Ocean Electronics (SYMPOL- 2013), CUSAT, Kochi,** during 23-25, October 2013.
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- Venkatesan G, Iniyan S, Purnima Jalihal and Mani Sundaram, *"Experimental studies on a barometric sealed flash evaporative desalination system using warm discharge water from process plant"*, **International Conference on Innovative Technologies and Management for Water Security (INDACON),** pp. 102 -110, NIOT, Chennai, February 12-14, 2014.
- Venkatesan G, Iniyan S, Prakash Kumar LSS and Naresh A , *"Water Injection Studies in a Curved Vane Demister using CFD"*, poster presentation, **International Conference on Innovative Technologies and Management for Water Security (INDACON),** pp. 476 - 483, NIOT, Chennai, February 12-14, 2014.

- Srinivasula Reddy Pilli, Jyothi Prakash A, Jayaraj K, Phani Kumar S.V.S, Ramana Murthy M.V. *"Vibration Analysis of Shell and Tube Heat Exchanger for Low Temperature Thermal Desalination Plant"*, **International Conference on Innovative technologies and Management (INDACON14), NIOT, Chennai,** February 12-14, 2014.
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- Mani A, Raju Abraham, *"CFD Studies on heat transfer for falling film evaporation in multi-effect distillation (MED) system"*, **Innovative technologies and management for water security, Indian Desalination Association Conference, Chennai,** February 12-14, 2014.
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- Krupa Ratnam, Rajaguru S, Limna Mol V.P, Santhanakumar J, Thirupathi K, Dharani G, Ganesh Kumar, Vijaya Ravichandran A, Phanikumar S.V.S, Vijayakumaran M, Rajasekhar D, Kirubagaran R, Atmanand M. A, *"Establishment of Ballast Water Treatment Technology – Test facility (BWTT-TF) by ESSO-NIOT",* **International Conference on advance technologies for Management of Ballast Water and Biofouling (MABB – 2014), NIOT, Chennai,** March 4-7, 2014.
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- Krupa Ratnam, Vedaprakash L, Kirubagaran R,*"Marine Biofouling Assessment on Ship's Hull – Its Variation within the Hull Topography and Between Vessel Types",* **International Conference on advance technologies for Management of Ballast Water and Biofouling (MABB – 2014), NIOT, Chennai,** March 4-7, 2014.
- Limna Mol V.P, Abhilash K.R, RaveendranT.V, Parameswaran P.S, *"Microfouling inhibitors from the Indian gorgonian Subergorgiareticulata (Ellis and Solander, 1786",* **International Conference on advance technologies for Management of Ballast Water and Biofouling (MABB – 2014), NIOT, Chennai,** March 4-7, 2014.
- Pradnya Meshram, Rachna Dave, Dharani G, Kirubagaran R, VenugopalanV.P, *"Mitigation of filtration membrane fouling by means of alginate lyase immobilization",* **International Conference on advance technologies for Management of Ballast Water and Biofouling (MABB – 2014), NIOT, Chennai,** March 4-7, 2014.
- Thiruppathi K, Lakshmi P, Saravanan N, Kirubagaran R, *"On-line Biofouling control in the plate heat exchanger system using osmotic shock technique",* **International Conference**

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- Saravanan N, Pankaj Verma, Limna Mol V.P, Sendhil Kumar R, Somasundaram S.T, Dharani G, Kirubagaran R, *"Role of microbial aggregation in biofilm formation by bacterial strains isolated from offshore finfish culture environment"*, **International Conference on advance technologies for Management of Ballast Water and Biofouling (MABB – 2014) NIOT, Chennai,** March 4-7, 2014.
- K. Thirupathi P, Lakshmi, Dhilsha Rajapan, Sudarsan K, Kirubagaran R, *"The effect of pulse power ultrasound waves for control of biofouling"*, **International Conference on advance technologies for Management of Ballast Water and Biofouling (MABB – 2014) NIOT, Chennai,** March 4-7, 2014.
- Venkatnarayanan S, Sriyutha Murthy P, Kirubakaran R, Venugopalan V.P, *"Valve movement pattern in the green mussel (Pernaviridis) in response to continuous chlorination"*, **International Conference on advance technologies for Management of Ballast Water and Biofouling (MABB – 2014) NIOT, Chennai,** March 4-7, 2014.
- Prince Prakash Jebakumar J, Vijaya Ravichandran, Nandagopal G, *"Preliminary studies on nature of epibiota assemblage on low crested coastal protection structures"*, **International Conference on Advanced Technologies for Management of Ballast Water and Biofouling (MABB 2014), NIOT, Chennai,** March 4-7, 2014.

NATIONAL CONFERENCES

- Phanikumar SVS, *"National Conference on CO2 Capture, Storage and Recycling (CCSR) 2013"*, **Konark Institute of Science and Technology, Bhubaneshwar,** April 27-28, 2013.
- Thangarasu P, Tata Sudhakar, Atmanand M.A, *"Comparison study on different Tsunami Detection Algorithms using BPR Data"*, **National symposium on Coastal Oceanographic studies :Modelling and observation COSMOS, NPOL, Kochi,** 9–10 May 2013, pp 10-16.
- Sundar R, Arul Muthiah M, R. Venkatesan R, *"Development of application software for real time tsunami buoy data reception"*, **National Symposium on Coastal Oceanographic Studies: Modeling and Observations (COSMOS) NPOL, Kochi** during 9-10, May 2013.
- Vijaya Ravichandran, Prince Prakash Jebakumar J, *"Marine outfall for a coastal sewage disposal – Design for increased dilution - A case study"*, **Ocean Society of India Conference 2013 (OSICON 2013) "Role of Oceans in Earth System", IITM, Pune,** pp.198-201, 26-28, November 2013.

- Ashokan M, Latha G, Ramesh R, *"Studies on rain noise coherence and vertical directionality in shallow waters of Indian sea"*, **Ocean Society of India Conference 2013 (OSICON 2013), IITM Pune,** November 26-28, 2013.
- Malarkodi A, Sridhar PSSR, Dhanalakshmi M, *"Design and implementation of underwater acoustic transducer calibration system"*, **Ocean Society of India Conference 2013 (OSICON 2013), IITM Pune,** November 26-28, 2013.
- Venkatesan G, Prakash Kumar L.S.S, Karthikeyan A, Sajeev, Rao Y.V.N, PurnimaJalihal, *"Challenges and experiences in demonstration of offshore thermo cline driven desalination plant"* – paper submitted for **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO Goa** during 5-7 February 2014,
- Manu P. John, Basanta Kumar Jena. *"Inter-comparison of HF Radar and Satellite Altimetry Derived Surface Currents"*, **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO, Goa,** 5-7 February, 2014.
- Suseentharan V, Sivakholundu K M, Basanta Kumar Jena, Ravinder M and Balaji R 2014. *"Long Term Port Monitoring System"*, **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO, Goa,** 5-7 February, 2014.
- S.A. Sannasiraj, M. Kalyani, E. Dinesh Kumar, K. Harini, G. Latha and V. Sundar, *"Inter Comparison of Wave Height Observations from Buoy and Altimeter with Numerical Prediction"*, **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO Goa,** 5-7 February, 2014. (It is Accepted for Publication in Indian Journal of Geo-Marine Sciences, IF:0.563)
- Sivakholundu K.M, Vijaya R, Kiran A.S and Abhishek T (2014), *"Short term morphological evolution of sandy beach and possible mitigation: A case study off Kadalur Periyakuppam"*, **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO, Goa.** 5-7 February, 2014. (Selected for Publishing in 'Indian Journal of Geo-Marine Sciences' (IJMS).
- Vijaya Ravichandran, Kiran A.S, Ramesh R, Ramanamoorthy M.V, Ramadass G.A, Atmanand M.A., *"Assessment of feasibility of suction pile anchor installation and pullout testing through field tests"*, **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014) CSIR-NIO, Goa,** pp. 189-193, 5-7 February 2014.
- Karunakar Kintada, Arunakumar Avula and Sivakholundu K.M (2013). *"GPS based control surveys and RTK bathymetry at Gulf of Khambat"*, **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), Goa,** 428-433, February 5-7, 2013.
- Giardino A, Elias E, ArunaKumar A and Karunakar K, *"Tidal modelling in the Gulf of Khambhat based on a numerical and analytical approach"*, **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), Goa,** 106-111, February 5-7, 2013.

- Sankar S, Vijaya Ravichandran, Venkatarao D, Badrinarayanan S, *"Mapping of spatial and temporal variation of shoreline in Poompuhar using comprehensive approach".* **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO, Goa,** 5-7 February 2014.
- Prince Prakash Jeba Kumar J, Vijaya Ravichandran, Sundararajan S, Basanta Kumar Jena, Ragumaran R, *"Water quality management for a coastal creek impacted by industrialization and urbanization through modeling of waste load",* **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO, Goa.** pp. 444-451, 5-7 February 2014.
- Buvaneshwari S, Vijaya Ravichandran, Mudgal B.V, *"Thermal pollution Modelling of cooling water discharge into a closed creek system",* **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO, Goa.** 5-7 February 2014.
- Nandagopal G, Prince Prakash Jeba Kumar J, Vijaya Ravichandran, *"Preliminary studies on epibiota assemblage on low crested coastal protection structures",* **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014), CSIR-NIO, Goa.** 5-7 February 2014.
- Kiran A.S, Vijaya Ravichandran, Arunakumar. (2014). *"Design of an environmental friendly shore protection measure for Kadalur Periakuppam, Tamil Nadu using hydrodynamic model studies".* **5th Indian National Conference on Harbour and Ocean Engineering (INCHOE2014), CSIR-NIO, Goa.** 5-7 February, 2014. (Selected for Publishing in 'Indian Journal of Geo-Marine Sciences' (IJMS).
- Simi Mathew, Latha G, Venkatesan R, Arul Muthiah M, Ramsundaram S, and Sundar R *"Very Severe Cyclonic Storms Captured by the buoys in the Bay of Bengal",* **NEM of 2013 SRM University, Chennai** during 21–24, February, 2014.
- Lix J K, Venkatesan R and Grinson George, *"Spring warming of the near-surface water around the Andaman Islands during 2011-2013",* **National Seminar on climate change and Marine Ecosystems (CCME 2014), CUSAT, Kochi,** 20 – 21 March, 2014.
- Vimala J, Latha G, Lavanya R and Venkatesan R, *"Prediction of Significant Wave Height Using WAM And ANN In Indian Seas",* **National Conference On Recent Trends in Modern Electronics and its Application (NC-RTMEA 2014) at Jeppiaar Institute of Technology, Chennai** during 13–14, March 2014.

INVITED TALKS / LECTURES

Dr. M.A. Atmanand

- Keynote address on National symposium on Coastal Oceanographic Studies : Modelling & Observations (COSMOS), NPOL, Kochi on May 9, 2013.
- Invited speaker on "Ocean Observations" at the Indo-French Workshop on Atmospheric Sciences & CCCR, New Delhi on October 3, 2013.
- Invited speaker on "Ocean energy and applications" at the Climate change workshop at MoES, New Delhi during October 4-5, 2013.
- Felicitation address on "Technology developments for Ocean Observations – Societal linkage" International Symposium on Ocean Electronics (SYMPOL), Cochin, during October 23-24, 2013.
- Invited talk on "Ocean-atmosphere observation systems" National Conference of the Ocean Society of India (OSICON 13) at IITM Pune on November 26-28, 2013.

Dr. Purnima Jalihal

- Guest lecture on "Ocean Renewable in the Indian perspective" at the 2nd International Congress on Ocean Energy Development in Bali, Indonesia, during May 22-24, 2013.
- Special address on the theme of "Water & Energy" at L&T Manapakkam, Chennai.on March 21, 2014.
- Talk in the conference on "World Water Day" at Gandhigram University in Madurai, India, on March 22, 2014.
- Keynote address on "Scaling up issues for large desalination in power plants and offshore" at INDCON-2014 held at ESSO-NIOT, Chennai on February 13, 2014.

Dr. R. Venkatesan

- Talk on "Significance of Indian moored buoy observation" at the International Tropical Meteorology (Intromet 2014) Symposium on Monsoon Observation Prediction and Simulation organized by Indian Meteorological Society, SRM University, on February 24, 2014.

Dr. K.M. Sivakholundu

- Talk on 'Development of Co-tidal model for Gulf of Khambhat' in Annual Hydrographic conference of NHO, Dehradun, on September 6, 2013.
- Talk on 'Coastal Engineering surveys' at the training program for State Government officials organized by ICMAM Project Directorate, on December 11, 2013.

Dr. M.V. Ramana Murthy

- Talk on 'Challenges in Island Desalination" at the International Conference on Innovative technologies and Management (INDACON14), Chennai, during February 12-14, 2014.

Dr. R.Kirubagaran

- A lecture on the "Endocrine disruptors in marine environment and their impact on fish reproduction during the short term hands on training in Recent Advances in Marine Ecotoxicological Testing", at the Department of Marine and Coastal Studies, Madurai Kamaraj University, Pudhumadam, Ramanathapuram District.
- Talk on Recent Advances in Marine Biotechnology during the National Workshop on Theory and Research Methods in Sciences at the Department of Biotechnology, Mother Teresa Women's University, Kodaikanal, on September 14, 2013.
- Talk on the Impact of Climate Change on fish reproduction during the Science Academies' Education Programme on "Climate Change Studies: An Organismal Approach" on March 27, 2014, at the Centre for Climate Change Studies at Sathyabama University, Chennai.

Mr. D. Rajasekhar

- Talk on "Clad Welding of Propeller Shaft" to the Base Maintenance Unit, Coast Guard Region-East, during December, 2013.
- Talk on "Innovative Engineering & Ship Management" at the Institution of Engineers (India), Chennai, during March, 2014.

Dr. G. Latha

- Talk on 'Numerical modeling of Oceanic processes and Applications in operational forecasts', National Conference on Pure and Applied Mathematics (NCPAM 2013), held at VIT Chennai, on April 19, 2013
- Invited lecture on 'Acoustic techniques for understanding the ocean environment' at Indian Institute of Technology Madras

Mr. Raju Abraham

- Talk on "Solar Energy for Better Future" at the RMK College of Engineering, Chennai on April 8, 2013.
- Talk on "Solar Energy for Desalination" at the Karunya Institute of Technology, Coimbatore.on August 2, 2013.
- Talk on "OTEC Experiences-Spin Offs and Road Ahead" at Indo-French Meet for technology collaboration, New Delhi on October 24, 2013.

Dr. B.K. Jena

- Talk on "Ocean Sciences and Technology in India" at Inspire Science Camp conducted by the Department of Science & Technology, Government of India, National Institute of Science and Technology, Berhampur, Orissa during November 25-30, 2013.

Dr. S.V.S. Phani Kumar

- Talk on "Opportunities in Marine Applications" at the International Conference of countries of Asia Pacific region on Technologies of Knowledge Intensive Business, Vladivostok, Russia, during September 13-17, 2013.

Dr. G. Dharani

- Lecture on "Marine Microalgae Culture for Nutraceuticals & Biofuel Production" at 5th Popular Lecture series for Popularization of Biotechnology, Sathyabama University, Chennai, on November 27, 2013.
- Talk on "Massive coral bleaching across the major reef ecosystem of Andaman, Lakshadweep and Gulf of Mannar group of Islands a possible impact of global warming" in the Science Academies' Education Programme on "Climate Change Studies: An Organismal Approach" Sathyabama University, Chennai during March 27-28, 2014.

Mr. G. Venkatesan

- Special lecture on "Keyways to sponsored research projects" at the School of Mechanical Engineering, Bharat Institute of Science and Technology, Selaiyur, Chennai on February 3, 2014.
- Guest lecture on "Research issues and challenges in Ocean technology" at the KCG college of Technology, Karapaakam, Chennai on March 3, 2014.

Mr. N. R. Ramesh

- Talk on Deep Sea Mining at the seminar on 'Earth Sciences for the Society' organized by Indo-German Nachkontakt Association, Hyderabad, India during November 7-8, 2013.

Mr. N. Vedachalam

- Talk on "Recent Trends in Energy Engineering", at Surya Polytechnic College, on March 8, 2014.

Mr. S. Ramasundaram

- Lecture on "INFOGEDDON-2K13" at the national level Socio-Technical Symposium, Sri Sai Ram Engineering College, Chennai on September 13, 2013

Mr. Kesavakumar

- Guest lecture on "Recent trends in Electrical Techniques "at ACT College, Kanchipuram on March 19, 2014.

Dr. Pankaj Verma

- Plenary talk "Recent Trends in Molecular Phylogeny and Taxonomy" at the national conference on Recent Trends in Biotechnology & Bioinformatics, Yogi Vemana University, Kadapa, Andhra Pradesh, during February 12–13, 2014.

BILATERAL COLLABORATION

A collaborative programme with the Water and Stream Chemistry Lab of BARC Facilities, Kalpakkam on "Advance methods for biofouling control" is in progress.

DEPUTATION ABROAD

S. No.	Name of the officer	Countries Visited	Programme under visit	Period
1	Shri Arul Muthiah Scientist `C'	Mauritius	Cruise on board Sagar Nidhi for retrieval and deployment of buoy systems	26th Feb - 4th Apr, 2013
2	Shri S. Sundar Jesuraj Scientific Asst. `B'			1st Mar - 4th Apr, 2013
3	Shri S. Elango, Project Scientist - I			28th Feb - 4th Apr, 2013
4	Shri T. Gnanadhas Project Scientific Asst.			26th Feb - 4th Apr, 2013
5	Shri C.K. Kalaivanan Project Scientific Asst.			28th Feb - 4th Apr, 2013
6	Shri P. Ramesh, Project Technician			
7	Shri Raju Abraham, Scientist `E'	Kathmandu, Nepal	To attend workshop on Micro-Turbines	19th – 22nd April 2013
8	Dr. Purnima Jalihal Scientist `G'	Bali, Indonesia	To deliver talk on Ocean Renewables in Indian Perspective in 2nd International Congress on Ocean Energy Development being organised by Darma Persada University & Saga University, Japan	22nd - 24nd May, 2013
9	Mrs A. Malarkodi, Scientist `C'	Denmark	For inspection of Low Frequency Calibration system and to attend training for operating the system	20th - 24th May, 2013
10	Shri A. Thirunavukkarasu Scientific Assistant `B'			
11	Shri R. Sundar Scientist `B'	Tianjin, China	To attend workshop JCOMM RMIC for Asia-Pacific region - marine instruments workshop	22nd - 25th July, 2013
12	Shri Prasad Punna Scientist `C'	USA	To attend training at National Ocenaic Atmospheric Administration - Pacific Marine Environmental Laboratory (NOAA-PMEL) and National Oceanic Atmospheric Administration - National Data Buoy Centre (NOAA-NDBC)	5th - 14th August, 2013
13	Shri B. Kesavakumar Scientist `B'			
14	Shri G. Venkatesan Scientific Assistant `B'			

S. No.	Name of the officer	Countries Visited	Programme under visit	Period
15	Dr. R. Venkatesan Scientist `G'	Paris, France	To attend 29th session of the Joint WMO-IOC followed by 33rd meeting on Argos Joint Tariff Agreement (JTA-33) being organised by Data Buoy Co-operation Panel (DBCP)	23rd Sep - 2nd Oct, 2013
16	Dr. G. Latha Scientist `F'	Germany	To participate in calibration and discussion with WTD Germany and to visit Embassy of India, Berlin	9th - 16th Sept, 2013
17	Mrs A. Malarkodi Scientist `C'			
18	Shri M. Arul Muthiah Scientist `D'	Norway	To participate in the Belmont Forum and JPI Climate Scoping workshop on Arctic Observing System	14th - 23rd Oct, 2013
19	Dr. G. Latha Scientist `F'	Port Louis, Mauritius	To participate in the Indian Ocean Global Observing System (IOGOOS) workshop and 10th Annual Meeting (IOGOOS-X)	21st - 24th Oct, 2013
20	Dr. SVS Phanikumar Scientist `E'	Vladivostok, Russia	To attend Indo-Russian research and practice pre-conference on creation and implementation of joint science-based projects	11th - 16th Sep, 2013
21	Shri D. Gowthaman Project Scientist - I	Colombo	To cruise on onboard US Ship Roger Revelle	8th - 26th Nov, 2013
22	Shri C. Muthukumar Scientific Assistant `B'			
23	Shri Jagadeesh Kadiyam Project Scientist - I		To cruise on onboard US Ship Roger Revelle	27th - 13th Dec, 2013
24	Smt Simi Mathew Project Scientist - I			
25	Dr. R. Kirubagaran Scientist `F'	Colombo, Srinlanka	To attend first meeting of the Regional Task Force and workshop to develop a Regional Strategy and Action Plan for Ballast Water Management (BWM) in South Asia	24th - 25th Feb, 2014

S. No.	Name of the officer	Countries Visited	Programme under visit	Period
26	Dr. G. Latha Scientist `F'	Russia	To participate in calibration of hydrophones and discussion about calibration process at VNIIFTRI	17th - 21st March, 2014
27	Mrs A. Malarkodi Scientist `C'			
28	Dr. M.V. Ramanamurthy Scientist `G'	UK	to attend UK-India seminar on impact of climate change on the coastal Environment jointly organised by University of Edinburgh and IIT Bombay and visit facilitites of Physical Wave Tank (FloWave) at University of Edinburgh, UK	26th - 30th March, 2014
29	Shri Arunakumar Avula Scientist `C'	The Netherlands	To visit M/s. Deltares for technical discussion on setting up the sediment transport and morphological model	23rd Mar - 9th Apr, 2014
30	Shri Karunakar Kintada Scientist `C'			23rd Mar - 9th Apr, 2014
31	Dr. Basanta Kumar Jena Scientist `E'			31st Mar - 9th Apr, 2014
32	Dr. R Venkatesan Scientist `G'	San Diego, USA	To attend Science and Observational planning workshop; visit to facilities at Scripps Institute, MBARI and visit to National Oceanic and Atmospheric Administration - National Data Buoy Centre (NOAA-NDBC)	24th Mar - 1st Apr, 2014

MEMBERSHIP IN COMMITTEES

Dr. M. A. Atmanand, Director, ESSO-NIOT

- Founding Chairman of IEEE Oceanic Engineering Society in India.
- Senior Member of IEEE.
- Life Member of Ocean Society of India (OSI).
- Fellow of Institution of Engineers (India)
- Secretary IEEE Madras Chapter (2006); Member Executive Committee Madras Chapter (2007, 2012, 2013); Vice Chair Madras Chapter (2008, 2009, 2014).
- Member of Technology Research Board of Ministry of Earth Sciences, Govt. of India.
- Member of Research Advisory Council of National Institute of Oceanography (CSIR – NIO)
- Member of Naval Research Board.
- Member of INSA National Committee.
- Member of Board of School of Maritime Design & Research of Indian Maritime University (IMU).
- Member of Project Advisory Board for project on "A Centre for Fuel Cell Technology (CFCT) – Phase II".
- Executive Committee Member of Science City, Dept. of Higher Education, Govt. of Tamil Nadu
- Member of Technical Advisory Committee for Tamil Nadu Maritime Board.
- Member of Coastal Protection and Development Advisory Committee (CPDAC)
- Member of Governing Council of Jerusalem College of Engineering.
- Member of Governing Council of Fluid Control Research Institute (FCRI), Ministry of Heavy Industries.
- Member of Governing Council of Indian National Centre for Ocean Information Services (INCOIS), Hyderabad.
- Member of Governing Council of National Institute for Wind Energy.

Dr. Purnima Jalihal

- Member, Programme Advisory Committee - Water Technology Initiative, Dept. of Science & Technology.
- Member, Technical Evaluation Committee - Nemmeli Desalination Plant set up by Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB).

Dr. R. Venkatesan

- Vice Chairman, Asia and Data Buoy Council Programme (DBCP) Capacity Building Action Group member.
- Member, International Buoy Programme for the Indian Ocean (IBPIO). Chairman of working committee on Buoy Vandalism constituted by DBCP
- Member , International Maritime Organization Biofouling Correspondence Group BLG16
- Member, Confederation of Indian Industry CII-Corrosion Management Committee
- Member, IEEE Oceanic Engineering Society.

Dr. G. A. Ramadass

- Member, IEEE Oceanic Engineering Society.

Dr. M. V. Ramana Murthy

- Member of Ocean Engineering Society (OES).
- Member of International Association for Hydro-Environment Engineering and Research (IAHR).

Dr. R. Kirubagaran

- Member, National Task Force, The Bay of Bengal Large Marine Ecosystem.
- Member, Project Review Board, Naval Materials Research Laboratory, Ambernath.
- Member, Board of studies for M.Sc. Marine Biology, Pondicherry University.
- Member, Board of studies for M.Sc. and Ph. D. Marine Biology, Alagappa University.
- Member, Research Advisory Council, Marine Bio-Resource Centre, Jamnagar.
- Member, Inter-Departmental Committee on Marine Bio-prospecting and Bio-energy, Department of Biotechnology, Government of India.
- Member, Coastal Aquaculture Authority of India.
- Research Supervisor and Member of Doctoral Committee, Sathyabama University
- Member of Doctoral Committee, SRM University and Sri Ramachandra University
- Recognized Research Guide, Anna University
- Life Member, Indian Science Congress Association
- Life Member, Society for Reproductive Biology and Comparative Endocrinology
- Life Member, Association for DNA finger printing and related technologies
- Life member, Ocean Society of India
- Member, Task Force Committee for Aquaculture and Marine Biotechnology, Department of Biotechnology, Government of India.

Dr. K. M. Sivakholundu

- Member, Technical Evaluation Committee of Fisheries Department for construction of harbors at Thengapattinam and Muttom.
- Member, State level monitoring committee for establishing fishing Harbors at Muttom, Thengapattinam and Poombuhar (Convened by Fisheries department)
- Member, Sectional committee (CED 47) of Bureau of Indian Standards for revising design Code IS 4651:1974 - Code of practice for planning and design of ports and harbours. Also convenor for work group entrusted with revision of the sub-component: IS 4651 – part-I – Site investigations
- Member, Technical Evaluation Committee appointed by State Government of Kerala for approval of DPR and other studies being undertaken by Vizhinjam International Seaport Limited (A State Government Undertaking).

Shri. D. Rajasekhar

- An Expert Member in Ship acquisition-GSI.
- Member Secretary – Joint Scientific and Technical Advisory Committee.
- An Expert Member for acquisition of Polar Research Vessel for NCAOR.
- Member Secretary – Project Monitoring and Coordination Committee-Acquisition of Two CRVs for ESSO-NIOT/MoES.
- Member, Technical Evaluation Committee (TEC) for Construction of India's Third Antarctic Station Bharati in Antarctica.

Dr. Dhilsha Rajapan

- Member, Acoustic Society of America
- Member, IEEE Oceanic engineering society, India chapter
- Member, IEEE/UFFC Society
- Life Member, Acoustic Society of India
- Life Member, Magnetic Society of India
- Member, Research & Consultancy Promotion Council of Anna University, Chennai

Dr. G. Latha

- Member, Acoustic Society of America.
- Member, IEEE Signal Processing Society.
- Member of the Local Council of Indian Meteorological Society - Chennai Chapter.
- Thesis Examiner for M.Sc. / M.Tech Projects in department of Mathematics, IIT Madras.
- Member, Doctoral Committee, Anna University.

- Member, Doctoral Committee, VIT, Chennai.
- Member, Doctoral Committee, Sathyabama University, Chennai.
- Life Member, Ocean Society of India

Shri Tata Sudhakar

- Member, IEEE
- Cdr Gopkumar Kuttikrishnan
- Fellow, The Institution of Engineers (India)
- Member, The Institute of Marine Engineers (India)
- Senior Member, Indian Institution of Industrial Engineering

Dr. B. K. Jena

- Member, GEO Global HF Radar
- Member, American Geophysical Union (AGU), since 2003, Florida Avenue N.W. Washington, DC 20009-1277 USA
- Associate Member, ASCE, USA, American Society of Civil Engineers since 2003
- Member, Board of Governors of the Coasts, Ocean, Ports, and Rivers Institute, USA, Since 2003
- Life Member, Ocean Society of India, Since 2008
- Secretary, Ocean Society of India (OSI), Chennai Chapter since 2011.
- Society Member, Coastal Education & Research Foundation, Inc. (CERF), since January 2012 and official publisher of the Journal of Coastal Research (JCR)
- American Meteorological Society (AMS), since January 2013.

Shri. C. R. Deepak

- Member, IEEE Oceanic Engineering Society, India chapter
- Life Member, Ocean Society of India
- Member, Mining Engineers Association of India

Dr. S. V. S. Phani Kumar

- Member, IEEE-Ocean Engineering Society (IEEE-OES).
- Member, Indian Desalination Association (InDA).
- Life Member, Ocean Society of India (OSI)

Dr. S. Ramesh

- Life Member, Ocean Society of India

Dr. G. Dharani

- Member, Professional Association of Diving Instructors
- Member, Doctoral Committee, SRM University
- Member, Doctoral Committee Anna University
- Life Member, Ocean Society of India

Dr. N. V. Vinithkumar

- Member, Multidisciplinary Committee to prepare state level action plan for A& N Island in line with the national action plan for climate change
- Member, Selection Committee, UGC fellowship in meritorious student programme, Pondicherry University
- Life Member, Ocean Society of India
- Member, Doctoral Committee, Pondicherry University

Mr. N. Vedachalam

- Member, Marine Technology Society
- Member, Society for Underwater Technology
- Member, International Society of Offshore and Polar Engineer

Mr. R. Saravanan

- Associate Membership of Institution of Engineers

Shri Shibu Jacob

- Member, IEEE Oceanic Engineering Society, India chapter

Shri N. R. Ramesh

- Member, IEEE Oceanic Engineering Society, India chapter
- Life Member, Ocean Society of India
- Mining Engineers Association of India
- Life member in “National Institution for Quality and Reliability”
- Member in “Madras Management Association (MMA)”

Mr. A. N. Subramanian

- Member, IEEE OES,
- Member, Institute of Engineering (AIME)
- Member, Indian Society for Technical Education (MISTE)

Dr. D. Sathianarayanan

- Member, IEEE OES

Shri. S. Muthukrishna Babu

- Member, IEEE Oceanic Engineering Society, India chapter
- Life Member, Ocean Society of India

Shri. P. Muthuvel

- Secretary and Member, IEEE Oceanic Engineering Society, India chapter
- Life Member, Ocean Society of India

HUMAN RESOURCE DEVELOPMENT

The training of staff members of ESSO-NIOT were carried out both in-house as well as external programmes. British Council, Indian Maritime University, etc., carried out in-house training on presentation skills, report writing, speaking clearly, Safety at Sea, etc. There were students (Nos 62) who carried out their project works in various departments of ESSO-NIOT. Short term internships (Nos 25) also arranged during the summer and winter vacation. The highlight of Human Resource Development (HRD) in this year is that a student Anjanei.D of std XII from Chettinad Vidyashram, Chennai was selected to go to the International Science Fair (ISWEEP 2014) with the guidance provided by Dr.R.Kirubagaran and Mr.Magesh Peter of MBT, NIOT.

Training Underwent by ESSO-NIOT Scientists and Technical Staff

Sl. No	Name of the Staff	Training Programme	Conducted by	Duration
1	Mr. C.R. Deepak	Introduction to ANSYS LS-DYNA	ANSYS Software Pvt Ltd, Bangalore	18-19th April 2013
2	Mr. C. Janarthanan			
3	Mr. N.R Ramesh	Lead Auditor Training programme on quality management system based on ISO 9001:2008 standard	TUV SUD South Asia Pvt Ltd, Chennai	6-10th May 2013
4	Mr.Peddinti S.S.R. Sridhar	Laboratory Management & Internal Audit as per ISO/IEC17025:2005	Centre for Electronics Test Engineering at Bangalore.	20-23rd May 2013
5	Dr. N. Thirumaleswara Reddy	Application of Matlab in Ocean Studies and Modelling (MATMOD)	Centre for Oceans, River, Atmosphere and Land Sciences, Indian Institute of Technology, Kharagpur	21-22nd May 2013
6	Mr. S. Srinivasa Rao	ASME Section VIII: Division 1 basic design and fabrication	Anchor Institute Cell, SVNIT-Surat	23-25th May 2013
7	Mr. J. Santhanakumar	SREB School in Chronobiology	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	6-30th June 2013
8	Dr. S. Rajaguru	Measurement of Uncertainty in Testing/ Calibration	Brainwave Consultants at Chennai	26-28th July 2013
9	Dr. N.V. Vinith Kumar	Coastal Ecosystem Modelling	Integrated Coastal and Marine Area Management, ESSO-NIOT Campus, Chennai	19-23rd August 2013
10	Mr Dilip Kumar Jha			
11	Dr. J. Benjamin Franklin			

Sl. No	Name of the Staff	Training Programme	Conducted by	Duration
12	Mr.T. Mani	Maintenance training	Advanced Training Institute, Chennai	19-30th August 2013
13	Mr. R.Elavarasan	Testing & Calibration of Industrial Instruments (Pressure & Temperature)	Advanced Training Institute, Chennai	19-25th August 2013
14	Mr. S. Tamil Mani			
15	Mr. K. Dinesh Kumar	Effective Stores Management	SATVAM Consulting Pvt Ltd, Bangalore	22nd August 2013
16	Mr. J. Rajkumar	Hypack Volume Computation	ASB System Pvt Ltd, Goa	22-23rd August 2013
17	Mr. P. Suresh Kumar	Control and Maintenance of Electrical Motors	Advanced Training Institute, Chennai	02-13th September 2013
18	Mr. R. Kumaradevan	Mechanical Testing of metals	Advanced Training Institute, Chennai	02-13th September 2013
19	Mr. S. Muthukumaravel	Embedded system design and application course.	Department of Electrical Engineering, Central Polytechnic College, Taramani	16 September 2013 to 05 October 2013
20	Ms.Sarojani Maurya			
21	Mr. G. Chiranjeevi Vivek			
22	Mr. G. Durai	Maintenance of Electrical Machines and Power Transformers	Advanced Training Institute, Chennai	16-27th September 2013
23	Mr. N. Suresh Kumar	3.02 maintenance of electrical machines and power transformers	Advanced Training Institute, Chennai	16-27th September 2013
24	Mrs.Vijaya Ravichandran	Advanced course on Computational Geotech	Indian Institute of Technology Madras, Chennai	18-20th September 2013
25	Ms. K.V. Reshma	Plaxis advanced course on computation Geotechnics	Ram Caddsys Pvt Ltd, Chennai	18-20th September 2013
26	Mr. A. Satya Kiran Raju			
27	Mrs. B. Krishnaveni			
28	Mr. A.S Kiran	Advanced course on Computational Geotechnics	Indian Institute of Technology Madras, Chennai	18-20th September 2013
29	Dr.Rajaguru	Laboratory Management Systems Implementation and Internal Auditing	Brian Consultants, Chennai	19-22nd September 2013

Sl. No	Name of the Staff	Training Programme	Conducted by	Duration
30	Mr. S. Tamil Mani	Personal Safety Measures for Electrical Maintenance Engineering	Usha Fire Safety Equipments Pvt Ltd, Chennai	24th September 2013
31	Mr. R. Subash			
32	Mr. S. Sasikumar	Export and Import	MSME – Development Institute, Chennai	25-29th September 2013
33	Mr. S.B. Pranesh	Design & Fabrication of Pressure Vessels: Section VIII Division 1 ASME	Inside Exploration Technologies Pvt Ltd, Chennai	3-5th October 2013
34	Mr. R. Kannan	Symposium on underwater signature management at ranges	Underwater Ranges, NSTL-RTC, Goa	7-8th October 2013
35	Mr. S.A. Sheik Meeran Mohideen	Radar Navigation, Radar Plotting	Indian Maritime College, T.Nagar	14-24th October 2013
36	Mr. Krishna Mohan	Administrative Law and Decision making process	Parsam Institute of Statutory Rules, Bangalore	23-25th October 2013
37	Mr. D. Narendra Kumar	Fail-safe, Design early detection and avoiding future recurrence of failures	Society of Material Science Engineers, Department of Mechanical Engineering, Anna University & Society for Failure Analysis Chennai Centre	28-29th October 2013
38	Mr.Ananthakrishna			
39	Mr. G. Nagarajan			
40	Ms.Mehmuna Begum	Remote Sensing GIS and Numerical Modelling Application	Coastal Disaster Management ICMAM, ESSO-NIOT Campus, Chennai	28 October to 1st November 2013
41	Mr. P. Venkateshwaran			
42	Mrs.Nidhi Varshney	Certified Reliability professional	Centre for Reliability, Ministry of communications & information Technology, Chennai	25-29th November 2013
43	Mr. S.B Pranesh			
44	Mr Devender Gujjula	Wind Energy Technology	Wind Energy Technology (C-WET), Chennai	27-29th November 2013

Sl. No	Name of the Staff	Training Programme	Conducted by	Duration
45	Mr. C. Jothi	Hydraulic & Pneumatic control course code 7.02	Advanced Training Institute, Chennai	9-23rd December 2013
46	Mr. C.R. Deepak	Advanced Computational Fluid Dynamics (ACFD 13)	Machine Design Section, Department of Mechanical Engineering, IIT Madras.	22-24th December 2013
47	Mr. Tata Sudhakar	Managing Technology Value Chains	Administrative Staff College of India, Hyderabad	6-10th January 2014

Conference / Workshop attended by ESSO-NIOT Scientists and Technical Staff

Sl. No.	Name of the Staff	Training Programme	Conducted by	Duration
1.	Mr.Raju Abraham	International Workshop on Microhydels	NAM S&T Centre at Kathmandu	19-22nd April 2013
2.	Dr. K.M Sivakholundu	Conference on Seventh Geo-Intelligence	Geospatial Geo-Intelligence, New Delhi	13-14th June 2013
3.	Mr. C.R. Deepak	Workshop on Titanium Matrix composites	Department of Metallurgical and Materials Engineering, IIT Madras, Chennai	30th August 2013
4.	Mr. K. Thirumurugan	Workshop on Hydromechanics of Submarines and Submerged Vehicles	Department of Ocean Engineering and Naval Architecture, Indian Institute of Technology Kharagpur.	13-14th September 2013
5.	Mr. P. Senthilkumar			
6.	Mr.JagadeeshKadiyam			
7.	Dr. D. Sathianarayanan			
8.	Mr. R. Ramesh			
9.	Mr.Junaid Ahmed	Workshop on Logistics & Cargo Management	MSME Development Institute, Guindy	21-22nd September 2013
10.	Mr. K. Thirupathi	2013 IEEE International conference on Signal Processing, Computing and Control	Jaypee University of Information Technology at Shimla-Himachal Pradesh	26-28th September 2013
11.	Mr. C. Harikrishnan	Conference on COSMOL	COSMOL Multiphysics Pvt Ltd, Bangalore	17-18th October 2013
12.	Mr. K. Prabhu	5th Indian National Conference on Harbour and Ocean Engineering (INCHOE 2014)	CSIR, National Institute of Oceanography, Goa	5-7th February 2014
13.	Mr.MukundaKesari			

Extra Mural Lectures at ESSO-NIOT, Chennai

An Extra Mural Lecture on **"Human Values and Professional Ethics"** was delivered by Professor V.S. Raju (Former Director IIT-Delhi and Dean, IIT-Madras) on September 11, 2013.

An Extra Mural Lecture on the topic **"Seven Steps to Indian Renaissance Dr. Kalam's Road Map to Developed India 2020"** was delivered by Prof. Arun Tiwari, on May 8, 2013.

Technical Lectures at ESSO-NIOT, Chennai

A lecture on **"RBR Sensor and Data Loggers",** was delivered by Dr. Greg Johnson, President of RBR Limited, Canada on April 16, 2013.

A talk on **"The on-going Scientific Activity in the University",** was delivered by Prof. R. Thandavan, Vice Chancellor, University of Madras, on 16th April 2013.

A talk on **"Vigilance"** was delivered by Smt. Seema Agrawal, IPS, Inspector General of Police, Vigilance, TANGEDCO as part of the observations of the Vigilance awareness week, on October 31, 2013.

A talk on **"Advances in Coastal Science and Numerical Modelling",** by Prof. Kerry Peter Black, University of Waikato, New Zealand, on 26th September 2013.

A talk on **"Mining Technology Development"** was delivered by His Excellency Mr.Nii A. Odunton, Secretary General, International Seabed Authority, Kingston, Jamaica on October 9, 2013.

A talk on **"How yoga and breathing techniques can help to dissolve stresses, increase energy, focus and clarity of mind",** was delivered by Mr. Kalyan and Mr. V Jayakumar, NGO - Art of Living, on November 19, 2013.

A talk on **"Ocean bottom Seismometer"** was delivered by Mr. Arne Schwenik, K.U.M. Umwelt- und Meerestechnik Kiel GmbH, Germany on December 5, 2013.

A talk on **"Synthetic Aperture for Bottom and sub bottom imaging"** by Prof. Manell Zakharia is on March 25, 2014.

SCIENTIFIC CRUISE PROGRAMS

Utilization of ESSO-NIOT Ships from 1st April 2013-31st March 2014

Sagar Nidhi			
From	**To**	**Days**	**Program**
01-04-2013	04-04-2013	4	OOS, ESSO-NIOT for buoy operation
05-04-2013	14-04-2013	10	S&GH,ESSO-NIOT-ROSUB Cruise preparation
15-04-2013	25-05-2013	41	S&GH,ESSO-NIOT-ROSUB Cruise
26-05-2013	27-05-2013	2	ISM/GI Survey
28-05-2013	29-05-2013	2	SAIC-INCOIS-Cruise preparation
30-05-2013	07-06-2013	9	SAIC-INCOIS-Cruise
08-06-2013	10-06-2013	3	DP Survey-Sea Trial
11-06-2013	11-06-2013	1	OOS, ESSO-NIOT Cruise Preparation
12-06-2013	28-06-2013	17	OOS, ESSO-NIOT Cruise
29-06-2013	01-07-2013	3	INCOIS-RAMA Cruise Preparation
02-07-2013	03-08-2013	33	INCOIS-RAMA Cruise
04-08-2013	05-08-2013	2	OOS, ESSO-NIOT Cruise Preparation
06-08-2013	23-08-2013	18	OOS, ESSO-NIOT Cruise
24-08-2013	25-08-2013	2	CMERI Cruise Preparation
26-08-2013	30-08-2013	5	CMERI-ROV sea trials cruise
31-08-2013	05-09-2013	6	S&GH,ESSO-NIOT-ACS Cruise preparation
06-09-2013	13-09-2013	8	VMC-Scientific Equipment calibration
14-09-2013	16-09-2013	3	OOS, ESSO-NIOT Cruise Preparation
17-09-2013	18-10-2013	32	OOS, ESSO-NIOT Cruise
19-10-2013	24-10-2013	6	Deep Sea Winch intervention/ ACS cruise preparation
25-10-2013	31-10-2013	7	ACS Sea Trials
01-11-2013	07-11-2013	7	A-Frame Piston Rod Repair
08-11-2013	13-11-2013	6	Steaming to Chennai
14-11-2013	14-11-2013	1	INCOIS Cruise Preparation
15-11-2013	02-12-2013	18	INCOIS Cruise
03-12-2013	03-12-2013	1	INCOIS Cruise Preparation
04-12-2013	15-12-2013	12	Annual Survey, SOE Preparation, Transfer of Ship management to SCI
16-12-2013	15-03-2014	90	Stay order from Madras High Court, Handing over/ Taking over/Initial Preparatory activities
16-03-2014	17-03-2014	2	Sea-Trial
18-03-2014	31-03-2014	14	Port Azimuth Thruster, DGPS signal for DPS 200, PA System Rectification

Sagar Manjusha			
From	**To**	**Days**	**Program**
01-04-2013	01-04-2013	1	CMERI-Durgapur
02-04-2013	03-04-2013	2	MBT, ESSO-NIOT Cruise preparation
04-04-2013	17-04-2013	14	MBT-FAD buoy deployment & sampling
18-04-2013	18-04-2013	1	CEE, ESSO-NIOT Cruise preparation
19-04-2013	23-04-2013	5	CEE, ESSO-NIOT-Kalpasar Project
24-04-2013	26-04-2013	3	OOS, ESSO-NIOT buoy operation
27-04-2013	29-04-2013	3	Maintenance
30-04-2013	08-05-2013	9	OOS, ESSO-NIOT buoy operation
09-05-2013	09-05-2013	1	OE, ESSO-NIOT Cruise preparation
10-05-2013	18-05-2013	9	OE, ESSO-NIOT-AUPD deployment
19-05-2013	19-05-2013	1	CESS-Trivandrum cruise preparation
20-05-2013	25-05-2013	6	CESS-Trivandrum-COMAPS programme
26-05-2013	31-05-2013	6	Goa University-sampling
01-06-2013	02-06-2013	2	MBT, ESSO-NIOT & Goa University cruise preparation
03-06-2013	18-06-2013	16	MBT, ESSO-NIOT & Goa University-sampling
19-06-2013	20-06-2013	2	Maintenance
21-06-2013	21-06-2013	1	OOS, ESSO-NIOT cruise
22-06-2013	26-06-2013	5	IIT-Madras student training programme
27-06-2013	29-06-2013	3	Maintenance
30-06-2013	01-07-2013	2	OOS, ESSO-NIOT cruise preparation
02-07-2013	04-07-2013	3	OOS, ESSO-NIOT buoy deployment
05-07-2013	14-07-2013	10	Maintenance
15-07-2013	19-07-2013	5	PRL-Ahmedabad-Sampling
20-07-2013	21-07-2013	2	PRL-Ahmedabad-cruise preparation
22-07-2013	04-08-2013	14	PRL-Ahmedabad-Sampling
05-08-2013	07-08-2013	3	IMU-Vizag for testing
08-08-2013	09-08-2013	2	Steaming to Chennai
10-08-2013	10-09-2013	32	Major overhauling of engines
11-09-2013	18-09-2013	8	OE, ESSO-NIOT equipment testing
19-09-2013	19-09-2013	1	OS, ESSO-NIOT-cruise preparation
20-09-2013	21-09-2013	2	Maintenance
22-09-2013	03-10-2013	12	OS, ESSO-NIOT-current meter deployment
04-10-2013	04-10-2013	1	Maintenance
05-10-2013	11-10-2013	7	OOS, ESSO-NIOT-buoy operations
12-10-2013	14-10-2013	3	Maintenance
15-10-2013	24-10-2013	10	PRL-Ahmedabad-Sampling
25-10-2013	27-10-2013	3	Maintenance
28-10-2013	01-11-2013	5	CESS-Trivandrum-COMAPS programme

02-11-2013	03-11-2013	2	Maintenance
04-11-2013	10-11-2013	7	ICMAM for Sampling
11-11-2013	11-11-2013	1	Maintenance
12-11-2013	15-11-2013	4	Steaming to Pipavav for CEE Cruise
16-11-2013	16-11-2013	1	CEE, ESSO-NIOT-cruise preparation
17-11-2013	28-11-2013	12	CEE, ESSO-NIOT-Survey
29-11-2013	01-12-2013	3	Steaming to Goa
01-12-2013	11-12-2013	11	Scientific Equipment and Ship Machinery Maintenance
12-12-2013	21-12-2013	10	NIO-Goa-Sampling
22-12-2013	22-12-2013	1	Maintenance
23-12-2013	26-12-2013	4	Steaming to Cochin
27-12-2013	27-12-2013	1	CESS-Trivandrum-Cruise preparation
28-12-2013	04-01-2014	8	CESS-Trivandrum-COMAPS programme
05-01-2014	07-01-2014	3	SCI-Annual Survey
08-01-2014	16-01-2014	9	Annamalai University-Sampling
17-01-2014	22-01-2014	6	Deficiency rectification, GTL renewal
23-01-2014	23-01-2014	1	IIT-Madras-cruise preparation
24-01-2014	31-01-2014	8	IIT-Madras-cruise
01-02-2014	31-03-2014	59	Auxiliary Engine Overhauling

Sagar Purvi

From	To	Days	Program
01-04-2013	03-04-2013	3	Maintenance
04-04-2013	06-04-2013	3	Madras University for sampling
07-04-2013	21-04-2013	15	Maintenance
22-04-2013	08-05-2013	17	Scientific Equipment Maintenance-Multibeam Installation
09-05-2013	10-05-2013	2	Multibeam Testing
11-05-2013	18-05-2013	8	Scientific Equipment Maintenance-Multibeam Installation
19-05-2013	20-05-2013	2	Cruise Preparation for CEE, ESSO-NIOT
21-05-2013	21-05-2013	1	CEE, ESSO-NIOT for survey
22-05-2013	26-05-2013	5	Waiting at Chennai Port (Bad weather)
27-05-2013	31-05-2013	5	CEE, ESSO-NIOT for survey
01-06-2013	09-06-2013	9	Engine and CPP repair
10-06-2013	14-06-2013	5	CEE, ESSO-NIOT for survey
15-06-2013	23-06-2013	9	Engine and CPP repair
24-06-2013	24-06-2013	1	Cruise Preparation for CEE, ESSO-NIOT
25-06-2013	27-06-2013	3	CEE, ESSO-NIOT for survey
28-06-2013	30-06-2013	3	Maintenance
01-07-2013	02-07-2013	2	Cruise Preparation for EEZ (VMC)-ESSO-NIOT

03-07-2013	10-07-2013	8	EEZ (VMC), ESSO-NIOT for survey
11-07-2013	11-07-2013	1	Bunkering
12-07-2013	14-07-2013	3	Delay in sailing due to maintenance
15-07-2013	19-07-2013	5	EEZ (VMC), ESSO-NIOT for survey
20-07-2013	23-07-2013	4	Repair work (Anchor)
24-07-2013	01-08-2013	9	EEZ (VMC), ESSO-NIOT for survey
02-08-2013	05-08-2013	4	Maintenance
06-08-2013	08-08-2013	3	Pole fabrication for Mutibeam echosounder installation
09-08-2013	11-08-2013	3	Delay in sailing due to Port Holiday
12-08-2013	16-08-2013	5	EEZ (VMC), ESSO-NIOT for survey
17-08-2013	23-08-2013	7	Anchor winch repair
24-08-2013	26-08-2013	3	EEZ survey training
27-08-2013	28-08-2013	2	Winch motor and fuel injector repair
29-08-2013	03-09-2013	6	EEZ (VMC), ESSO-NIOT for survey
04-09-2013	06-09-2013	3	Multibeam cable repair work
07-09-2013	15-09-2013	9	EEZ (VMC), ESSO-NIOT for survey
16-09-2013	20-09-2013	5	SVP Testing
21-09-2013	25-09-2013	5	EEZ (VMC), ESSO-NIOT for survey
26-09-2013	28-09-2013	3	Fishing net entangled-Waiting for divers
29-09-2013	29-09-2013	1	Steaming to Chennai
30-09-2013	05-12-2013	67	Gearbox Repair work
06-12-2013	25-12-2013	20	Auxialiary Engine overhauling-FSI clearance-GTL renewal
26-12-2013	27-12-2013	2	Testing and Calibration of Scientific Equipments
28-12-2013	30-12-2013	3	Maintenance
31-12-2013	08-01-2014	9	EEZ (VMC), ESSO-NIOT for survey
09-01-2014	23-01-2014	15	Maintenance
24-01-2014	31-01-2014	8	EEZ (VMC), ESSO-NIOT for survey
01-02-2014	11-02-2014	11	Seawater pump and valve overhauling
12-02-2014	20-02-2014	9	Maintenance
21-02-2014	25-02-2014	5	Side Pole Removal, Pressure sensor rectification
26-02-2014	27-02-2014	2	Maintenance
28-02-2014	28-02-2014	1	MMD Survey
01-03-2014	01-03-2014	1	Deficiency Rectification suggested by surveyor
02-03-2014	02-03-2014	1	EEZ (VMC), ESSO-NIOT for Multibeam Calibration
03-03-2014	04-03-2014	2	Deficiency Rectification suggested by surveyor
05-03-2014	05-03-2014	1	EEZ (VMC), ESSO-NIOT for Multibeam Calibration
06-03-2014	10-03-2014	5	Deficiency Rectification suggested by surveyor
11-03-2014	12-03-2014	2	EEZ (VMC), ESSO-NIOT for Multibeam Calibration
13-03-2014	14-03-2014	2	Maintenance
15-03-2014	22-03-2014	8	EEZ (VMC), ESSO-NIOT for survey
23-03-2014	31-03-2014	9	Maintenance

Sagar Paschimi			
From	**To**	**Days**	**Program**
01-04-2013	01-04-2013	1	Andhra University for INCOIS Project
02-04-2013	03-04-2013	2	Cruise preparation for Andhra University Cruise
04-04-2013	06-04-2013	3	Andhra University for INCOIS Project
07-04-2013	09-04-2013	3	Maintenance
10-04-2013	13-04-2013	4	Steaming to Paradip for IMMT cruise
14-04-2013	15-04-2013	2	Cruise preparation for IMMT cruise
16-04-2013	21-04-2013	6	IMMT Bhubaneswar for sampling
22-04-2013	02-05-2013	11	Repair work(Rope entanglement, Gear box problem)
03-05-2013	07-05-2013	5	Steaming to Haldia for IMMT cruise
08-05-2013	17-05-2013	10	Port stay due to Bad weather
18-05-2013	25-05-2013	8	Steaming to Vizag
26-05-2013	03-06-2013	9	Maintenance
04-06-2013	07-06-2013	4	Andhra University for sampling
08-06-2013	10-06-2013	3	Maintenance
11-06-2013	12-06-2013	2	Cruise preparation for NRSC-NIO-Vizag cruise
13-06-2013	15-06-2013	3	Port stay due to Bad weather
16-06-2013	20-06-2013	5	NRSC-NIO-Vizag cruise for sampling, radiometer testing
21-06-2013	23-06-2013	3	Maintenance
24-06-2013	28-06-2013	5	Annamalai University for sampling
29-06-2013	02-07-2013	4	Maintenance
03-07-2013	11-07-2013	9	IIT Madras for sampling
12-07-2013	16-07-2013	5	Maintenance
17-07-2013	19-07-2013	3	Annamalai University for COMAPS
20-07-2013	22-07-2013	3	Maintenance
23-07-2013	24-07-2013	2	Cruise preparation for CEE, ESSO-NIOT cruise
25-07-2013	06-08-2013	13	Maintenance
07-08-2013	08-08-2013	2	Annamalai University for COMAPS
09-08-2013	13-08-2013	5	Steaming to Vizag for Andhra University cruise
14-08-2013	14-08-2013	1	Cruise preparation for Andhra University cruise
15-08-2013	17-08-2013	3	Andhra University for sampling
18-08-2013	22-08-2013	5	Steaming to Chennai for IIT Madras cruise
23-08-2013	23-08-2013	1	Cruise preparation for IIT Madras cruise
24-08-2013	31-08-2013	8	IIT Madras for sampling
01-09-2013	04-09-2013	4	Maintenance
05-09-2013	08-09-2013	4	Cruise preparation for CEE, ESSO-NIOT
09-09-2013	14-09-2013	6	CEE, ESSO-NIOT for survey
15-09-2013	18-09-2013	4	Maintenance
19-09-2013	21-09-2013	3	Cruise preparation for CEE, ESSO-NIOT
22-09-2013	01-10-2013	10	CEE, ESSO-NIOT for survey

02-10-2013	07-10-2013	6	Maintenance
08-10-2013	08-10-2013	1	IIT Madras for sampling
09-10-2013	17-10-2013	9	Waiting at Chennai Port (Bad weather)
18-10-2013	22-10-2013	5	Steaming to Vizag for Andhra University cruise
23-10-2013	23-10-2013	1	Cruise preparation for Andhra University cruise
24-10-2013	27-10-2013	4	Port Stay at Vizag Port: Waiting for weather to improve
28-10-2013	30-10-2013	3	Andhra University for sampling
31-10-2013	11-11-2013	12	Maintenance
12-11-2013	16-11-2013	5	Steaming to Paradip for IMMT cruise
17-11-2013	18-11-2013	2	Maintenance
19-11-2013	19-11-2013	1	Cruise preparation for IMMT-Bhubaneswar
20-11-2013	21-11-2013	2	IMMT Bhubaneswar for sampling
22-11-2013	26-11-2013	5	Waiting for Logistics
27-11-2013	28-11-2013	2	Waiting at Paradip Port (Bad weather)
29-11-2013	01-12-2013	3	Steaming to Haldia
02-12-2013	02-12-2013	1	Cruise preparation for IMMT-Bhubaneswar
03-12-2013	04-12-2013	2	Waiting for Logistics
05-12-2013	10-12-2013	6	IMMT Bhubaneswar for sampling
11-12-2013	17-12-2013	7	Steaming to Vizag
18-12-2013	19-12-2013	2	Cruise preparation for NRSC-INCOIS
20-12-2013	23-12-2013	4	NRSC-INCOIS cruise for Sampling
24-12-2013	26-12-2013	3	Maintenance
27-12-2013	27-12-2013	1	Cruise preparation for Andhra University
28-12-2013	31-12-2013	4	Andhra University cruise for Sampling
01-01-2014	01-01-2014	1	Cruise preparation for Andhra University
02-01-2014	02-01-2014	1	IRS Survey
03-01-2014	03-01-2014	1	Maintenance
04-01-2014	06-01-2014	3	IMU-Vizag for ADCP data collection
07-01-2014	07-01-2014	1	Maintenance
08-01-2014	10-01-2014	3	Andhra University cruise for Sampling
11-01-2014	31-01-2014	21	Deficiency Rectification-Annual Survey
01-02-2014	04-02-2014	4	Andhra University cruise for Sampling
05-02-2014	17-02-2014	13	Deficiency Rectification-Annual Survey
18-02-2014	20-02-2014	3	Steaming to Paradip
21-02-2014	21-02-2014	1	Cruise preparation for IMMT-Bhubaneswar
22-02-2014	24-02-2014	3	IMMT Bhubaneswar for Survey
25-02-2014	25-02-2014	1	Maintenance
26-02-2014	01-03-2014	4	Steaming to Kolkata
02-03-2014	06-03-2014	5	Maintenance
07-03-2014	10-03-2014	4	IMMT Bhubaneswar for Survey
11-03-2014	11-03-2014	1	Maintenance

12-03-2014	17-03-2014	1	Steaming to Vizag
18-03-2014	19-03-2014	2	Maintenance
20-03-2014	20-03-2014	1	Cruise preparation for Andhra University
21-03-2014	23-03-2014	3	Andhra University cruise for Sampling
24-03-2014	25-03-2014	2	Maintenance
26-03-2014	30-03-2014	5	Steaming to Chennai
31-03-2014	31-03-2014	1	Maintenance

ADMINISTRATION

Following are the details of the manpower position during the period from 1.4.2013 to 31.3.2014 at ESSO-NIOT.

(a) Staff Strength

ESSO-NIOT has a total strength of 163 staff members, the details of which are furnished here under:

Sl.No.	Category	No. of Posts Sanctioned	No. of Posts Filled	No. of Posts Vacant
1.	Scientific	90	87	3
2.	Technical	54	54	NIL
3.	Administrative	18	17	1
4.	Multi Tasking Staff	6	6	Nil
	Total	168	164	4

(b) Appointments

Sl.No	Name	Post	Date of Appointment
1.	Shri V. Doss Prakash	Scientist `B' (Electronics)	02-04-2013
2.	Cdr Gopakumar Kuttikrishnan	Scientist `F' (Mechanical) on deputation basis	09-12-2013
3.	Shri T. Prakash	Scientific Assistant `A' (Electronics)	23-12-2013
4.	Selvakumar R	Scientist – B (Civil)	12-03-2014

(c) Promotions under Modified Flexible Complementing Scheme

Sl.No	Name	Post	With effect from
1.	Dr. G.A. Ramadass	Scientist `G'	01.01.2014
2.	Dr. G. Dharani	Scientist `E'	01.07.2013
3.	Shri S. Muthukumaravel	Scientist `E'	01.01.2014
4.	Shri G. Venkatesan	Scientist `E'	01.01.2014
5.	Shri Shibu Jacob	Scientist `D'	01.07.2013
6.	Shri M. Arul Muthiah	Scientist `D'	01.07.2013
7.	Dr. M. Kalyani	Scientist `C'	01.07.2013
8.	Shri M. Selvakumar	Scientist `C'	01.07.2013
9.	Shri S. Srinivasa Rao	Scientist `C'	01.01.2014
10.	Shri Karunakar Kintada	Scientist `C'	01.07.2013

(d) Promotion under Career Progression Path

Sl.No	Name	Post	With effect from
1.	Shri G. Chandrasekar	Scientific Asst `B'	01.07.2013
2.	Shri G. Nagarajan	Scientific Asst `B'	01.07.2013
3.	Shri V. Gowthaman	Scientific Asst `B'	01.07.2013
4.	Shri N. Sundaravadivelu	Scientific Asst `B'	01.07.2013

(e) Resignations

Sl.No	Name	Post	Date of Resignation
1.	Shri A. Vijayasankar	Scientist `B'	02.08.2013

(f) Retirements - NiI

(g) Mrs D. Megala, Junior Executive expired on 23/02/2014 due to illness.

RIGHT TO INFORMATION

The Right to Information Act 2005 came into force for its enactment from 12th October 2005 to promote transparency and accountability in the working of every public authority in India.

Right to Information Annual Return 2013 – 2014

Ministry / Department / Organization : National Institute of Ocean Technology, Chennai
Ministry of Earth Sciences

Year : 2013 – 14 (Upto March 2014)

Progress in 2013 – 14

	Opening Balance as on 01.04.2012 6(3)	No. of applications received as transfer from other Pas u/s	Received during the Year (including cases transferred to other Public Authority)	No. of cases transferred to other Public Authorities	Decisions where requests / appeals rejected	Decisions where requests / appeals accepted
Requests	2	15	10	0	3	20
First Appeals	0	0	1	0	1	0

No. of Cases where disciplinary action taken against any Officer	0

No. of CAPIOs designated	No. of CPIOs designated	No. of AAS designated
0	1	1

No. of times various provisions were invoked while rejecting requests

Relevant Section of RTI Act 2005													
Section 8 (1)										Sections			
a	b	c	d	e	f	g	h	i	j	9	11	24	Others
1	0	0	0	0	0	0	0	0	0	0	0	0	2

Amount of Charges Collected (in Rs.)		
Registration Fee Amount	Additional Fee & Any other charges	Penalties Amount
100	750	-

RTI Annual Return Information System (2013 - 2014)	
National Institute of Ocean Technology, Chennai	
Ministry of Earth Sciences (Please note that field prefixed with * are mandatory)	
* Organization Status Attached Office	Autonomous Body under Ministry of Earth Sciences, Government of India
* Name of Organization (upto 100 characters)	National Institute of Ocean Technology
* Nodal / Coordinating Officer Name	Dr. G.A. Ramadass
* Nodal / Coordinating Officer designation	Scientist - G
* Contact Address	National Institute of Ocean Technology
	Velachery Tambaram Main Road,
	Pallikaranai, Chennai – 600 100.
* State	Tamil Nadu
E-Mail Address	cpio@niot.res.in
Phone Number	044 – 6678 3388
Fax No., (if any)	044 – 2246 0275
Website address of Department / Organization (Please do not write 'http://')	www.niot.res.in

RTI Annual Return Information System (2013 – 2014)	
National Institute of Ocean Technology, Chennai	
Ministry of Earth Sciences (Please note that fields prefixed with * are mandatory)	
* Name of CPIO	Dr. G. A. Ramadass
* Gender	Male
* Designation	Scientist – G
* Address	National Institute of Ocean Technology,
	Velachery – Tambaram Main Road,
	Pallikaranai, Chennai.
Pin code	600 100.
Phone No.	6678 3388
Email	cpio@niot.res.in
* Appellate Authority Name	Dr. M.A. Atmanand, Director, ESSO-NIOT, Chennai

The Secretary-General, International Seabed Authority, Kingston, Jamaica, visited NIOT on 9th October 2013, and delivered a special lecture on Mining Technology Development.

National Technology Day was celebrated at ESSO-NIOT Chennai on 11th May 2013. Shri.Avinash Chander, Distinguished Scientist, Chief Controller R&D (Missiles and Strategic Systems), DRDO honored the occasion as Chief Guest and delivered the Technology Day lecture.

An International Conference on Advanced Technologies for Management of Ballast Water and Biofouling (MABB 2014) was successfully organized and conducted during March 4-7, 2014 and a souvenir was released to mark the occasion.

National Institute of Ocean Technology
(ESSO, Ministry of Earth Sciences, Govt. of India)
NIOT Campus, Velachery – Tambaram Main Road,
Pallikaranai, Chennai – 600 100. INDIA.
Tel : +91 44 6678 3300 / Fax : +91 44 66783571
Email : postmaster@niot.res.in
Web : www.niot.res.in

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