



ANNUAL REPORT 2016-17

National Institute of Ocean Technology
(Ministry of Earth Sciences, Govt. of India)

On the occasion of the 23rd Foundation Day of NIOT on November 17, 2016, Dr.K.Kasturirangan, Former Chairman, ISRO was invited as the Chief Guest. A lecture was delivered by the Chief Guest and he visited various facilities of NIOT.



Beach restoration project commenced in Puduchery with Bhumi Pooja in the presence of Hon'ble Chief Minister of Puduchery on March 3, 2017. Beach nourishment work has commenced.

The 5th Session of IOC Regional Committee for Central Indian Ocean (IOCINDIO) meeting was organized in Chennai from 25th to 27th April 2016. It was initiated under the agreement between the Ministry of Earth Sciences, Government of India and IOC/UNESCO. Discussion on regional cooperation, scientific understanding, challenges faced in this region such as coastal hazards, monsoonal pattern, climate change and fisheries were held.



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 (MoES), Government of India. NIOT is managed by a Governing Council headed by Secretary MoES 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 NIOT FOR THE YEAR 2016-17

Sl. No.	Name	Designation
1.	Dr.M.Rajeevan Secretary to Govt. of India Ministry of Earth Sciences, New Delhi	Chairman From 7 th December 2015
2.	Smt Anuradha Mitra, IDAS AS & FA Ministry of Earth Sciences, New Delhi	Member From 17 th December 2014
3.	Dr. C. Muralikrishna Kumar Sr. Adviser (CIT&I and S&T) NITI Aayog, New Delhi	Member From 1 st August 2015 To 15 th September 2016
4.	Shri U.V.Lakhane Executive Director (Projects), Engineers India Limited, New Delhi	Member From 27 th February 2012 To 15 th September 2016
5.	Dr.P.S.Nair Former Dy. Director, ISAC, Bangalore	Member From 6 th June 2006 To 15 th September 2016
6.	Shri Anand Singh Khati, IRPS Joint Secretary Ministry of Earth Sciences, New Delhi	Member From 30 th July 2012
7.	Shri D.K.Das Deputy Director Space Application Centre, Gujarat	Member From 10 th March 2015 To 15 th September 2016
8.	Prof. Bhaskar Ramamurthi Director Indian Institute of Technology Madras, Chennai	Member From 27 th February 2012 To 15 th September 2016
9.	Shri Kedarnath Shenoi Director Naval Physical & Oceanographic Lab, Kochi	Member From 1 st March 2015 To 15 th September 2016
10.	Dr. C. Durga Malleswar Director Naval Science & Technological Lab Visakhapatnam	Member From 1 st October 2013 To 15 th September 2016
11.	Dr.P.S.Goel Chairman-SAC,NIOT & Former Secretary, NIOT	Member From 16 th September 2016
12.	Dr.S.A.Sannasiraj HOD, Dept. of Ocean Engg., IIT Madras Chennai	Member From 16 th September 2016
13.	Dr.P.K. Panigrahi Scientist-G, NSTL, Vizag	Member From 16 th September 2016
14.	Dr. K.Sudarshan Scientist-G, NPOL, Kochi	Member From 16 th September 2016
15.	Dr.M.P.Wakdikar Advisor, Ministry of Earth Sciences, New Delhi	Member From 16 th September 2016 Permanent Invitee From 1 st January 2015 To 15 th September 2016
16.	Prof.Santosh Kapuria Director Structural Engineering Research Centre, Chennai	Permanent Invitee From 30 th December 2015 To 15 th September 2016
17.	Dr.S.S.C.Shenoi Director, National Institute of Ocean Technology, Chennai	Member Secretary From 1 st August 2015

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FROM THE DIRECTOR'S DESK

I am pleased to present you with great happiness the Annual Report of National Institute of Ocean Technology (NIOT) for the year 2016-17. By means of increasingly innovative methodologies, over a period of more than two decades, NIOT has matured to cater to the strategic and societal demands of the country in the domain of ocean technology, by demonstrating niche technologies in the field of energy, freshwater, living and non-living marine resources, coastal protection, and ocean observations.



In order to meet the ever increasing demand for energy and freshwater, a Ocean Thermal Energy Conversion – Desalination plant has been conceptualized and the necessary drawings have been prepared to establish that in Kavaratti island. The sea bed investigations also have been completed at the potential site to concretize the design.

National Institute of Wind Energy under Ministry of Non-conventional Energy, had approached NIOT to design and execute 50 m tall tower to house a LIDAR to make measurements to estimate the wind energy potential in the high tidal range Gulf of Khambhat. NIOT could provide the most economical design and innovative indigenized methodology for the installation of the tall structure that can withstand the high tidal currents and poor soil conditions. The 50 m tall tower housing the wind measuring instruments is making continuous measurements in the complex Gulf of Khambhat, since March 2017, and is a monumental example of NIOT's offshore structure design capability.

In our endeavor to achieve a sustainable shoreline management system, different new techniques based on the site conditions have been attempted and they have shown successful results. A hybrid solution consisting of a submerged reef and beach nourishment being implemented at the Pondicherry coast has already resulted in the growth of beach. Another solution, based on submerged dyke made of geo-synthetic tubes and sand in Kadalur – Periyakuppam on Tamil Nadu coast also has shown the natural restoration of an eroded beach. We will be happy to extent such technological advices for the protection of our coasts at any site.

Our ROSUB 6000 was successfully deployed to locate the remains of the lost Indian Air Force aircraft (AN 32) at around 3500 m water depth in the Bay of Bengal and the Indigenously developed remotely operated vehicle (PROVe) was deployed for the first time in the open ocean environment in the Arabian Sea for bio-diversity investigations at 100 m water depth, for Central Marine Living Resource & Ecology. It is satisfying to note that both performed well as expected; yet again proving their ruggedness and utility for varied applications.

Other successes towards the development of deep-sea technology include the successful testing of pumping system at 5500 m in the Bay of Bengal and the deep sea Autonomous Coring System at a water depth on 2900 m in the Bay of Bengal. The former will augment our efforts in developing a system to mine the poly-metallic nodules from the Central Indian Ocean basin and the later will augment the efforts in the extraction of gas hydrates laying below the sea bed at water depths of 1500-3000 m.

The successful deployment of the drifter buoy with a 15 m thermistor string in Arabian sea and the upgradation of the indigenously developed Buried Object Scanning/detection Sonar (BOSS) a DGPS and standard bench top sub systems for better sea bed positioning are notable achievements in our efforts in the development of new instruments for various oceanographic applications.

The analysis of ambient noise measurements made using the IndArc mooring deployed by NIOT in the Kongsfjorden Fjord in the Arctic have revealed interesting results on ice melting and biological species in the Fjord. The mooring continues to record the noise with two hydrophones every hour.

Reliability of ocean observation platforms have been improved multifold. The coastal buoy deployed off Chennai (CB06) has been successfully tested by switching over to cyclone mode during Roanu and Vardah cyclones. At cyclone mode, the buoy starts transmitting data at higher frequency till the cyclone passes over the location. The buoy determines when to transmit the data at higher frequency based on the fall in atmosphere below a threshold. The IndARC II mooring in the Arctic was successfully retrieved and redeployed on 27 July 2016. A remotely operable Robot "Sagar Avalokan" for surface sampling was successfully developed and tested at high seas. The data from the network of 19 tide gauges and 18 automatic weather stations maintained by NIOT was transmitted to INCOIS in real time.

Discovered a new species of biofilm forming bacteria and a new taxa of deep sea *Streptomyces* sp. NIOT.Ch.40 with antagonistic activity. 1.5 µg/mL methicillin-resistant *Staphylococcus aureus* (MRSA) was also isolated. The open sea cage culture of cobia at

Thupilipalem, Andhra Pradesh yielded a harvest of 3,061 kg of cobia. Considering the usefulness to the fishermen, the Andhra Pradesh State Fisheries Department funded the deployment of eight more cages in the open sea cages off the coast of Pamanji.

On the infrastructure front, while the compound wall work is in progress, at the sea front facility at Pamanji, Nellore, four mobile laboratories also have been established to progress with the Ballast water treatment related work. The construction of compound wall at Vagaru also is progressing.

The acquisition of two new CRVs is in progress and expected them to join the NIOT fleet by end of 2019.

During the year, NIOT also underwent critical review by an Independent Peer-Review Committee constituted by Secretary, MoES under the Chairmanship of Dr.K.Kasturirangan, INAE Satish Dhawan Chair of Engineering Eminence, Raman Research Institute, Bengaluru. Dr.M.Y.S.Prasad, Former Director, SHAR, Sriharikota, ISRO, Hyderabad, Dr.B.N.Suresh, Former Director, VSSC, ISRO, Bangalore, Dr.N.Vedachalam, Distinguished Professor, Vikram Sarabhai Space Research Centre, Thiruvananthapuram, Prof.M.S.Ananth, Former Director, IIT Madras were the members of the committee. Dr.M.P.Wakdikar acted as the Member Convenor of the Committee. The review was in pursuance of the recommendations of the Expenditure Management Commission of the Department of Expenditure, Government of India and as per GFR that stipulates periodical review of autonomous bodies to ascertain whether the autonomous bodies are meeting the purpose for which they were established and whether they need to continue as autonomous institutions. The committee reviewed the activities and performance of NIOT during November 16-17, 2016 and submitted the report to Secretary, MoES.

I take this opportunity to place on record my sincere thanks to Dr.M.Rajeevan, Chairman, Governing Council and Secretary, MoES for his continuous encouragement and guidance in executing the projects at NIOT. I would also like to thank the members of Governing Council, for their valuable advices and suggestions on managing the projects as well as the institute. I also thank the Chairman and members of Scientific Advisory Council, and the Finance Committee for their valuable advice and suggestions on different stages of the ongoing activities of NIOT. Colleagues in the Ministry of Earth Sciences and at the Centres - NCAOR, CMLRE, ICMAM, INCOIS, NCESS, NCMRWF and IMD have always been cooperative on any issues which needed their help. I thank them all.

Finally, I would like to convey my heartfelt thanks to the scientists, technical support and administrative support staff for their determined efforts, whole hearted involvement and



the team work that kept the institute live and a place most desirable to work on ocean technologies. My special thanks to all helped in preparing this report especially to G.Latha, S.Ramesh, G.Venkatesan, K.Jossia, D.Shyamala, M.Sarojini, T.Abhishek, V.Pankaj, S.Jawahar and L.Jenitha. I am grateful to them for their help and advices in giving the final shape to this report.

Jai Hind.

(SATHEESH SHENOJ)

MAJOR ACCOMPLISHMENTS OF THE YEAR 2016-17

- In principle approval for the proposed OTEC - Desalination plant obtained from Lakshadweep Administrator to establish the LTTD plant powered by Ocean Thermal Energy Conversion at Kavaratti Island.
- Deep sea and shallow water bathymetry survey were carried out off Kavaratti island using Sagar Manjusha and Sagar Nidhi. Survey Data was analyzed and potential sites for the establishment of the OTEC - Desalination plant have been identified and conveyed to U.T.Administration.
- Deep water work class Remotely Operated Vehicle (ROSUB 6000) was deployed for target verification of the missing AN32 aircraft in the Bay of Bengal at 3400m water depth.
- Indigenously developed shallow water / polar remotely operated vehicle (PROVe) was deployed in the Arabian Sea for bio-diversity investigations and at Chennai port for locating the barge search during Vardah cyclone.
- Autonomous Coring System was depth qualified at 3000m water depth in the Bay of Bengal
- Coral reef exploration carried out using PROVe at Andaman Islands.
- Pumping subsystem test platform sea trials at ORV Sagar Kanya was successfully completed at 82 m to 264 m water depth.
- Underwater imaging was carried out for sunken barge by using remotely operable vehicle PROVe and report submitted to Chennai Port.
- As per the schedule the High Pressure retainable water Sampler (HPS) system functionality, electronics compatibility and performance test were successfully carried out at hyperbaric test facility of Royal Netherlands Institute for Sea Research during January , 2017.
- Offshore substructure to support LiDAR for measuring offshore wind has been successfully installed in Gulf of Khambhat which is the first of its kind in the country. The design and installation methodologies were evolved by MoES-NIOT.
- Beach restoration project commenced in Puducherywith BhumiPooja in the presence of Hon'ble Chief Minister of Puducheryon March 3, 2017. Beach nourishment work has commenced.
- Demonstrated successfully the performance of 100 m of submerged dyke segment off Kadalur Periyakuppam for shore protection. 70 m of beach is formed within a period of 6 months
- The indigenously developed Buried Object Scanning/detection Sonar (BOSS) has been upgraded with a DGPS for cm level accuracy and standard bench top sub systems.
- A patent has been awarded for the invention of a broad band underwater transducer for Marine applications.
- Design, Development and implementation of Spar type Rigid Submerged Fish cage is completed and deployed at Andaman, North Bay for its performance study.
- Drifter with 15 m thermistor string deployed in Arabian Sea and data is being received continuously.
- The autonomous ambient noise system deployed off Chennai with INSAT communication recorded noise due to very severe cyclonic storm and heavy rain during the passage of VARDAAH.

- As part of IndARC mooring, long time series ocean ambient noise data have been collected for 9 months in the Kongsfjorden Arctic.
- Coastal buoy system deployed off Chennai CB06 switched to cyclone mode and transmitted low pressure data after sensing the recent ROANU cyclone. This buoy system is incorporated with rapid mode data collection algorithm during cyclone/low pressure period. It worked successfully and transmitted the real time data.
- NIOT and NCAOR team successfully retrieved the IndARC II mooring and redeployed on July 27, 2016, onboard Norway Polar Institute (NPI) vessel RV Lance. Oceanographic data from the subsurface sensors have been collected for another year.
- Omni buoys and Coastal buoys captured the signals of super cyclone VARDAH passage during December 8-13, 2016. CB06 deployed off Chennai with Cyclone detection algorithm transmitted data in Rapid mode and recorded Sea level pressure of 973.51hpa, wind speed of 126km/h on 12th December 2016.
- Robot “Sagar Avalokan” a remotely operable surface sampling system has been successfully tested at high seas by OOS team onboard Sagar Nidhi.
- A new species of biofilm forming bacteria was discovered and named as *Pseudogracilibacillus marinus* sp. nov. A new taxa of deep sea *Streptomyces* sp. NIOT.Ch.40 with antagonistic activity of 1.5 µg/mL against methicillin-resistant *Staphylococcus aureus* (MRSA) was isolated.
- Open sea cage culture of cobia was demonstrated at Thupilipalem, Andhra Pradesh (AP), in collaboration with the AP state fisheries. A total of 3,061 kg of cobia were harvested and sold at Rs. 325/kg.
- Deployed eight numbers of open sea cages off the coast of Pamanji, Nellore.
- Four numbers of container-based laboratories have been established for analysis related to cage culture, micro algal culture and ballast water treatment in the Seafront facility at Pamanji, Nellore.
- Successful implementation of innovative engineering solutions onboard Ships is resulting in reduced cost of maintenance & enhanced operational time.
- Operating a network of 19 tide & 18 automatic weather stations and the data is transmitted to INCOIS on real time.

RENEWABLE ENERGY AND FRESH WATER



*Demonstration of ocean current turbine
at Macpherson Strait, Andaman Islands*

RENEWABLE ENERGY AND FRESH WATER

The groups mandate is to develop technologies for tapping renewable energies from the ocean and generating high quality clean drinking water from the ocean. Technologies like Low Temperature Thermal Desalination (LTTD) using coolant water discharge from thermal power plant and offshore deep sea cold water, wave energy using floating devices, marine hydrokinetic turbine development, solar desalination, heat exchangers for LTTD and Ocean Thermal Energy Conversion (OTEC) are the focal areas of research.

Waste Heat Utilization from Power Plants for LTTD Applications

Experimental Studies continue in the LTTD plant set up in the North Chennai Thermal Power Station (NCTPS) using condenser reject heat of NCTPS as feed water to the LTTD plant. The system is being continuously operated using plate heat exchangers and water of high quality continuously generated. A study has been conducted to find out the minimum warm seawater flow to maintain the same yield and to optimize vacuum load thereby power requirements of the whole system. A series of experiments were conducted by varying the warm seawater flow rates by introducing a variable frequency drive. The fresh water is collected in large storage tanks located near the plant for the usage by power plant personnel.

Harnessing hydrokinetic energy in ocean currents

NIOT had carried out ocean current measurement at the MacPherson Strait which connects Bay of Bengal on West and Andaman Sea on East for a brief period and found peak current velocity exceeding 1.2 m/s mainly due to tidal influence. A horizontal axis cross flow turbine (0.8 m in diameter, 1 m in length), with three straight blades was designed and developed in-house and tested at MacPherson Strait successfully. The turbine had an underwater enclosure for housing transmission drive, an electrical generator and instrumentation. The turbine was mounted on a floating platform specially designed to suit hydrokinetic energy harvesting. The turbine was towed from main bay in Port Blair to the test location along a 48 km long route. It was lowered to the depth of 2 m from water level at the desired location. Selected location is ~20 m deep channel between Rutland Island and the smaller Lal Tikri Island. The turbine started generating electricity whenever current speed exceeds above 0.8 m/s and gave consistent performance throughout the trial period.

The power generated by the turbine was used for incandescent lamps and excess power was dissipated in a resistive load bank. This exercise generated valuable data about the performance of the turbine with variable tidal currents at the test sites via direct measurements. The maximum electric power reported during the trial was 304 W. During the trial the turbine functioned at coefficient of performance of 0.22 that matched the earlier test results. The turbine was retrieved after successful completion of the trial. These

tests paved the way for scaling up for off grid units for remote coastal locations.

During this exercise, the detailed current measurement exercise was carried out at the test location inside Macpherson Strait. Measured current data was used for arriving at sizes of a larger turbine with target peak power output of 5 kW. Different deployment techniques for the turbine in floating and seabed mounted condition are being studied.

Development of Low speed alternator for ocean current turbines

Low speed electric generators are required due to the low speed nature of the ocean current turbine system. Indigenous developments of alternators have been initiated and Permanent Magnet Synchronous Generator (PMSG) configuration has been chosen as it does not require external excitation source which suits the undersea electricity generation. Initially a 1kVA, 250 rpm, 24 pole PMSG was developed in house and it was tested successfully. A 5kVA 60 pole, 100 rpm and 26 rpm PMSGs are being designed for upcoming sea trials of scaled up ocean current turbine.



Demonstration of indigenously developed low speed PMSG for Ocean current turbine

Development of floating wave energy devices and impulse turbines

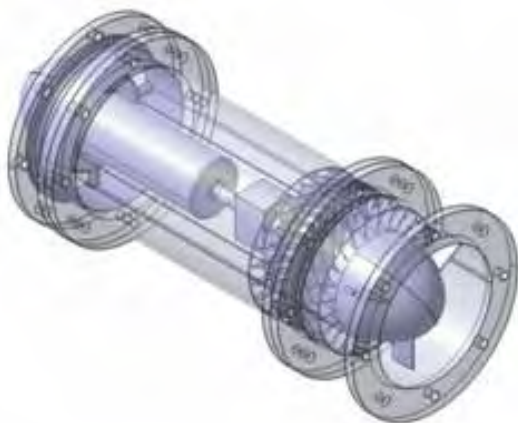
The group has been working on development of floating wave energy devices based on the oscillating water column (OWC) principle. Efforts have been made to maximize power from wave to wire. Studies related to optimizing buoy sizing to generate higher pneumatic power, optimizing turbine design and sizing to maximize mechanical power output and development in electrical system to match turbine- generator characteristics have been carried out. As a part of development of Impulse turbine for improved efficiencies, studies were carried out for assessing the performance of bidirectional impulse turbine (BDI) to utilize the full cycle of OWC, in collaboration with IIT Madras. These studies employed optimization techniques coupled with Computational Fluid Dynamics (CFD) analysis to find effect of guide vane angle, number of guide vanes and rotor blades on the performance

of a 298 mm BDI turbine. The exercise led to an improved efficiency of the turbine over a wide range of flow coefficients. Fabrication of reconfigured turbine with optimized blade geometry has been completed and the turbine will be comprehensively tested for various operating conditions in Oscillating air flow test rig.

A new BDI turbine with optimized blade geometry is being designed using an indigenous analytical technique and CFD tool. Turbine design will be chosen on basis of its match with the existing 196 UDI turbine in terms of the damping characteristics.

Wave energy powered navigational buoy

Based on earlier wave energy based BBDB sea trials, using the same 196 mm diameter UDI power module a wave powered navigational buoy has been designed and currently being fabricated. To suit the turbine and functional requirement of the buoy, the OWC sizing needed to be carried out. Small scale physical model studies in wave flume and CFD studies to predict hydrodynamic performance on the new design were then carried out. The electrical power generated from navigational buoy oscillates randomly and will have to be stored in battery bank for powering the navigational lamp continuously. The voltage changes very rapidly due to incoming random waves, therefore selection of generator and charging circuit is very crucial. The total estimated power consumption during a day is 250Wh. Test was carried out at oscillatory test rig at IIT Madras for different charging circuits of various capacities, speeds and voltage. 196 mm UDI turbine power module with Permanent Magnet Direct Current (PMDC) of 48VDC, 1500 rpm generator performed better than the other generators rated for other voltages and speeds tested during this exercise. The navigational buoy with the power module will be tested off Ennore port.



Optimized bidirectional turbine



Estimation of water surface and airflow inside the OWC using CFD

Studies on Heat Exchangers and Demisters

Experimental setup at LTTD plant in NCTPS was instrumented at appropriate locations and the data has been continuously logged and studied for evaluating the performance of various parameters. Simple liquid column inclined manometers with red oil as measuring medium have been installed to quantify the pressure drop across the demister and data collected under various operating conditions. It was found that inclined manometer shows consistent results and a good response with the variations in operating conditions such as low vapor velocities, vacuum and mixture of gases.

Experiments are also being carried out to measure the volumetric flow rate of gas mixture exiting out of condenser. Vortex, orifice and turbine flow meters were used for the measurement and found that they were not responding properly for the present operating conditions. Hence a recovery condenser was installed for the collection of uncondensed water vapour and for estimating the volumetric flow rate of gas mixture. Detailed analysis has been done on the experimental data and also modeling & simulations were carried out using HTRI software. Simulation results are in good agreement with the experimental data. Experiments are being carried out by varying warm and cold seawater flow rates.

Efforts at NIOT are also focused on powering desalination using OTEC. Towards this a laboratory setup to run OTEC and desalination cycle has been planned. This setup at NIOT will be used for carrying out studies on various components of OTEC powered desalination including 2 kW OTEC turbine which was developed inhouse. Other components such as heat exchangers, flash chamber, chiller etc. required for this laboratory were also designed and fabricated and currently are being readied for integration to set up the OTEC-Desal laboratory.

Generation of theoretical and experimental data for optimization of solar desalination components.

In most of the coastal regions of India, there is scarcity for fresh water and abundant availability of solar energy. By utilizing solar energy a desalination system can be integrated to produce freshwater from abundantly available sea water. Hence various heat transfer correlations available for horizontal falling film evaporation and steam condensation were analyzed and the suitable correlations for designing an experimental solar Multi effect Desalination (MED) setup were proposed. In-house MATLAB code for MED-TVC process and solar concentrator was validated with Ramanathapuram plant data. Using this MATLAB code, components for a 1000 liter per day capacity experimental plant were designed. Mechanical and thermal design of the components was done using

ANSYS and HTRI software. Sensitivity analysis was carried out to understand the influence of critical parameters like liquid load, feed water temperature and pressure on fresh water yield on MED process.

Direct solar desalination systems have low operating and maintenance costs but require large installation areas and high initial investment. However, solar distillation is an appropriate solution for remote areas and small communities in arid and semi-arid regions lacking water. Solar stills with different slope angles (23° & 45°) and equal basin area (1 m^2) were designed, fabricated and appropriate instrumentation was incorporated. Data was continuously logged during the course of experimentation. Experimental results of the stand-alone solar still were compared with the theoretical model developed in-house and found in agreement with experimental results for the stand alone still.

An Evacuated Tube Collector (ETC) was used to increase the water temperature of solar still basin without the use of conventional energy. Feeding of this energy is done by natural circulation (thermo-siphon) due to the temperature difference between the solar still and ETC. Later experiment was carried out by comparing total production of standalone solar still and an ETC coupled solar still. Comparison of the yields between the coupled and stand alone solar stills were studied. It was found that total production of the coupled solar still was about three times of standalone still.

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

Two major projects which were undertaken with Industrial partnership for setting up of LTTD plants are

- A. Pre-project activities for establishing large scale desalination plant including studies on complex offshore components and thermal components.
- B. Design, development, installation and commissioning of a large capacity desalination plant using condenser reject heat in Tuticorin Thermal Power Station (TTPS) for producing drinking and industrial quality water.

A. Detailed Design Report (DPR) for floating desalination plant of capacity 10 Million Liter per Day (MLD) was completed. The DPR includes thermal system design, platform to house plant components, offshore moorings and pipeline, instrumentation & control, data acquisition, electrical, methodology for transportation of fresh water from platform to mainland, stages of construction of platform, classification society approval and calculation of project costing.

B. As part of setting up of a LTTD plant of 2 MLD capacity in Tuticorin Thermal Power Station, a detailed design document containing technical documents from various disciplines for the plant is ready. The design can now be utilized for the construction and installation of the plant.

A new OTEC powered desalination plant at Kavaratti

As a step towards meeting growing drinking water demand at Kavaratti, NIOT has proposed a new self powered thermal desalination plant that will generate the following outcomes upon completion:

- (a) A green renewable energy technology using ocean thermal energy conversion (OTEC) principle will be demonstrated; and
- (b) Low temperature thermal desalination plant will generate drinking quality water of 100 m³/day meeting fully or partially the need of Kavaratti Island in U.T. Lakshadweep.

The project has been identified as a priority program by NITI Aayog. Significant amount of survey work and design activities were carried out in the year. Deep sea and shallow water bathymetry, CTD (Conductivity, Temperature, Depth) measurements, water sampling etc. were carried out in different phases using vessels Sagar Manjusha and Sagar Nidhi. The outcomes of the surveys at Kavaratti were used as input to the process design.

Two types of OTEC cycles – closed cycle and open cycle – were considered for the process design. Several configurations for seawater systems were conceptualized and studied for closed cycle OTEC powered desalination. A computer code was written that could incorporate all the configurations in order to arrive at process parameters with estimated gross power matching all parasitic power requirements of desalination and OTEC. Results of the analysis showed that the common cold water intake configuration could provide the best solution in terms of gross power requirements among all options and this configuration was further analysed for optimum distribution of overall available temperature difference in the system to maximise the net power output (i.e. the difference between gross power output and parasitic power requirement). In another design exercise, a baseline configuration of the open cycle OTEC process was arrived at where no refrigerant was needed to run the power cycle. Now this process design will undergo several iterations towards optimization before a final design is chosen.

Success of this project will put India as the forefront in development of OTEC globally and pave way for large scale self-powered desalination and development of standalone OTEC plants.



Turbines for powering island desalination plant using ocean thermal energy conversion

As a part of the OTEC-Desalination project at Kavaratti, turbine design was undertaken to cater to the process requirements arrived at from the site conditions and various blade geometries were designed for turbine for closed cycle and open cycle separately. Axial flow configuration was explored for close cycle using ammonia as the working fluid operating between 960 kPa and 720 kPa pressures. Axial and radial inflow configurations was explored for open cycle using flashed vapour from desalination unit as the working fluid operating between 3 kPa and 1.7 kPa pressures. Detailed performance simulations using computational fluid mechanics (CFD) principles are underway for these designs.

OCEAN STRUCTURES AND ISLAND DESALINATION



Supporting substructure for LiDAR platform installed at Gulf of Kambhat



Commencement of proposed solution at Puducherry Coast

OCEAN STRUCTURES AND ISLAND DESALINATION

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.

- Development of technologies for offshore structural components
 - Feasibility studies on Fixed and Floating platform for Offshore Wind Turbine.
 - Design and Demonstration of Submerged Offshore Reefs for beach restoration at Pondicherry coast.
 - Estimation of wave forces (breaking & non-breaking) through wave structure interaction studies.
 - Analysis, design and model studies of fixed platforms, floating platforms, riser configurations, moorings and components for Deep sea cold water pipe of Low Temperature Thermal Desalination Plants in Islands.
- Establishing desalination plants in the Islands of Union Territory Lakshadweep.

Feasibility studies on Fixed and Floating platform for Offshore Wind Turbine

Wind profile data for a two year period is mandatory for establishment of offshore wind farm. So, LiDAR based data collection platforms were designed for MNRE-NIWE at Gulf of Khambhat and for M/s Suzlon at Gulf of Kutch, considering the prevalent high tidal currents and poor soil conditions in the Gulfs. An installation methodology was designed by modifying a Jack-up barge with state of the art launching and driving mechanism for the unique and first of their kind platforms in India. The overall project cost was thus reduced to 40% compared to prevailing methodologies. The platform at Gulf of Khambhat has been successfully installed in about 15m water depth about 25 km from Pipavav port.



Installation of Substructure for Offshore Wind Measurements

Design and Demonstration of Submerged Offshore Reefs for beach restoration at Pondicherry coast

The coastline of Puducherry and the neighboring Tamil Nadu coastline have suffered from severe coastal erosion due to natural and anthropogenic activities. Short term measures like Seawalls and Groin field were attempted by Puducherry government but the erosion problem shifted further north, with increased intensity. Detailed shoreline management plan was prepared using satellite data and process based measurements covering both the predominant seasons (SW and NE Monsoons). Based on the positive response for the 60m beach gain during the implementation of MoES-NIOT's experimental beach nourishment scheme along coast line using the dredged sand from harbour mouth, Puducherry government requested MoES-NIOT to implement a permanent solution for beach restoration.



Rainbow Dredging and Reef construction activities

Detailed process based measurements and numerical studies were undertaken to arrive at a proposal for two reefs along with beach nourishment. Methodology for implementation of beach nourishment was worked out, which indicated an immediate 0.5 million m³ of sand requirement. Various configurations of offshore retaining structures are studied to increase the life of the nourished beach and minimize the effect of erosion on the north side and a hybrid solution with Beach Nourishment and two Reefs is proposed to protect the coast and restore the lost beach. The project initiation for northern Reef being implemented by MoES-NIOT was performed in the presence of honorable Chief Minister of Puducherry.

The beach Nourishment is being implemented by Puducherry Government under technical Guidance of NIOT.



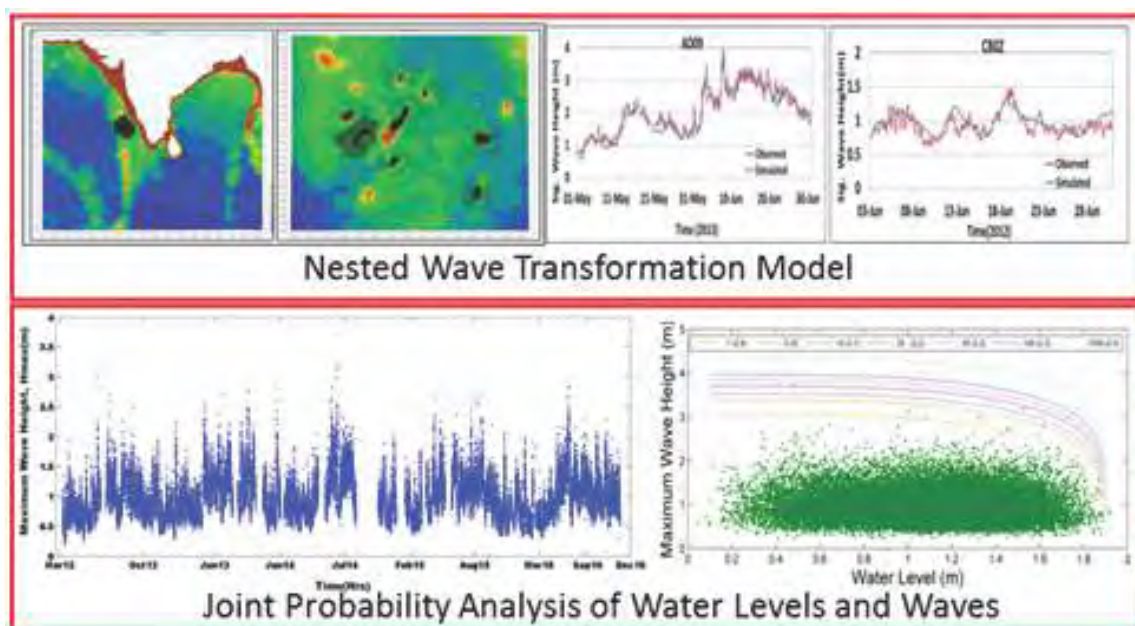
Before implementation



Anticipated post implementation

Estimation of wave forces (breaking & non-breaking) through wave structure interaction studies

Full scale experiments are being conducted on seawater intake caisson/structure at Agatti, where wave (incident & reflected) and tidal parameters are measured continuously from March 2012 to April 2017 (5 years) by bottom mounted directional wave recorders. An extensive array of pressure transducers is mounted on the intake structure to measure the incident wave pressure. The wave pressure data analysis was carried out and the total pressure acting on the caisson has been estimated for the pre monsoon, monsoon and post monsoon seasons.



Wave Structure Interaction Studies

Numerical simulation of intake structure is carried out using open source CFD solvers OpenFOAM® and IHFOAM. The predicted total pressure acting on the structure was validated with the available field data. Furthermore, simulations were carried out for maximum wave conditions and the magnitude of forces acting on the structure were obtained for use in the design procedure. Hydrodynamic measurements collected as part of Full scale experiments are relatively for shorter durations. However, for reliable estimation of extreme wave events through probabilistic approach, wave climate will be required for decades. So, a two stage nested wave model for Lakshadweep Islands was setup with wind as forcing parameter. The model was validated with available offshore wave data measured by data buoy and is showing good agreement. Based on the studies inputs were provided to Indian Road Congress for evolving Guidelines for estimation of Wave loads on Structures.

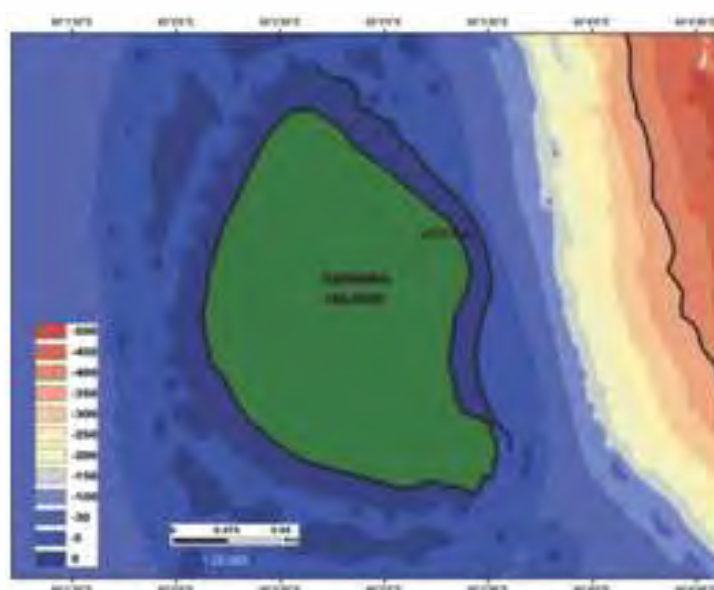
Establishing desalination plants in the Islands

UT Lakshadweep

The improvisation studies conducted in the existing LTTD plants. Along with inputs from improvisation studies design was modified for enhancing the production capacity to 1.5 lakh liter per day in the proposed establishment of LTTD plants in six islands of UT Lakshadweep. Technical guidance is being rendered to UT Lakshadweep administration in the perusal of the proposal the establishment of the plants.

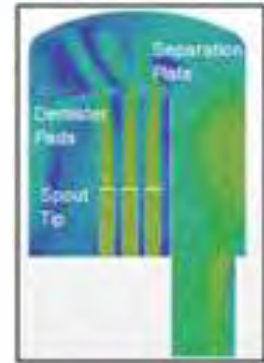
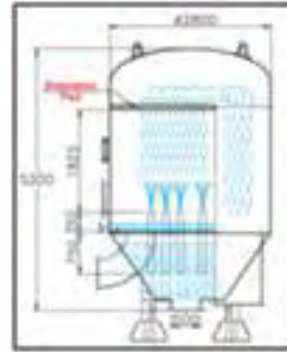
Andaman and Nicobar

The detailed bathymetry survey was conducted to ascertain the length of the pipe and the bridge for establishing LTTD plant in Chowra Island.

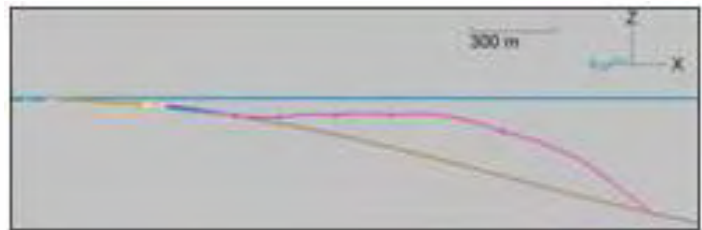


Bathymetry of Chowra Island

The oceanographic data for the design was based on secondary data available. The pipe line analysis indicates that the submarine cold water pipeline to draw cold water is about 2.5 km long and intake structure to draw warm water and cold water be placed at about 6m water depth about 200 m from the coast. A pre-feasibility report for establishment of 1 lakh liters per day capacity LTTD plant at Chowra Island was submitted.



Flash chamber



Deep sea cold water pipe

DEEP SEA TECHNOLOGY



*Missing aircraft AN 32 target verification
using deep water vehicle ROSUB 6000*



*Slurry pumping sea trial from
onboard Sagar Kanya*

DEEP SEA TECHNOLOGY

The mandate of the Deep Sea Technologies group is to develop technology for the exploration and exploitation of deep ocean mineral resources such as poly-metallic manganese nodules, gas hydrates, hydrothermal sulphides; and for other oceanographic, polar and industrial applications.

Missing Indian Air Force aircraft AN 32 target verification using deep water ROV - ROSUB 6000

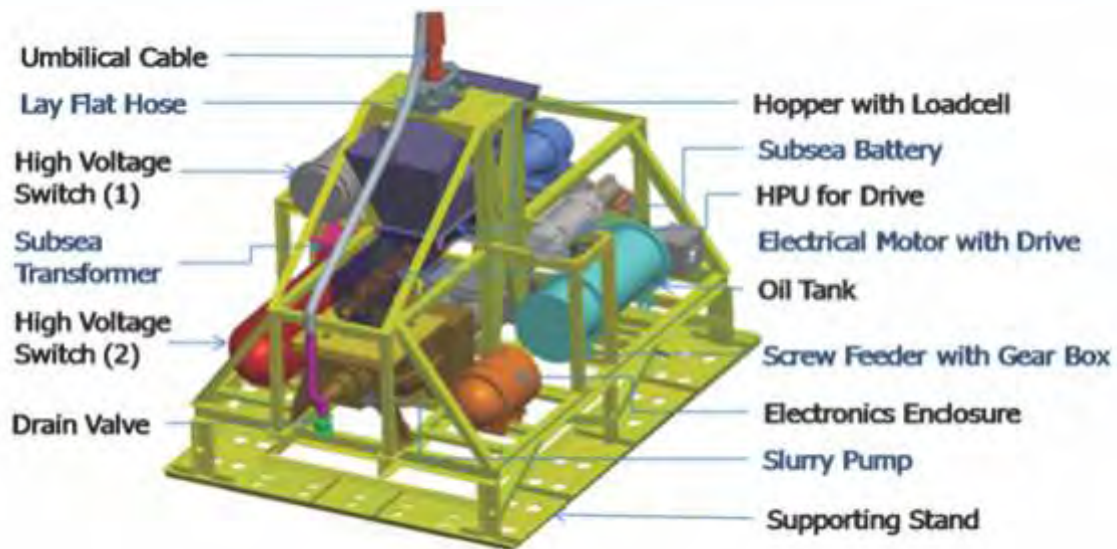
A deep water remotely operated vehicle (ROSUB6000) developed at NIOT for exploration of deep sea minerals was deployed based on the request of Indian Coast Guard onboard Sagar Nidhi for the verification of missing aircraft AN-32 targets in the Bay of Bengal identified by the GSI vessel Samudra Ratnakar and NIOT vessel Sagar Nidhi. Three priority locations were verified at 3400m depth using cameras and sonars fitted to the vehicle (ROSUB6000). A joint team comprising of NIOT, Indian Air force, Indian Navy and Indian Coast Guard participated in the verification of likely targets but no debris of the aircraft was found at these locations.



ROSUB 6000 systems on board Sagar Nidhi and sea floor images

Pump tests and sea trial

Sea trial was conducted onboard ORV Sagar Kanya during August 2016, to assess pulsatile slurry flow behaviour in an actual flexible vertical riser system, with and without crushed natural manganese nodules. A slurry pumping system with riser unit was deployed from the ship to depths of 110 – 250 m. The flexible hose (Φ 100 mm) of the riser was instrumented with a pressure sensor at predetermined locations to record the inline pressure fluctuations.



*(Dimensions – 3.2 x 2.8 x 2.6 m)
Schematic of Pump Frame for Trials*



Pumping trials from onboard Sagar Kanya

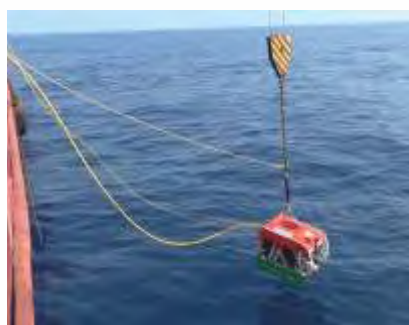
The pumping trials established the following with regard to slurry pumping up a vertical riser with crushed nodules:

- (i) Pulsatile flow with intermittent pumping (with a twin-piston pump) up a vertical riser causes settling of the slurry. The problem gets aggravated severely with kinks/bends in the hose, resulting during deployment. These locations give rise to plugging of the hose and pressure surges.
- (ii) Flow velocities close to 4-5 times or higher of the settling velocity of the largest particle was essential to ensure that heavier particles do not initiate separation and segmentation of the particles. Severe hose choking and hose rupture was observed at even low slurry flows.

- (iii) The particle sizes with a large spread of the sizes were observed to cause settling of the larger particles and a non-uniform slurry flow. There is a need to ensure very narrow particle size distribution for uniform flow up a vertical riser, especially with pulsatile flows.
- (iv) Pumping with crushed manganese nodules was observed to greatly cause deposition and adherence of the fine particles/powder to the hose's internal surface. The rise in the friction factor due to this effect is to be established experimentally.

Bio diversity studies in the Arabian Sea using shallow water / polar remotely operated vehicle (PROVe)

PROVe is an underwater Remotely Operated Vehicle (ROV) designed and developed indigenously for shallow water applications up to 500 m and it is capable of operating in the Polar and open ocean environmental conditions. During March 2017, the PROVe was deployed in the open ocean environment for the first time using MoES research vessel FORV Sagar Sampada by the joint team of NIOT and Centre for Marine Living Research and Ecology (CMLRE), Cochin for carrying out biodiversity investigations in the Arabian Sea off-Mangalore at 40, 96 and 200m water depths. The launching and retrieval of PROVe was carried out with ship based crane and using a quick release lock and latch mechanism. Underwater videography of the sea weed fields and other organisms were recorded. Under water spectral irradiance, salinity, conductivity and water temperature were also recorded using ROV-mounted scientific sensors during the expedition.



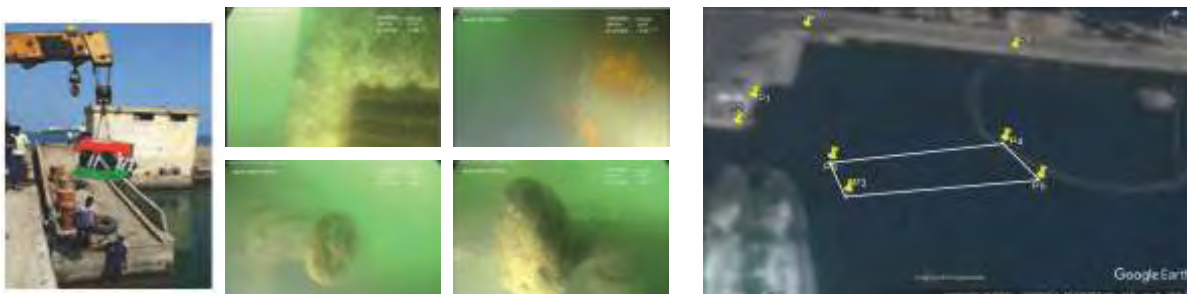
PROVe deployed in Arabian Sea



Underwater images of the seaweed fields

Spatial mapping of the sunken barge using PROVe

In Jan 2017, PROVe was used for carrying out underwater inspection of the barge which sank in the Chennai Port during the Vardah cyclone. The ROV was piloted and the images of the sunken barge were recorded with the aid of the vehicle onboard cameras as shown in the figures. As the visibility was poor in turbid waters, ROV based imaging SONAR was employed to obtain the acoustic image of the barge. Overall spatial mapping of the barge with reference to the jetty was done. Detailed report with coordinates of the sunken barge was submitted to Chennai port for enabling salvage operation.



PROVe launching

Underwater images and spatial mapping

Mining Machine Grouser Optimisation Studies

The sea bed soil at 5000-6000 m water depth at the Central Indian Ocean Basin (CIOB) has very low soil shear strength of less than 2 kPa. The mining machine being developed is a crawler type with twin tracks. The tracks had grousers of involute profile. A reduced experimental undercarriage with involute grousers was developed to experimentally study the sinkage, traction force and locomotion on simulated soft soil conditions in a test tank.



Locomotion Studies with Reduced Under-Carriage

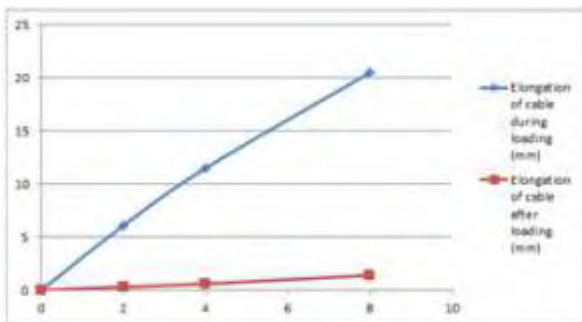
Excessive sinkage and deformation of the soft soil was observed with involute grousers, leading to considerably reduced traction and bulldozing effect from the accumulated frontal soil. Effects of grouser shape-geometry, height and pitch were thus analyzed numerically and experimentally on a given contact area and length for the maximum traction with minimal sinkage. Grouser shapes of involute, wedge and pin types were studied.



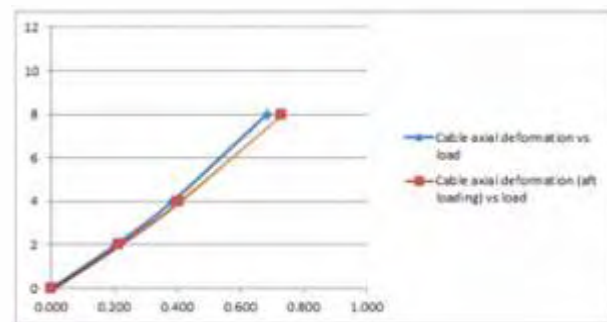
Locomotion Trials with Pin-type Grouser

Assessment of Umbilical Cable under Loading Conditions

Experimental study of effect of suspended loads on electro-optic umbilical cable were undertaken i.e. the effect on the fibre-optic line and the power conductors. The umbilical was loaded statically with known dummy weights up to 12 ton (in steps of 2 tons).



Cable load vs elongation



Cable axial deformation vs load

The power conductor yield was observed to initiate at about 10 t static load, recorded by change in cable resistance. The umbilical failed at about 12.5 t. Losses in the fibre optic was not recorded till the cable failure.

Deep Sea Riser System - Clamping of Riser Hose with Umbilical

Clamping of the flexible hose to the umbilical is very critical in ensuring that the deployment enables hose without kinking and bends. Bends and kinks in the hose leads to choking and plugging due to settling of the slurry flow and excessive pumping pressures. Unlike rigid pipes or non-collapsible flexible pipes, lay flat hoses without strapping loops make it extremely difficult to fasten them to the umbilical. The high pressure slurry hose being used has no provision for fastening and strapping of the hose was understood to adversely affect the hose strength. Consequently under slurry load, the flexible hose slips

down due to self-weight. To avoid this problem, various fastening approaches were studied, also ensuring that the time taken was minimal keeping in mind the required deployment of over 5500 m length.

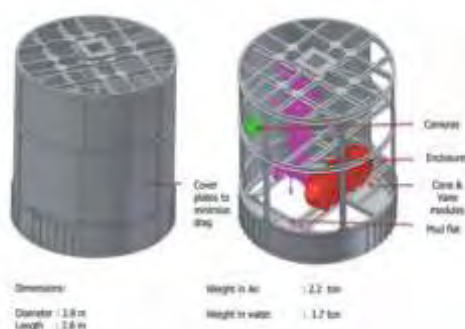
Development of Augmented In-situ Soil Tester (IST)

Information about the sea bed soil properties and prevailing conditions is essential to optimise the design of the Mining Machine and to plan the locations for the mining campaign. An in-situ soil tester (IST) had been developed to estimate the soft soil strength of the sea bed at the First Generation Mining Site as shown in the figures. The same had been deployed earlier successfully to a depth of 5462 m at CIOB. The system has since been augmented to assess the nodule abundance of the area and also to assess the soil response when subjected to a steady vibratory load (as would be the case when the high capacity pumps are used). Besides, the IST was also equipped to collect soft soil cores for tests and comparison of the data on the surface.



In-situ Soil Tester Deployment

An Autonomous Battery operated In-situ soil tester for 6000 m depth operation is also being developed at NIOT for sea bed soil characterization. This new soil tester would have much reduced weight and would not require an umbilical cable for handling the system. The system is configured for handling with rated capacity rope and is fully operable with sub-sea batteries. The soil parameters measured along with system parameters can be stored locally offline and can be retrieved later for analysis. The system can operate for 8 hrs duration.



Battery operated In-situ Soil Tester

Readiness of Experimental Under-Carriage for Sea Trials

Locomotion trials of an Experimental Under-Carriage (EUC) has been planned to be undertaken at the CIOB on the actual soft sea bed soil conditions to validate the efficacy of the designed track system. The EUC was built-up and tested with complete system in readiness for deployment for sea trials. Sea trials are planned at shallow water depths up to 1000 m prior deployment at the CIOB, with intensive instrumentation for traction forces, cable drag, vehicle attitude underwater and sinkage-pull out issues with regard to soft soil.



Experimental Under-Carriage

Manned Submersible

In-house developments are in progress for the manned submersible personnel sphere with view ports and entry hatch, life support system, power budget estimation, underwater battery system design etc. A mock up personal sphere of 2.1m diameter is realized. The acrylic view ports are designed, fabricated and tested in the hyperbaric chamber for 600 bar pressure withstand capability. In the design of the view ports and flanges by tension triangle method is found to offer considerable stress reduction at the corners, enabling increased the number of operating cycles.



Mockup Human Sphere



Acrylic view ports and flanges



Inter institutional R&D projects (PMN) (XII plan)

The need for carrying out basic research and familiarizing deep-sea mining activities with the universities and associated R&D institutes was felt essential. A few institutes have been identified and research proposals initiated.

Soil- Machine Interaction Studies on Deep Sea-bed Poly-metallic Nodule Mining Systems

The project deals with studying the interaction of soil-collector and hydrodynamic resistances encountered during mining operations. Laboratory facility has been developed at Anna University under inter-institutional R&D. Testing of the pick-up-collector system is planned to commence shortly.



Soft Soil Simulating Bentonite Trial Bed

Development of high strength to weight ratio materials for the body of unmanned underwater vehicle

A project on development of high strength to weight ratio materials for the body of unmanned underwater vehicle was taken up with IIT Kharagpur. The work aims at developing metal matrix nano composites (MMNC) materials. Al-5083 castings with infused alumina nano particles have been completed to lab scale and the resultant material has been observed to have superior properties as compared to the base metal. The project has been completed.

Dynamic analysis of deep sea polymetallic nodule mining crawler for enhanced speeds in soft soils

A project on kinematic and dynamic analysis of different configurations of undercarriage including various grouser shapes for increased locomotion speed has been taken up with IITM Chennai. Mathematical modelling and experimental study has been undertaken to develop the characteristic property curve of soft soil when worked upon. The project has been completed.

Manganese Nodule Slurry characterization and pumping study for vertical transport

A project to study the slurry flow up a vertically mounted hose with crushed manganese nodules and the flow characterisation was undertaken with IMMT, Bhubaneswar. The study envisaged estimating the pressure drops and slurry flow behaviour in continuous and pulsating flows, up a vertical pipe-hose. The project has been completed.



Vertical Riser Test Setup

Evaluation of design parameters for dewatering of manganese nodules

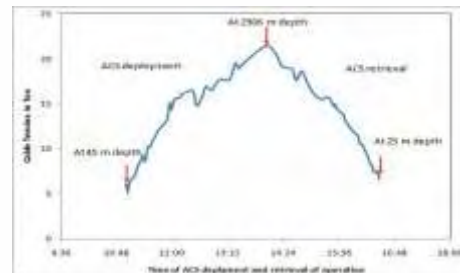
A project to evaluate the development of dewatering and separation systems of the crushed nodules from the slurry pumped up has been undertaken with IMMT, Bhubaneswar. The aim is to study different separation mechanisms and systems, so as to develop a suitable compact system, that can be installed onboard a ship in continuous slurry operation. The project is currently in progress..

Gas Hydrates

Under the Gas Hydrate program, development of exploration tools and extraction feasibility studies of gas hydrate with reference marine gas hydrate reservoir settings of India are carried out. An Autonomous Coring System (ACS) capable of collecting 100m core from deep ocean basins with wire-line technology has been developed was qualified for its integrated functionality at about 3000 m water depth successfully during Sep - Oct 2016. The functionality qualification at 3000m water depth includes underwater hydraulic valves for subs system operations using rate and proportional manifolds, subs sea power system, electronics, control software, sensor, luminaries and cameras.



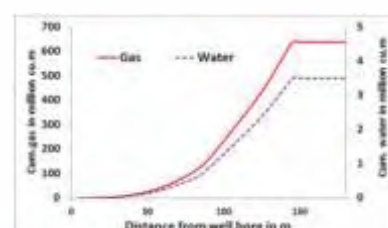
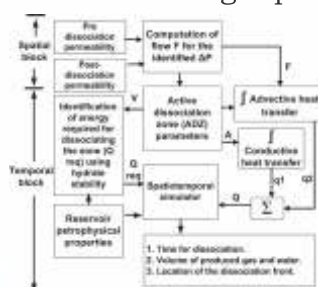
View of the ACS onboard Sagar Nidhi



Launching and recovery profile

Extraction of methane from the Gas Hydrates reservoirs in Indian continental margins

The group is involved in developing technology for the extraction of methane from the Gas Hydrates reservoirs in Indian continental margins. A numerical coupled spatio-temporal depressurization model (STDM) is developed using MATLAB software. With the petrophysical reservoir properties in the Krishna-Godavari basin reservoir as inputs, simulations were performed using STDM and gas hydrate reservoir modelling software TOUGH + HYDRATE to identify the productivity of a vertical well in the KG basin 10 D location. It is found that a well could have a lateral reach up to 145m and last for 1.5 years with a cumulative methane gas production of 650 million m³.



Spatio temporal depressurization model architecture and results of a well in KG basin

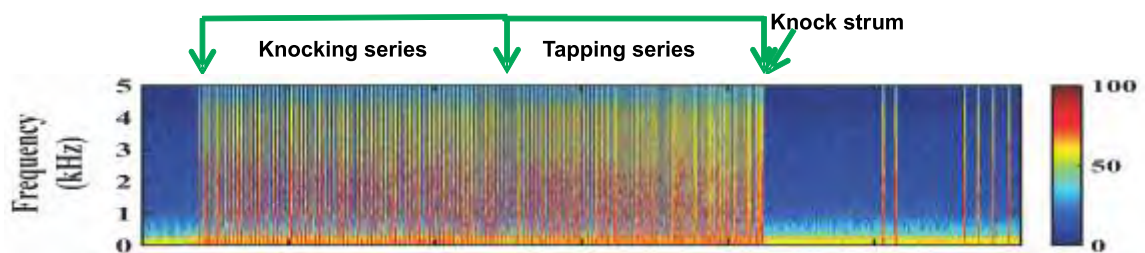
OCEAN ACOUSTICS & MODELING



Deployment of Ambient noise sytem in the Arctic



Data collection near the ice glacier melting location



long ks--fast ts--k-strum

OCEAN ACOUSTICS & MODELING

The Ocean Acoustics programme is focussed on establishing ambient noise measurement stations along the Indian coast, long term ambient noise measurements in Arctic regions, noise characterisation including bioacoustics, geoacoustics, rainfall estimation, development of vector sensor arrays for source localization, sound propagation modelling, underwater acoustic communication systems and upgradation of Acoustic Test Facility (ATF).

Establishment of ambient noise stations along the east and west coast of India:

INSAT communication for Ambient noise system-Ambient Noise Measurement System (ANMS) with 21 element array was incorporated with INSAT communication system and laboratory tests were conducted. Subsequently sea trial was conducted off Chennai by deploying the system in shallow waters at 16 m depth. Position monitoring parameters were transmitted in real time through INSAT.



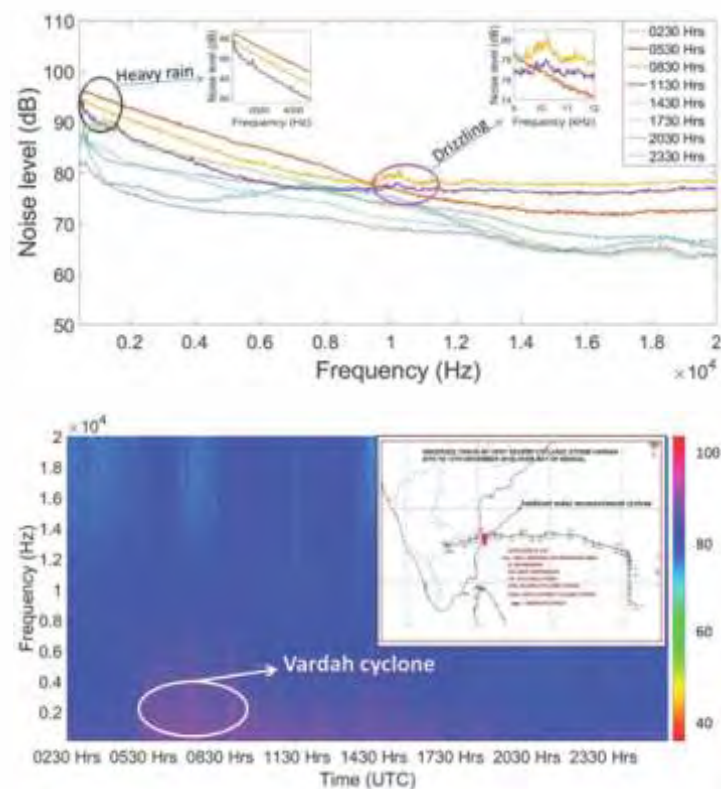
ANMS (with INSAT communication) deployment off Chennai during March 2016

Then on 1st December 2016 the ambient noise measurement system (ANMS) with 21 element array and associated data acquisition modules with INSAT communication was deployed off Chennai at 17 m depth. The system withstood the severe Cyclonic storm VARDAH that crossed Chennai on 12th December 2016 and was transmitting in real time. The entire system was retrieved on 15th December with 15 days of time series measurements. Weather parameters were measured by a buoy deployed by the OOS group of NIOT, closure to the site.

Ambient noise measurements off Chennai during very severe cyclonic storm Vardah

The cyclone Vardah crossed Chennai, in the afternoon hours of December 12, 2016, and dissipated on 13th December 2016. The maximum wind speed was recorded as 27m/s

during cyclone landfall. The total cumulative rainfall was observed as 150mm. The noise data sets were analysed and power spectra pertaining to high winds and rain during cyclone event have been estimated. During the cyclone and storm conditions, ambient noise level was observed to have increased by 5-10 dB from normal values in the band less than 10 kHz.



Noise Spectrum and Spectrogram during Vardah Cyclone

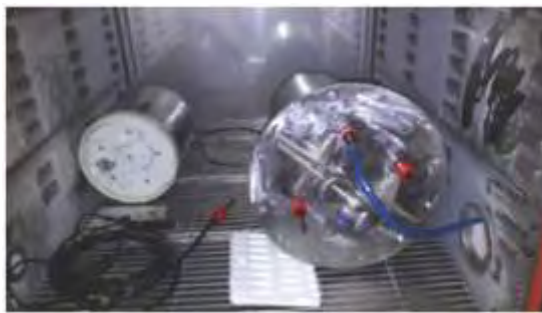
Polar ambient noise measurements - Ambient Noise Measurements in the Arctic Region, Kongsfjordem.

The Ambient Noise Measurement System (ANMS) deployed in the Arctic along with IndArc 2 mooring in July 2015 was retrieved on 28th July 2016, with 280 days of noise time series measurements. Further, a new ANMS was deployed along with IndArc 3 on 29th July 2016. The new system has two hydrophones capable of acquiring 3 mins data hourly. The qualification of the system for deployment in Arctic was performed by conducting the following tests.

- The Data Acquisition Enclosure of the system was subjected to pressure testing in hyperbaric chamber.
- The hydrophones, enclosure and the battery casing was tested in the Environmental chamber for checking performance of the components at subzero temperature. System tested till -4°C .



System retrieval in the Arctic



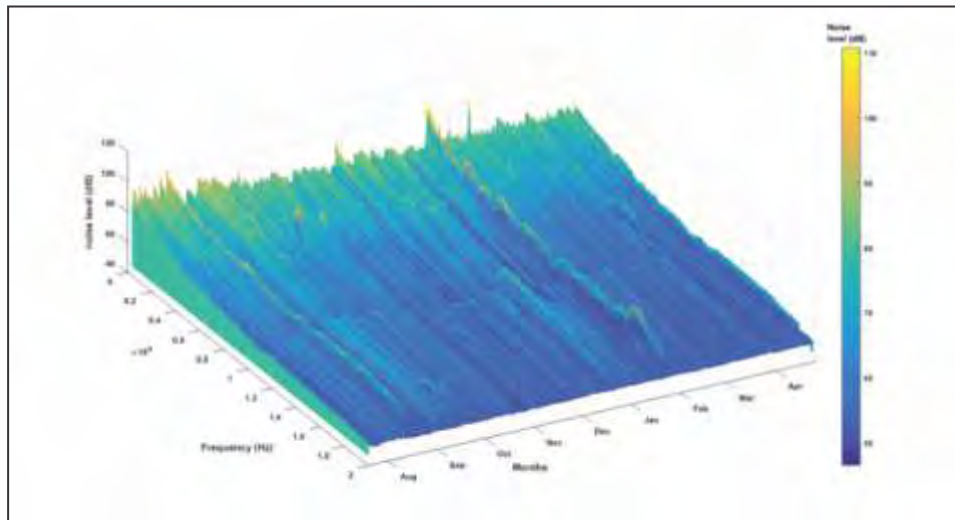
ANMS testing in the Environmental Chamber of NIOT

Arctic Data Analysis

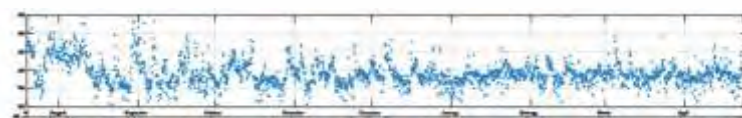
Noise due to ice dynamics: The soundscape of the Kongsfjorden has been studied. Signatures of ice dynamics have been identified to analyse the Iceberg calving, bobbing and blooping events.

Noise Variability

Variability in ambient noise levels during open water and ice covered condition is examined. The ambient noise in the Arctic depends on the nature of ice (whether continuous, moving, broken or shore fast), temperature, speed of sound and the speed of wind. The measurement period is from July 2015 to April 2016. In measurements obtained, months with open water comes first, slowly ice picks up and then the noise level gradually comes down. August-September are the months when the extent of sea ice is the lowest in Arctic. It is observed that the noise levels are highest during this period.



Spectrum during the measurement period



Variation in noise level for 1 kHz during the period July 2015 to April 2016

Iceberg calving noise

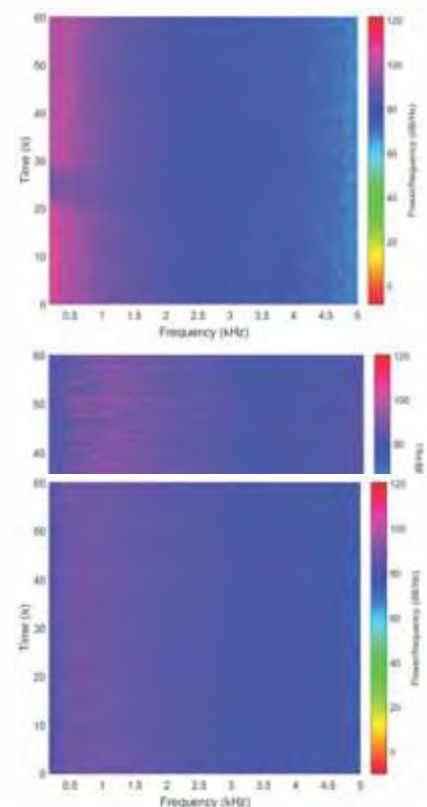
Large Ice chunk breaking noise falls in the frequency band 100 Hz to 500 Hz from edge of glacier produce noise. Ice calving ambient noise level increases by 10-20 dB from normal value.

Iceberg bubbling noise

Melting blocks of icebergs create ambient noise and is typically due to the leakage of gas bubbles that are freed by melting. This fall is in the band 500 Hz to 3 kHz.

Iceberg bobbing and blooping noise

Noise having bursts of a few milli-seconds originated by the rubbing and bouncing of ice masses, fall in the frequency band 200-1000 Hz. These are produced by ice quakes in the large icebergs, or large icebergs scraping the ocean bed. The frequency of sound created from the bobbing of ice ranges from 100 Hz - 2 kHz.

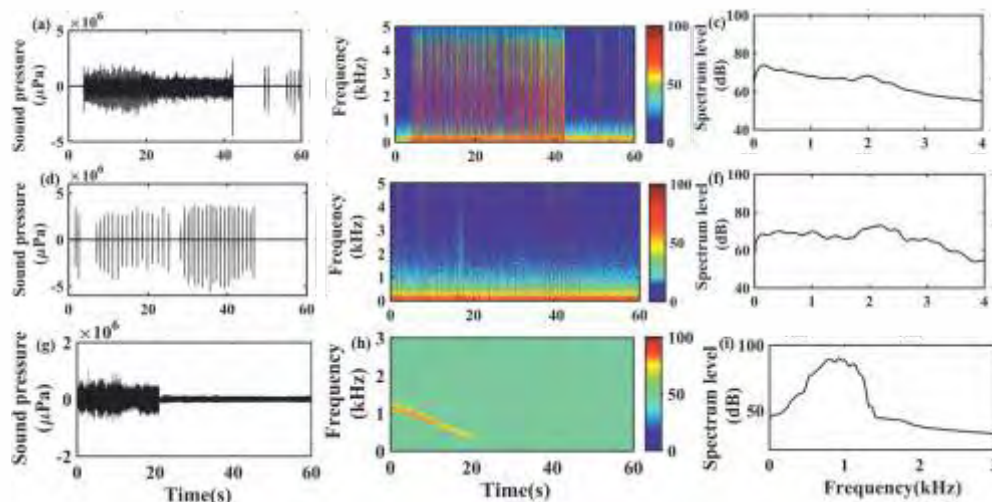


Iceberg calving noise

Bioacoustics

Noise are generated by Walrus occur during January to April with the peak in the month on February, whereas bearded seal vocalizations occur during the month of April. Male Walrus produces different patterns of sounds including knocking series containing higher energy and lower repetition rate, and tapping series with less intense and quick repetition. In the time series data two song types such as diving vocalizations songs and surface coda songs have been recorded.

Bearded seal produces trilling sound composed of long tumble vocalization with a initial frequency around 1.2 kHz and descending in steps to an end frequency of around 0.35 kHz with the noise spectrum level of ~90 dB re 1 μ Pa. The vocalization is longer in duration around 22 s. Their vocalizations are associated with sea ice concentration.



Waveform, spectrogram and noise spectrum level of walrus and bearded seal vocalizations.

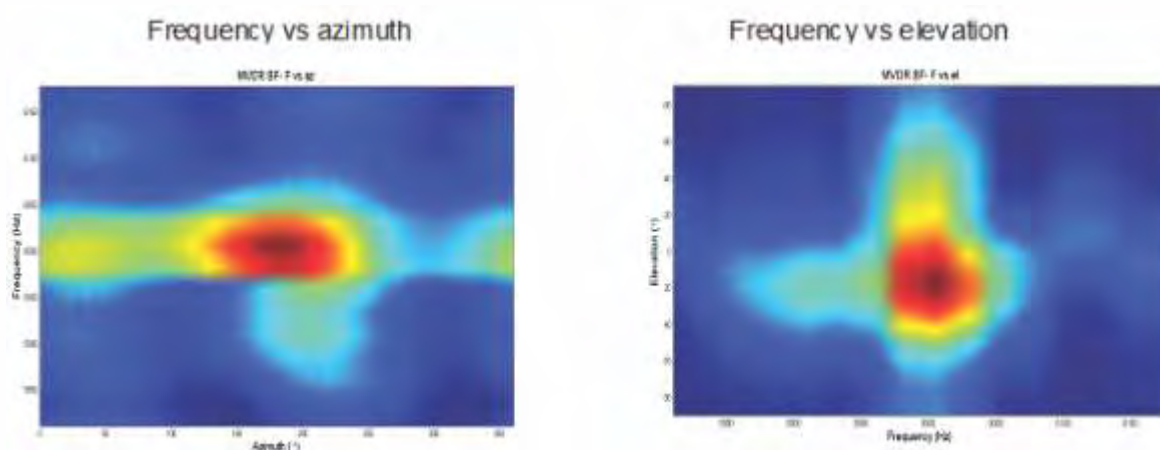
Seabed classification/characterization using underwater acoustics: Seabed characterization based on Directionality/Reflection loss using 21 element array data

Stabel vertical directionality and reflection loss pattern for a shallow environment off Chennai is used for characterizing the seabed. The loss gives an estimate of the reflectivity of the seabed. Main features are low loss upto a critical angle and three interference lobes beyond this. Ambient noise inverted bottom loss for the array's design frequency of 10 kHz is 2 to 2.5 dB. For characterization, the measured reflection loss pattern is compared with the theoretically estimated pattern.

Development of Vector Sensor Array (VSA) for Underwater Source localization and signal estimation

A three element vector sensor array was deployed off Chennai and tested for active measurement. Testing has been carried out to find the Direction of Arrival (DoA) of acoustic signal at different ranges and at different orientations. In this shallow water field trial the VSA was positioned stationary at the seabed and the acoustic source was transmitted from different locations. A burst signal of 1 kHz to 6kHz was used for a range of 100m to 450m from the VSA. Data was collected using a high sampling data acquisition system for a period of 10seconds. DoA estimation has been successfully carried out.

After active measurement testing, VSA was deployed in the open ocean at 17m depth for a period of two weeks in September 2016 to collect the ambient noise and the system was successfully retrieved.



DoA estimation from active measurement data using MVDR beamforming

Acoustic Test Facility

Revamping of the Acoustic Transducer Positioning System (ATPS) including hardware and software has been taken up.

- Positioning control system for long and cross travel (X & Y axes) for two numbers of trolleys.
- Total revamping of hydraulic system (Z-axis) with rotation control over 360 degrees.
- Total control of 3 axes (X, Y and Z) from PC as well as HMI.

Tender has been floated and a technical evaluation committee has been formed for evaluating the bids.

Automated instrument calibration using LabVIEW

As part of up-gradation, instrument calibration is automated using LabVIEW. Manual calibration of instruments such as filters, pre-amplifiers, waveform generators and

multimeters requires a lot of time and effort. The developed system will perform a predefined calibration procedure in a sequential manner which will subsequently reduce human effort and save a lot of time. This also reduces human errors which occur during manual measurements. GPIB/USB/Serial communication is used to control the instruments and also for data transfer.

Development of Underwater Acoustic Communication System based on Time Reversal Mirror (TRM)- Phase II (with IIT Delhi)

In order to develop a real time underwater acoustic communication system using TRM, Channel estimation and Frequency Synchronisation have been carried out.

The task of Channel estimation is accomplished in three ways; viz Fourier Transform (FT) Based Method (This technique is easier to implement, but it is severely affected by noise), Least Mean Square (LMS) Based Method, and Correlation Based Method.

Development of a passive acoustic technique to analyze fish sound data recorded at laboratory and shallow water sites (with NIO Goa)

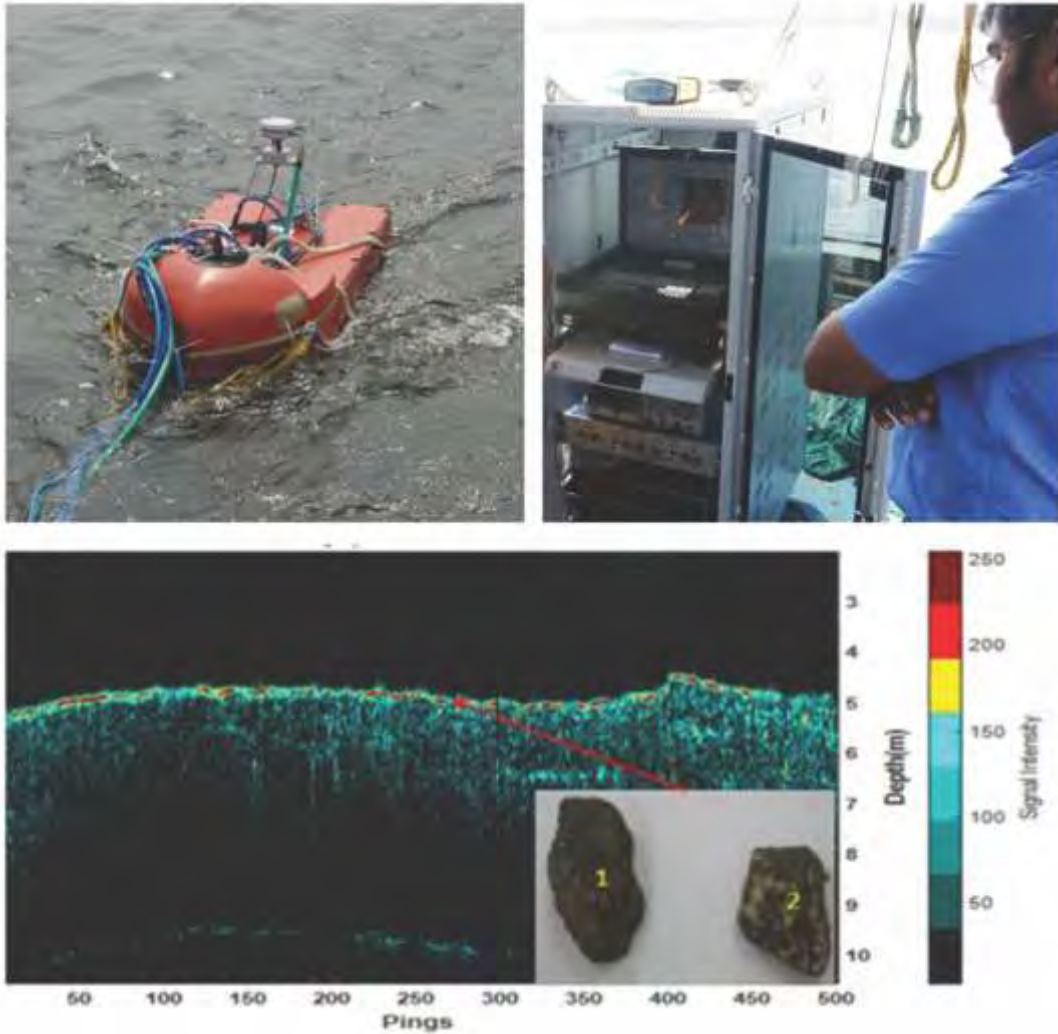
The work focuses on the development of a technique for passive acoustic recorded fish sound data under laboratory conditions to utilize as a template data for validating acquired fish sound data from shallow water sites. To achieve this, passive acoustic data from Malvan, Ratnagiri area were acquired. Also, processed and interpreted fish data from Kavaratti lagoon; Lakshwadeep acquired using single hydrophone and photographic data. Fish data segmentation technique from fish mixed sound data by the use of signal processing technique through fractal technique to obtain peak frequency is adopted.

The fishes identified are Sapphire Damselfish, Indo-Pacific Sergeant, Goatfish, powder blue surgeon, Peacock grouper.

Investigation of acoustic propagation in the presence of internal waves across shallow waters of Northern Bay of Bengal (with IIT Madras)

The joint field experiment on shallow water acoustic transmission/reception was carried out by NIOT and IIT Madras off Chennai coast in shallow waters at 20m depth. In this experiment, a source of 1kHz was used for transmission and the receiver was mounted at 10m depth on a mooring. The source was kept a 10m depth at different distances from the receiver mooring, i.e., 2km, 5 km, 7km and 10km. The signal levels recorded at the receiver were compared with the source levels. The maximum TL was analysed and the results made it apparent that there was significant bottom interaction. The source levels recorded suggested that the projector was transmitting at close to its maximum power (190 dB).

MARINE SENSORS SYSTEMS



***Indigenously developed Buried
Object Detection Sonar for shallow water applications***

MARINE SENSORS SYSTEMS

Group has a mandate to develop marine sensor systems for ocean application with following major objectives

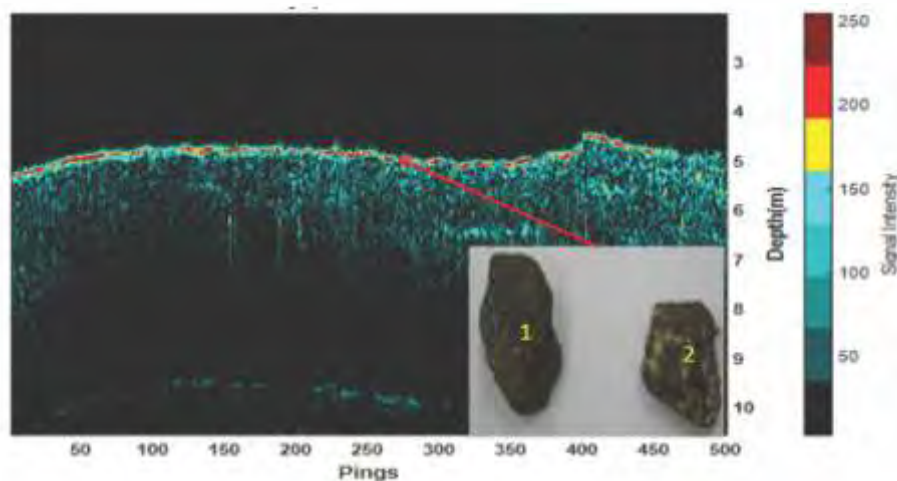
- To develop sophisticated underwater sensor technologies and systems for marine applications
- To establish a facility of excellence in order to provide electronic support for the various activities and projects of NIOT
- To create infrastructure for reducing the development time and facilitate rapid prototyping

Development of Buried Object Scanning/detection Sonar (BOSS) - Design modifications

BOSS system was realized with standard bench top sub system and entire system is integrated in a rack for easy operation. The system is upgraded with DGPS and better geo reference. The position data from DGPS and the hydrophone data input are synchronized for signal processing.

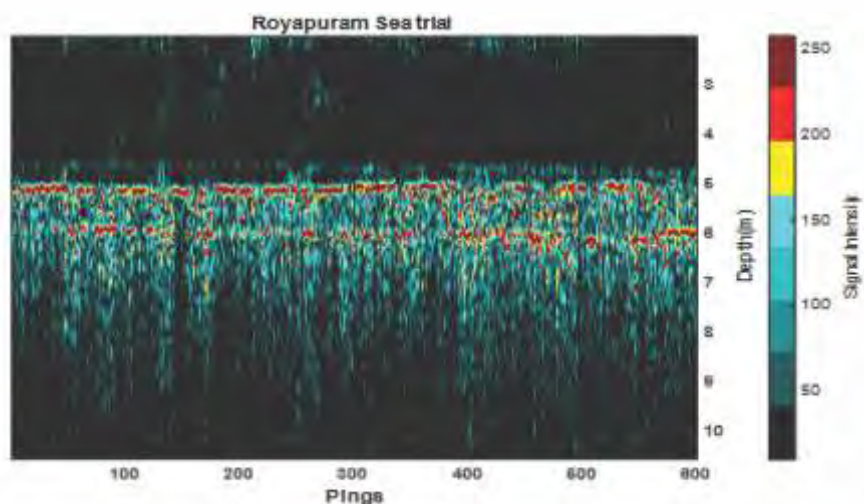
Sea trials:

Harbour trials were carried out with the upgraded system at Royapuram harbor, Off Chennai. The system detected several naturally buried objects and confirmed their physical presence by a diver. Two stones of dimension 24x10cm and 18x10cm were retrieved from test site. The frequency of operation was 2-24 kHz and number of pings was 8 pings/s. Towed body was towed at 1 knot over the object.



Naturally buried stones detected by the system

At some locations, Buried Object Sonar system identified multiple layers as shown in the figure, reconfirming the results obtained in earlier sea trials before flood. Observed sea bed penetration was more than 1.5m at the study site.



Multiple sea bed layers identified by the system

Development of BOSS stand-alone system

Currently the system has been realized with all the subsystems except signal processing unit. AC-DC converter was incorporated in the tow body of BOSS. For this, subsystems are developed in modular miniaturized forms to accommodate in the electronic enclosures.

- i. A custom built signal generator and receiver card was designed and fabricated for the standalone system. The card can generate arbitrary wave forms with windowing at the selectable frequency range in the 2-24 kHz with required pulse duration. The card is designed to generate 1-10 pings/s. Also it can receive data from 32 channel hydrophone arrays, packetize the data and transfer over Ethernet to the deck side signal processing unit for further processing. The data acquisition duration is also variable from 10ms to 50ms as per depth of operation. The card also has two RS 232 interfaces for DGPS and motion sensor interface. These data can be send over Ethernet as UDP packets. The lab tests of the card for sonar signal generation and signal reception from 32 channels, interfacing of the card with the sonar signal processing unit for real time processing are successfully carried out.



Sonar Signal Generator and Receiver Card

- ii. In order to remotely configure and operate the system from deck, front end GUI was developed. The sonar parameters like transmitting signal, frequency range, pulse duration, ping rate, data acquisition duration, etc. are made remotely configurable through GUI. The remote configuration and operation of the signal generator and receiver card through the GUI is successfully tested in the lab.
- iii. In order to develop the stand alone BOSS system, sub systems assembly plan in the tow body has been made and heat transfer analysis of the electronic enclosure in the tow body also carried out. The enclosure has been designed in-house and the assembly plan is in such a way that it can transfer theoretically 186 W, which is well above the generated heat of 125 W by the sub system.

Utilization of Electronic Support Facilities

All the commissioned electronic support facilities, established by the group were effectively used for quality control tests of subsystems developed by different groups of NIOT. Shock and Vibration test facility damaged during the deluge is rectified and made operational.

OCEAN ELECTRONICS



AUPD



Drifter Buoy



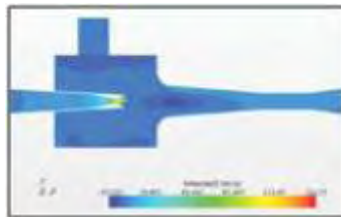
Deep Sea AUPD



'C' - Profiler



Submerged Fish Cage



Water Ejector



Acoustic Modem

OCEAN ELECTRONICS

Ocean Electronics group is concentrating on Design, Development and Demonstration of different types of Autonomous Observation systems for oceanographic applications. Presently the group is involved in the development of Deep Sea Autonomous Underwater Profiling Drifter (DAUPD), Drifter buoys, Acoustic Modem, Open sea Automatic Submerged Fish cage Technologies, Wireless based expendable CTD & 'C' Profiler etc.

Deep Sea Autonomous Underwater Profiling Drifter

AUPD Technology was developed and transferred to Indian Industry. Deep Sea Autonomous Underwater Profiling Drifter (DAUPD) for low density Bay of Bengal and facility to add additional payloads is under development. The first prototype system with high capacity variable buoyancy engine (1000 cc) for 500 m depth is realized and pressure tested in laboratory. Control electronics design & development and system assembly & integration is completed and qualification tests are in progress. Sea trial of first prototype system is planned shortly.



DAUPD

Pradyu – Development of Drifter Buoy with INSAT Communication

NIOT has completed the indigenization of drifting buoys (DB) with INSAT communication. This technology is transferred to two Indian industries and trial production of 20 units was completed. 11 units were deployed and performance is being analysed. The data is published in reputed journals. Implementation of accelerometer based wave measurement scheme in drifting buoy is under progress and field trials being carried out.



SST mounted in drifting buoy (Pradyu)



NTC Thermistor Sensor Capsule

Depth Sensor Capsule

Subsurface temperature measurement string

Open sea Rigid type Submerged Fish cage technologies

a) Spar Rigid Type Submerged fish cage

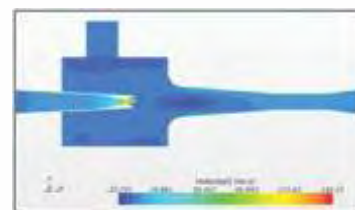
The group has designed and demonstrated open sea Spar rigid type submerged fish cage for Marine Biotechnology Group, who are planning for deploying rigid type cages to withstand the higher sea state conditions. The concept of submerge the cages during the adverse sea conditions is the recent advancement in the sea farming to safeguard the cages as well as the live stock during harsh climatic conditions. The above system contains a spar rigid type fish cage and an electronics unit which makes the cage system always submerged to a desired depth of 10-12m which protects fish from adverse weather condition and manual intervention. The prototype system consists of an octagon frame connected to central spar cylinder with variable ballast, fish net, submersible pump, HDPE floats attached to the system and control station. The variable ballast central spar is used to change the buoyancy of the system using both hydro and pneumatic system (hybrid system design) so that the fish cage can either be surfaced or submerged. System design is a unique one having hybrid for the buoyancy control and it is deployed in Andaman Island and performance is being monitored.



Spar rigid type submerged cage deployed in Andaman

b) Water ejector based feeder system for submerged cage

A suitable feeder system for the submerged cage at the depth 10-12m in open sea was designed in-house. The submerged feeder operates on the principle of Venturi Nozzle and theory of jets where high speed (i.e. with kinetic energy) fluid is sent into the ejector through nozzle and the fluid speed increases because of diminishing section. According to Bernoulli's principles, when speed increases, there will be decrease in static pressure (i.e. Vacuum at the suction) along the fluid boundaries. Consecutively, this leads to the entrainment and mixing of second fluid with main motive /working fluid (i.e. seawater) supplied through the nozzle utilizing the vacuum created by the system without any vacuum



Ansys Analysis for water ejector

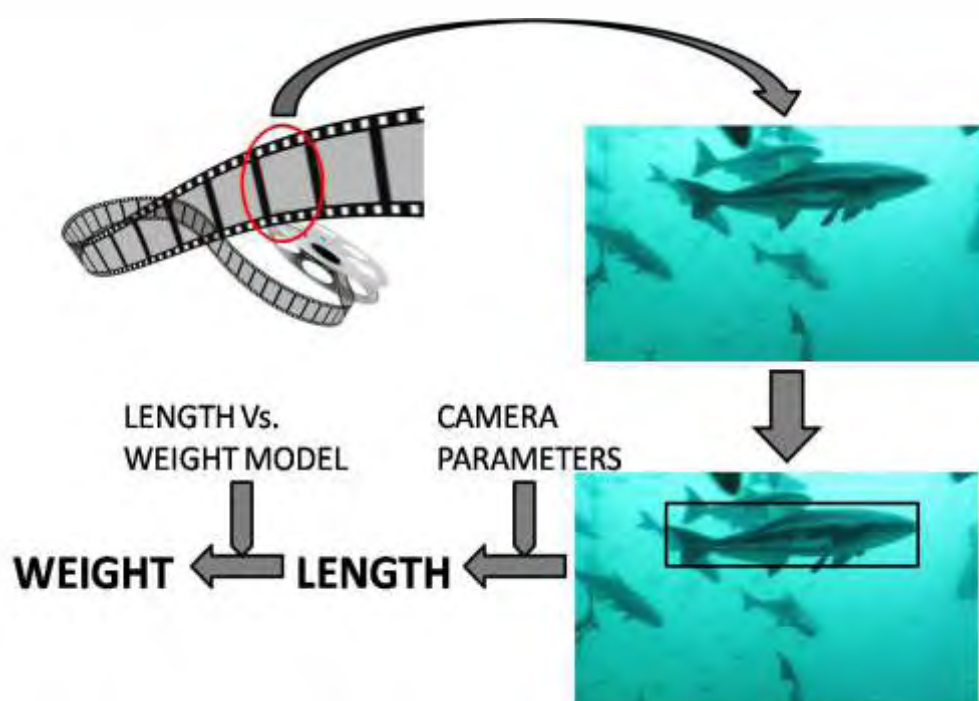


Water ejector

engine. This gives the possibility to add other materials to the water streams to mix and carry forward to any system. This design has been tested during the sea trial at Andaman during March 2017.

c) Fish Biomass Estimation

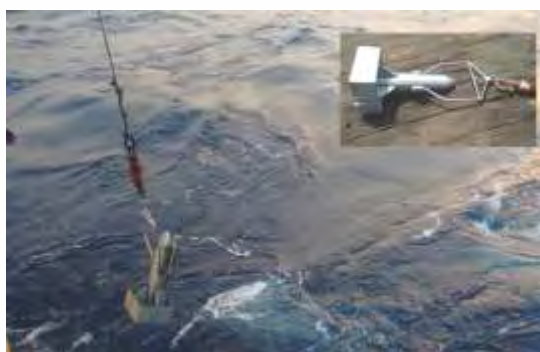
A vital input to Fish Farming in open sea cages is the feedback provided by analysing the growth of the fishes inside the cage. This will serve as a critical input in analysis of fish growth statistics as well as in deciding upon the quality, quantity and constitution of feed required at all stages. The design is of non-invasive method for estimating the weight of the fish cultured (Cobia, *Rachycentron canadum*) using a single video camera set-up. The approach is to estimate the total length of fish from video captured image and using the total length vs. weight model for Cobia to estimate its corresponding weight. The calibration of camera was carried out to estimate its parameters and the laboratory tests results shown an average error in the range of 9 – 13% for objects of length varying between 8 cm to 1m. The field trial is in progress.



General Architecture for bio-mass estimation

C-Profiler

The group is involved in the development of C-Profiler to measure real time CTD data from ships/boats on the move. C-profiler consists of a tow fish which is tethered to the ship by an EM Cable and does the basic 'tow-yo' type of shallow water profiling using a Winch onboard without stopping the ship. System can be controlled remotely, anywhere from the ship; also change of different sensor heads on deck enables observation of various other ocean parameters without extra profiler. Tow fish design and fabrication is completed and it was taken for a sea trial to estimate the maximum load on the winch. Further experiments are planned once the winch is procured & installed.



C-Profiler during sea trial

Wireless based Expendable CTD (WXCTD)

For upper ocean thermal profile observations and to provide appropriate in situ data for testing ocean and ocean-atmosphere models, the group is involved in the development of Wireless Expendable CTD. This compact unit measures sea water temperature up to 500m depth and transmits wirelessly using Zig Bee communication to the ship avoiding the use of wire rope and winch for such measurements. Presently 4 system of WXCTD has been



WXBT in lab and during sea trial



fabricated, lab tested for communication and reliability. This system has unique feature incorporating miniature pressure sensor for depth versus temperature/salinity profile in good accuracy compared to other system available in market presently.

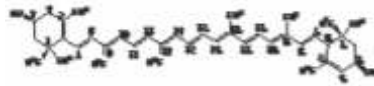
Acoustic Modem for Underwater Communication

Orthogonal Frequency Division Multiplexing (OFDM) based communication scheme has been developed. The system is further enhanced with Doppler correction algorithm to minimise the error due to Doppler shift and the performance of the system is improved with Viterbi decoding Technique and convolution coding. Now Implementation & evaluation of Advanced FEC coding technique is in progress.

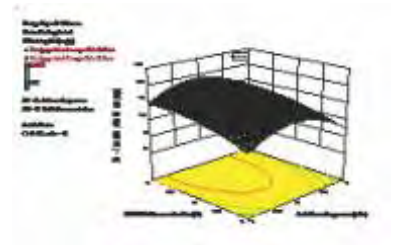
OCEAN SCIENCE AND TECHNOLOGY FOR ISLANDS



Red and Brown algal oil extracted from spent biomass



All-E-(3R, 3R, 6R)-Lutein extracted from Chlorella vulgaris



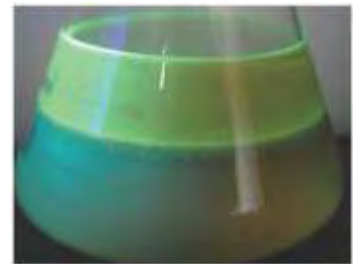
RSM for Microwave-assisted extraction



Isolate of Deep sea bacteria isolated from 2000 m depth



Three dimensional structure prediction analysis of ectA protein



Fluorescent secondary metabolite extracted from deep sea bacteria



A portion of harvested fish prior to auctioning



Prototype Submersible Cage testing at Port Blair



Part of cobia fish harvest from Open sea cage at Thupilipalem

OCEAN SCIENCE AND TECHNOLOGY FOR ISLANDS

Ocean Science and Technology for Islands (OSTI) is primarily focusing on three major activities viz. Marine Algal Biotechnology, Marine Microbial Biotechnology, Open Sea Cage Culture and Ballast Water Treatment Technologies – Test Facility with the following objectives:

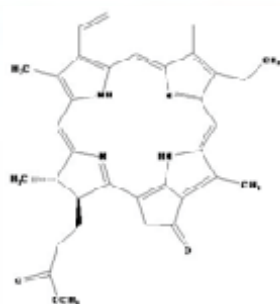
- Development of mass culture, harvesting, dewatering and extraction techniques for the production of nutraceuticals from marine microalgae.
- Isolation, culture, extraction, purification and characterization of novel secondary metabolites from marine microbes including deep sea microbes for environmental and biomedical applications.
- Design, development and testing of sea cages suitable for Indian seas, and demonstration of marine finfish farming in open sea cages.
- Establishment of land-based Ballast Water Treatment Technologies – Test Facility for testing and validation of ballast water treatment systems.

Microalgal biotechnology

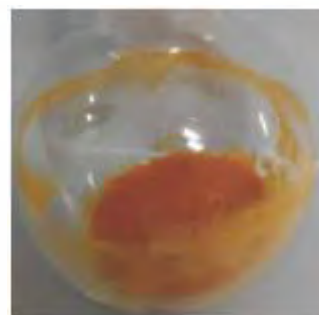
Marine algal research includes development of viable technology for the production of high value nutraceuticals and biolipids from marine micro and macroalgae. In this regard, bio-prospecting of *Chlorella vulgaris* for multiple products has been attempted and a process for production of pharmacoactive growth promoter (possessing significant number of pharmacologically vital proteins with high nutritional value, thermostability and promising effect against central nervous system depression) from the wet biomass of *Chlorella vulgaris* has been developed and filed for patent. Algal PUFA-1 (Red oil) and PUFA-2 (Brown oil) exhibiting 84.5% mortality at 10 µg/mL and 88% mortality at 25 µg/mL, respectively, in human strains of *Mycobacterium tuberculosis* and a chlorophyll derivative (methyl pyropheophorbide-a, that finds major application in photodynamic therapy) has been successfully isolated from the spent biomass of *C. vulgaris*. Pharmaceutically important carotenoids, lutein (All-trans) and its geometrical isomers, such as 9Z-lutein and 13Z-lutein, were isolated in pure form from the spent biomass of *C. vulgaris*. Extraction of lutein from *Chlorella sorokiniana* biomass was optimized and maximum lutein yield of 20.69 ± 1.2 mg/g was obtained at a time of exposure of 2 min, solid:liquid ratio of 1:45 and alkali concentration of 8 M. Mass culture of marine diatom *Amphiprora paludosa* with potential as commercial fertilizers has been optimized and high yield of fucoxanthin (14.41 mg/L), a pharmaceutically important carotenoid was also achieved.



Pharmacologically active growth promoter



Methyl pyropheophorbide-a



Lutein (All-trans) simple form

Microbial biotechnology

Marine microbial research was mainly focused on isolation, culture, extraction, purification and characterization of novel secondary metabolites from marine microbes including deep sea microbes.

Antifungal secondary metabolites (sesquiterpenes and ascotricin derivatives) producing *Ascotricha* sp. KF 1 was isolated from sediment samples collected at a depth of 1235 m off-Cochin (10° 21' 117" N 75° 47' 252" E) and successfully cultured at 100 bar pressure conditions in a high pressure low temperature fermentor system. The mycelia size was reduced by 3-4 fold and increased production of long chain saturated fatty acids, such as pentadecanoic acid (C15), heptadecanoic acid (C-17) and octadecanoic acid (C-18) were recorded in high pressure culture condition. The ascotricin derivative was found to possess agonistic activity against human serotonin 2c receptor (h5HT2c). Sesquiterpenes showed significant inhibition against three MTCC fungal type strains, *M. rouxii* (MTCC 386), *A. fumigates* (MTCC 2550) and *C. albicans* (MTCC 227) with MIC values of 4, 6 and 5 µg/mL, respectively. The sesquiterpene fraction provided more than 70% survival rate in the in vivo antifungal analysis of *C. elegans* with *C. albicans* model.

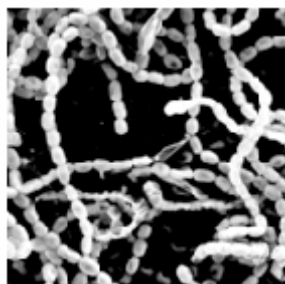
Narrow spectrum antifungal secondary metabolites producing *Purpureocillium lilacinum* OC-II2a was isolated from sediment samples collected at a depth of 1495 m off-Cochin (09° 47' 003" N 75° 27' 002" E). MIC value against *Cryptococcus albidus* (MTCC 2661) was found to be 2 µg/mL. Bioactive fraction was found to protect the nematode *C. elegans* upon co-inoculation during in vivo analysis. The secondary metabolites of *P. lilacinum* was found to be active against malarial parasites, *Plasmodium falciparum* (3D7) and *Plasmodium falciparum* (K1) exerting IC₅₀ of 0.17 and 0.699 µg/ml, respectively.

Colchicines producing fungus, *Penicillium citrinum* 7H52B, was isolated from a marine sediment collected at a depth of 4500 m in the Arabian Sea (16°37'29"N 68°50'35"E) and successfully cultured in 100 bar pressure condition. Increased production of long chain unsaturated fatty acids, such as hexadecanoic acid (C-16) and octadecanoic acid (C-18)

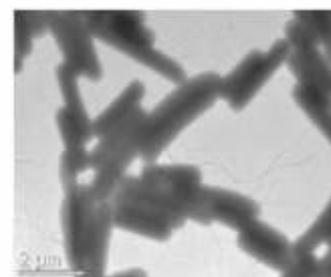
was observed at high pressure culture conditions. The secondary metabolites extracted shows antifungal activities against *C. albicans* (MTCC 227) and *Cryptococcus albidus* (MTCC 2661) with MIC value of 5 and 6.5 µg/mL, respectively.



Ascotricha sp. cultured at 100 bar pressure



S. olivaceus NIOT.Ch.40 spore chains (SEM)



P. marinus sp. nov. (TEM)

A new species of marine biofilm forming bacteria was isolated and named as *Pseudogracilibacillus marinus* sp. nov., based on the physiological, biochemical and chemotaxonomic (fatty acid, peptidoglycan, quinone and polar lipid compositions) experiments, in combination with phylogenetic analysis (16S rRNA and *dnaK* gene sequences) techniques. A new strain of actinobacteria *Streptomyces* sp. NIOT.Ch.40 was isolated from 2000 m deep sea sediment and identified based on morphological, biochemical and genomic analyses. The secondary metabolites produced by this *Streptomyces* sp. exhibited a specific inhibitory activity against Gram-positive bacteria and was significantly effective ($p < 0.0001$) against methicillin-resistant *Staphylococcus aureus* (MRSA). The MIC and MBC against MRSA was 1.5 µg/mL, which was statistically significant in comparison with control drug erythromycin.

Surfactin synthetase gene with 729 bp length, encoding putative proteins of 242 amino acids from *B. licheniformis* NIOT-06 was cloned and sequenced. Molecular mass of surfactin synthetase was estimated to be 27646 Da. The amino acid sequence of *srfA* was found to be 96%, 83% and 76% homologous to surfactin synthetase gene of *B. subtilis*, *B. atrophaeus* and *B. amyloliquefaciens*, respectively. Secondary structure of the ectoine biosynthesis genes from the deep sea halotolerant bacteria, *Bacillus clausii* NIOT-DSB04, was predicted to have alpha-helical structure with maximum hydrophilic molecules. Prediction analysis also revealed the presence of substantial acidic amino acids, regions with high antigenicity and very high backbone chain flexibility.

A total of 123 cultivable marine actinobacteria isolated from the deep sea core sediments were categorized under 10 genera, of which *Streptomyces* sp., *Dietzia* sp. and *Brevibacterium* sp. are the dominant genera. Filamentous actinobacteria was recorded high in the bottom core sediments and non-filamentous actinobacteria was recorded high in the top core sediments.

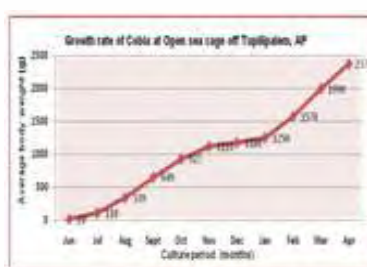
Open sea cage culture

Open sea cage culture of cobia (*Rachycentron canadum*) was demonstrated at Thupilipalem coast, Andhra Pradesh (AP) in collaboration with AP state fisheries. Fishes attained an average weight of 2.37 g with an average daily growth rate of 7.26 g/ day. A total of 3,061 kg of cobia were harvested and sold at a farm gate price of Rs. 325/kg, which fetched an amount of Rs.9,95,000/. In addition to this, the above culture operation has also generated an employment of 2,000 man days to the local fishermen. More importantly, the cage systems successfully withstood the fury of cyclone 'Vardah' which made the landfall near the culture site with a wind velocity of 100-120 km/hr. Development of captive brood stocks for commercially important marine fin fishes like *Caranx ignobilis* (Giant Trevally), *Rachycentron canadum* (Cobia) and *Lutjanus argentimaculatus* (Mangrove red snapper) are being carried out in 9 m diameter sea cages at North Bay, Port Blair.

A prototype octagonal semi-rigid type submersible cage with a volume of 11 m³ was developed and tested at North Bay, Port Blair. Ascending and descending capabilities of the cage was performed with pneumatic and hydraulic methods. A one day introductory training program on open sea cage culture of marine fin fishes was organized and convened for 100 traditional fishers of the Pamanji region. To overcome the shortage for marine finfish seeds a multi species marine finfish hatchery is planned to be established at NIOT sea front facility near Pamanji, Andhra Pradesh.



A portion of harvested fish prior to auctioning



Growth rate of cobia cultured at Thupilipalem, AP



Prototype submersible cage testing at Port Blair

Development of advanced methods for biofouling control

NIOT has successfully designed and developed a low cost high voltage pulse system (HVPS) for the marine biofouling control and ballast water treatment technology development. Total removal of biofilm was observed at 8 modules (40 seconds pulsation) and there was no revival of biofilm formation in test coupons subjected to 35 seconds of pulsation and higher (≥ 7 modules). Towards development of novel antifouling strategies, PDMS with

0.5% loading elicited maximum settlement inhibition of the barnacle, *Balanus reticulatus*: CuO (92%); ZnO (68%); SiO₂ (63%) and TiO₂ (46%). PDMS polymer surfaces patterned with 500 μm spacing microtopographies showed 84% inhibition of barnacle larval settlement. ClO₂ was observed to be an alternative antifouling biocide to chlorine in power plant cooling water systems causing 45-63% reduction in naupliar metamorphosis, 70% inhibition of cyprid settlement and 80% inhibition of metamorphosis to juveniles at low residual of 0.1 mgL⁻¹ and exposure for 20 min. As part of enzyme immobilization on ultrafiltration membrane for fouling mitigation and flux recovery, immobilization of an alginate-degrading enzyme, alginatase (Alg L) onto cellulose acetate membrane was found to be highly effective. The ecotoxicological effects of present and upcoming antifouling techniques indicated that continuous exposure to chlorine residuals of 1.0 mg/L elicited immediate and complete valve closure response in the green mussel *Perna viridis*. Further, a rapid and sensitive method for assessment of chlorine-induced damage in marine phytoplankton (diatoms) was developed based on chlorophyll autofluorescence and SYTOX® Green nucleic acid stain.

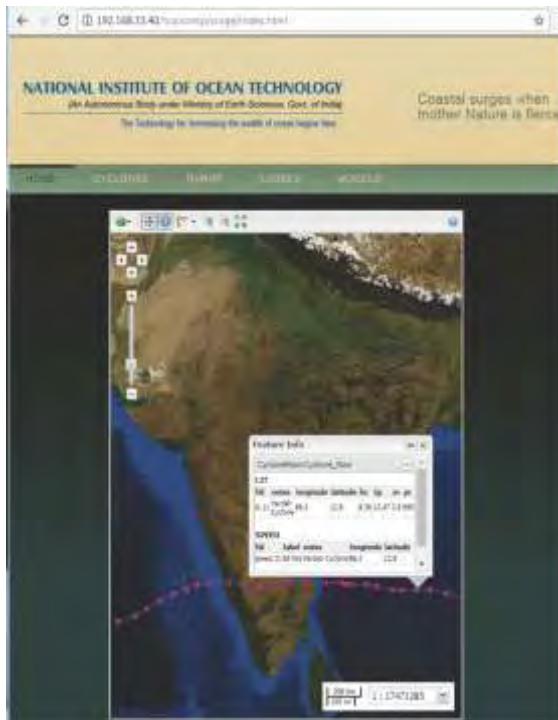
Ballast Water Treatment Technologies - Test Facility

The baseline study of physico-chemical and biological parameters initiated in May 2014 is being continued and as on 31st March, 2017, 35 monthly samplings have been successfully completed. The observed water quality and biological parameters conformed to IMO guidelines. Considering the requirement of large quantity of seawater for carrying out validation of ballast water treatment systems, the Open Sea (OS) station was identified as the suitable location for drawing intake water for the test facility, with added supplements as recommended by the IMO, whenever necessary.

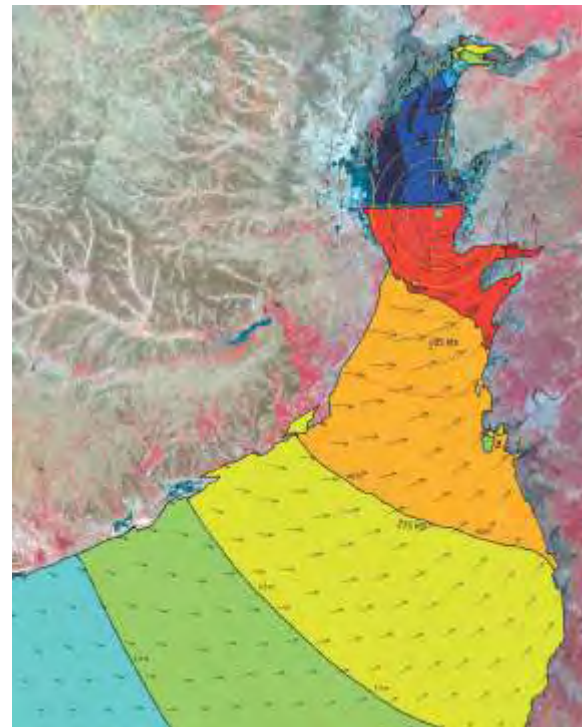
Seawater quality

To detect changes in coastal water quality, predict pollution levels and undertake associated activities like determination of seawater quality criteria to facilitate actions that ensure protection and preservation of marine environment, sea water quality monitoring programme was undertaken in the coastal waters, in and around Port Blair. An intense heterotrophic dinoflagellate bloom caused by *Protoperidinium pellucidum* was observed at Port Blair Bay, South Andaman Island during May 6-10, 2016. *P. pellucidum* population density increased from 20 cells L⁻¹ (pre-bloom) to 3.36 x 10⁶ cells L⁻¹ (bloom) and contributed up to 99.93% of total phytoplankton community. The bloom appeared during a relatively high temperature condition with seawater salinity > 33 psu. High level of ammonia was recorded at post-bloom period, associated with anaerobic decomposition of dead bloom biomass.

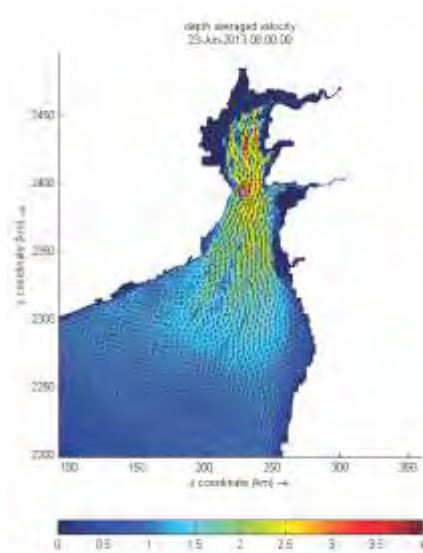
COASTAL AND ENVIRONMENTAL ENGINEERING



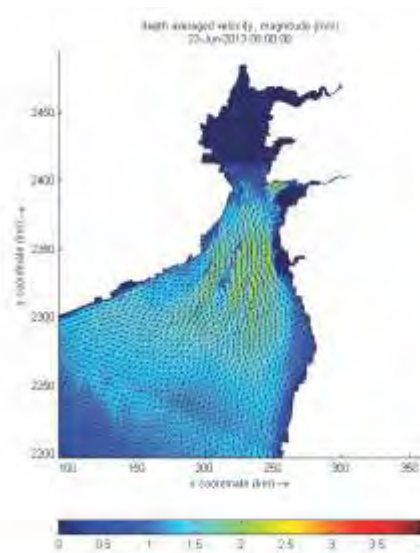
Indian Surge web portal



Storm surge at Kalpasar dam



Comparison of depth averaged velocities in Gulf of Kambhat for Pre and post dam Scenarios



Numerical Model Studies for Gulf of Kambhat

Dam Impact Studies on currents at Gulf of Kambhat

COASTAL AND ENVIRONMENTAL ENGINEERING

Coastal and Environmental engineering group works with a mandate to enhance existing scientific knowledge on coastal processes, and their interaction with other spheres of earth. The development process integrates field observations with state of the art equipment, mathematical analysis, and design of models to develop concepts of sustainable engineering intervention.

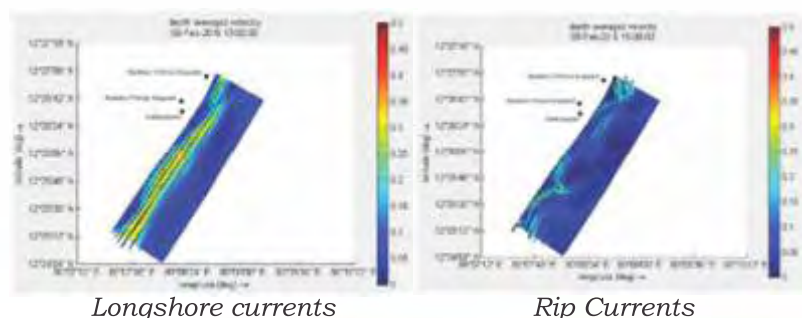
The major projects taken up by group are

- A. Shoreline Management
- B. Technical criteria Atlas
- C. Operation of HF Radar network along the Indian coast under Ocean Observation Network
- D. Hydrodynamic and sediment model studies for Gulf of Khambhat
- E. EIA Studies and Bathymetry Surveys for Kavaratti Island for the proposed OTEC project
- F. Engineering and environmental consultancy work to cater nation building exercise.

A) Shoreline Management

Characterization of littoral transport at selected sites along Indian coast to identify zones of accretion/erosion patterns

Shoreline Evaluation studies for Kadalur Periyakuppam, Tamil Nadu: Beach Profile changes have been monitored along Kadalur Periyakuppam coast on monthly basis for three years and the rate of change in beach volume has been estimated. Littoral Environmental Observations (LEO) also carried out along with beach profiles. Numerical simulations were simulated for littoral currents and rip currents at Kadalur Periyakuppam as a case study. Validation of observed littoral currents and measured has been successfully done. Longshore sediment transport rate for the Kadalur Periyakuppam coast is estimated.

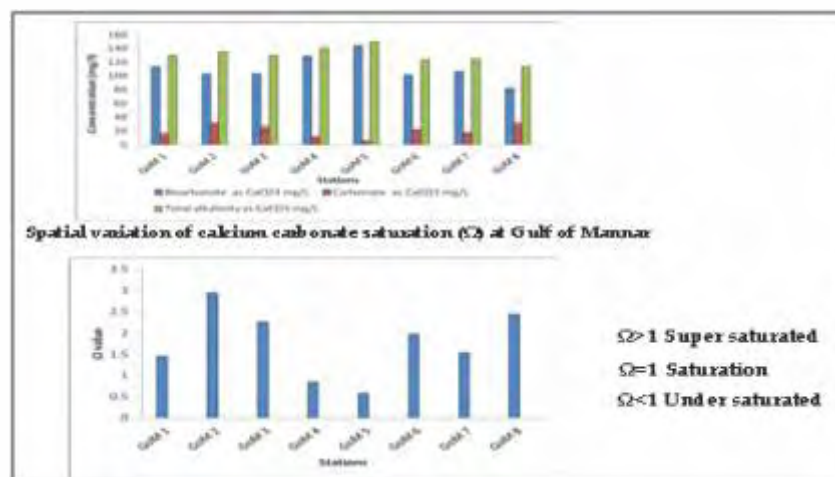


Audit of Shorelines under sustainable shore line management programme : The purpose of "DISSEMINATE" is to provide details of coastal structures (manmade interventions) including structures installed for coastal protection along Indian coastline and their response to sediment movement and their effectiveness to provide an understanding to potential users, researchers and stakeholders of the coastal zone thereby defining the requirement to design sustainable coastal structures in future.

At present, Tamil Nadu coast has been selected for marking all engineering structures along the coastline by dividing Tamil Nadu coast in to 7 zones, each zones divided into potential places or locations based on factors like coastline orientation. The images are generated using unique name based on the location and zone. In future, the other coastal states shall be included in the existing web site.

Study and characterize the creek and estuarine dynamics with respect to morphodynamics and water quality issues and develop a data base as part of Atlas

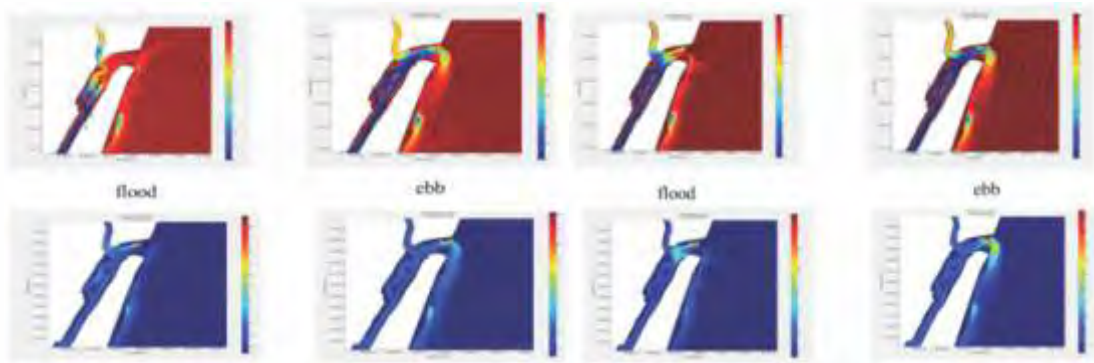
The study of physico-chemical parameters of coastal water in Gulf of Mannar and Palk-Bay, southeast coast of India : Monitored the spatial, seasonal variation of the coastal water quality of the Gulf of Mannar, Palk Bay and Kaduvaiyar estuary (Nagapattinum port), southeast coast of India.



Spatial variation of bicarbonate, carbonate saturation and total alkalinity at Gulf of Mannar

Ennore Creek Predictive Modeling of water Quality : A hydrodynamic model, built on Delft3d was setup for the Ennore creek and validated with available Waste Load Allocation (WLA) observations. The model is coupled with simplified analytical formulae for prediction of the Water Quality (WQ) parameters, Dissolved Oxygen(DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD). The coefficients were calibrated for the site during the WLA observation period.

Short range forecast of atmospheric data, with temperature and salinity derived from GOCM, Industrial outfall are being used to drive the WQ estimates.



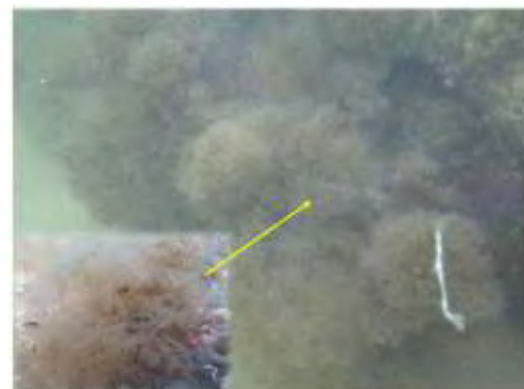
Thermo-Haline Plots for NE Spring

Thermo-Haline Plots for NE Neap

Study of ecological impacts of coastal protection measures : Impact of coastal protection structures where alien material is used was assessed for the ecology variations. Presence of around 170 species of epibiota dominated by gastropods and 21 invasive alien species at various coast structures all along Tamil Nadu coast is recorded. Alien bryozoan *Amathia verticillata* from Caribbean region, presumed as native species of India was re-evaluated and established as alien to Indian coastal waters (Bio invasions Records 2017). Alien ascidians specimens (18 Nos.) collected along this coast have been submitted to Zoological Survey of India and accession numbers are obtained. The coastal structures are found to provide substrate for refugees of climate change victims by supporting minimum conducive environmental condition for survival.



Eualetastulipa at breakwater of Royapuram Fishing Harbour boulders



Amathia verticillata at breakwater boulders of Colachel Fishing Harbour

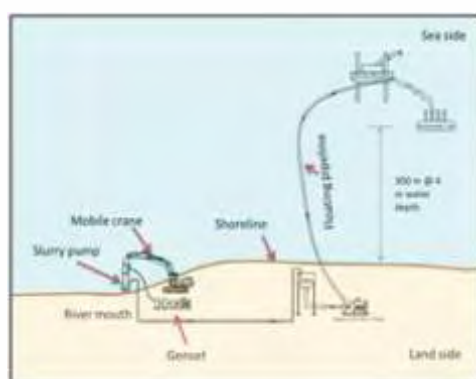
Demonstration of shore protection works with pilot projects

Demonstration of environmentally friendly coastal protection measure is being undertaken at three fishing villages of Kadalur (KPK) in Kanchipuram District, Tamil Nadu. Numerical modelling using DELFT 3D was carried out and submerged dyke was proposed as a sustainable solution for shore protection.

The construction work was started in May 2016. 100 m of the dyke segment is completed.

Present status of demonstration of shore protection:

- Methodology of deployment in wave breaking zone is tested successfully.
- 100 m submerged dyke is laid using Jackup barge, sand pumping using floating pipelines from the shore
- Significant formation of beach behind the dyke installed in conformation with the theoretical designs of USACE
- Response of dyke and stability of geosynthetic tubes to 'Vardah' cyclone of December 2016 is tested. The dyke is found to be intact and safe against the storm waves generated by Vardah cyclone.
- The maximum wave height measured by NIOT wave rider buoy at 15 m water depths was 6.3 m and the significant wave height during the period was 2.84 m.
- Underwater images showed growth of mussels on the surface of geosynthetic tubes indicating that the material is environment friendly.



Construction methodology



Beach formation behind dyke area

B. Technical Criteria Atlas

Tide

The plan project 'Technical Criteria Atlas' aims to provide ready reference for parameters like tide, wave and water level in terms of return period/ extreme values required for

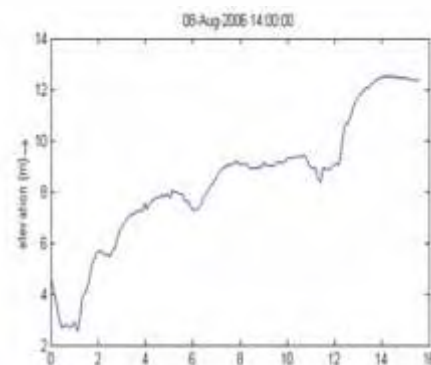
preliminary planning, analysis and design of coastal infrastructures. The project is envisaged under three components – Tide, Wave and Storm Surge.

Estuaries and Inlets

Localized models are developed to cater the requirements of maritime development. These site specific zones does fall under the ambit of regional scale domains and are handled individually depending upon the industrial demand. Moreover the effects of hydrology are intertwined into the tidal hydrodynamics for such locations.

Tapi Estuary

Hazira and Mora near Surat are highly industrialized and have a major marine footprint. The mouth hydraulics are further complicated with the runoff, common to riverine ports. The complexity in such cases is attributed frequent floods in the river, which needs to be assessed to look in the engineering design reference. An extreme flooding event of 2006 was simulated to establish the design levels.



Water level variation against distance (Km) from mouth

Coastal Observation Network

NIOT initiated a development program for the ports to install and maintain an observatory called Coastal Monitoring System (CMS) for measuring tide, current, wave and meteorological parameters. CMS is a modular system has a comprehensive set of observations on tide, current and weather. It also has facility to add more number of parameters with minor modifications whenever required. Currently, there are 17 tide and 14 Met-Ocean observatories are running successfully along Indian coast.

Storm Surge : Calibrated tidal models were utilized to carry out storm induced surge simulations. Storm surge model was setup for the Arabian Sea and is coupled with spectral wave model. Simulation was carried for the storms passed in between 1970-2015. Water level envelopes are being developed. A web map server (digital) was developed to display the

estimated water envelopes for historic storms. The models are run in tandem with spectral wave models to evaluate the shallow water wave surge interaction.

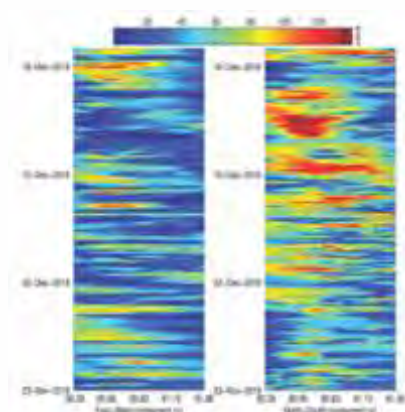
Major cyclones of higher intensity were completed and utilized in Kalpasar studies. Similar strategy is being adopted for Bay of Bengal.

Wave : Accurate wave information is vital to many coastal and offshore activities and describes ocean-state in general. Waves play an important role in design criteria of coastal and offshore structures. Describing the characteristics and variability of wave requires long term observations with sufficient spatial and temporal resolution. In general the availability of measured wave data is very sparse and may not cover the various meteorological conditions (seasonal and inter-annual variability, cyclones etc.) and it is limited to specific locations.

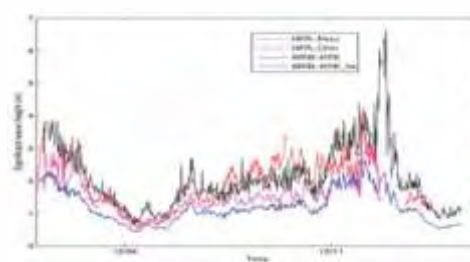
The Andaman & Nicobar Island and Lakshadweep Islands is updated in existing wave atlas. The wave atlas including Islands will be simulated using high resolution ECMWF wind data from 1998 to 2015. The version-2 of wave atlas with statistics will have simulation between 1998 and 2020. At present, extreme value of wave data up to 1 in 50 years available for existing 15 years simulation.

C. Coastal HF Radar network along Indian coast including Andaman island under Ocean Observation Network (OON)

Successfully 5 pairs of the High Frequency Radar's along the Indian Coast are in operational and the data is kept available to scientific community through INCOIS. Cyclone observations, high wave activities are reported to ministry during various cyclones i.e, NADA cyclone and Vardah Cyclone, December 2016 and deep depressions occurred in the year 2016.



The Hovmöller diagram for north-south (v) and east-west(u) component along 11.77350° N latitude.



Comparison of HF radar measured wave height and Wave buoy measured wave height at Periyakuppam during cyclone

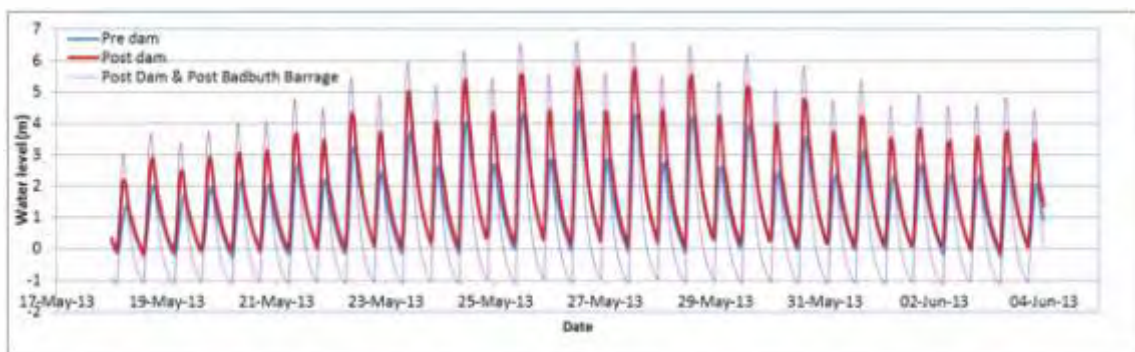
D. Hydrodynamic and sediment model studies for Gulf of Khambhat, Kalpasar

Kalpasar is a major civil engineering work envisaged to capture fresh water draining out from Mahi, Narmada and Sabarmati rivers. An earthen dam was proposed across the Gulf of Khambhat from Bhavnagar to Dahej to form a natural basin. Kalpasar department has entrusted the sea bed engineering investigations and numerical modeling work to NIOT.

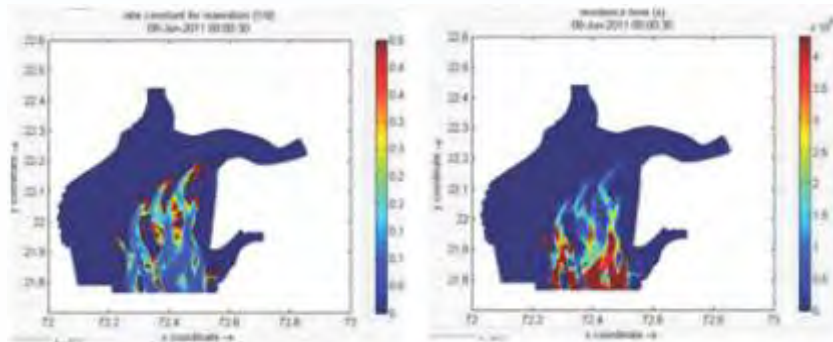
Numerical model studies related to hydrodynamics, wave and sediment transport were carried out for Gulf of Khambhat to assess the impact of proposed dam on hydrodynamics and inundation. Hydrodynamic impact of proposed dam on either side of the dam is studied using numerical model studies.

Model scenario such as dam construction, dam break, reservoir stratification and Saline water evacuation with sluice gates were simulated. Dam cross section has been designed based on the design water level arrived from the model studies (hydrodynamic, wave and storm surge). NIOT is working closely with Design team of Kalpasar to evaluate the impact of the construction works.

Reservoir model studies were carried to study the dispersion characteristics of the pollutant river discharge. Reservoir water quality for various dependency discharges of rivers were carried out. Established the requirement, and engineering specification of saline water flushing strategy. Numerical simulations were carried out to study the combined effect of Kalpasar dam and Bhadbuth barrage at the downstream of Bhadbuth barrage. Dam break scenario model studies were carried with the revised dam breach configuration suggested by the Kalpasar Scientific Audit Committee. From the flow model results the impact of proposed dam water level and currents on existing ports in Gulf of Khambhat is analyzed. Sediment transport model studies for Gulf of Khambhat are calibrated and assessed the sedimentation pattern for post dam scenario.



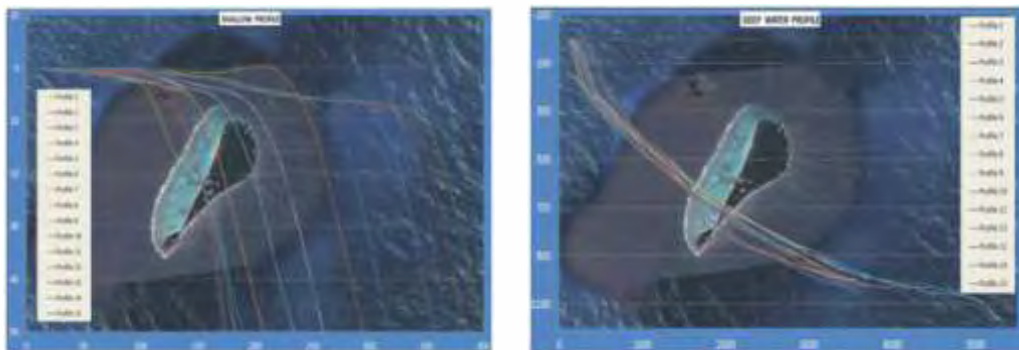
Water level variation on d/s of the Bhadbuth barrage for pre dam, post dam & post dam cum Bhadbuth barrage



Reservoir pollutant dispersion studies

E. EIA studies and bathymetry surveys for Kavaratti Island, Lakshadweep for the proposed OTEC project

Bathymetry surveys using multi-beam sonar, shoreline mapping using RTK GPS and physical oceanographic measurements such as tide, current, temperature along with sediment and water sampling was carried out for the proposed OTEC project at Kavaratti Island in Lakshadweep. Major parts of the field data collection were carried out from 12-Aug-2015 to 15-Aug-2016 and further survey during January and February 2017



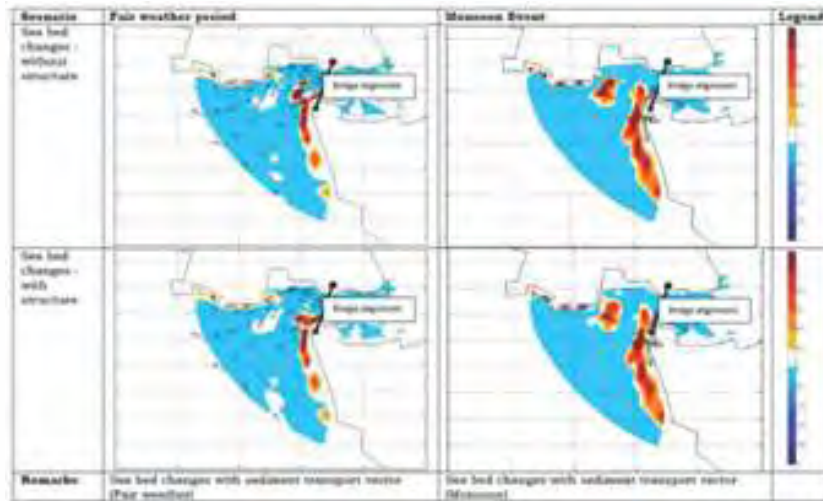
Shallow water bathymetry profiles for Kavaratti Island

Deep water bathymetry profiles for Kavaratti Island

F. Engineering and environmental consultancy work to cater nation building exercise

Study of Hydrodynamic and Morphological change at Tiracol Estuary, GOA

Morphological changes due to the proposed bridge on Tiracol River are assessed by using the numerical simulations.

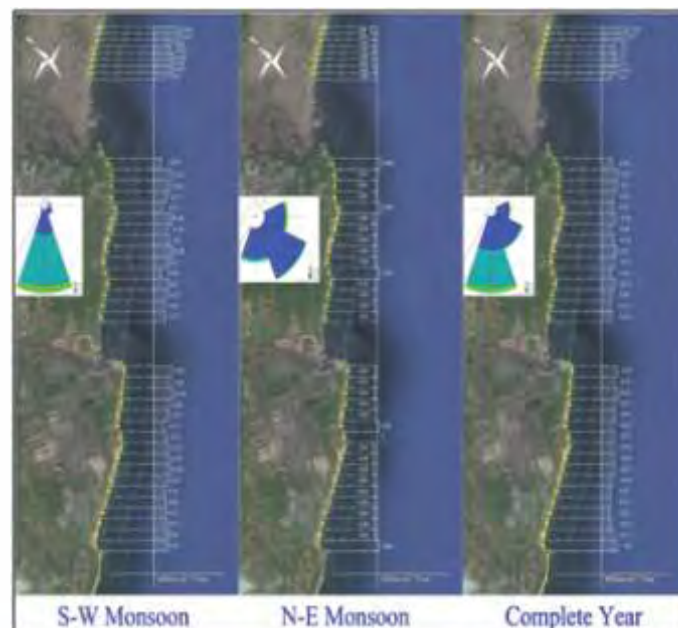


Morphological change at Tiracol Estuary, GOA

Coastal Erosion Mitigation and Shoreline Management Plan for Visakhapatnam

The wave climate was collected from the NIOT wave atlas for the year 2011 at 30m water depth. 40 beach profiles were collected along the Visakhapatnam coast from the South of Gangavaram to North of Visakhapatnam. Littoral sediment transport rate along the Visakhapatnam coast was estimated.

NIOT has collected the annual dredging, sand by passing details by pumping to onshore with the rainbow technique, from VPT and GPL and analyzed sediment budgeting at Visakhapatnam port.



Littoral transport rate along the Visakhapatnam coast

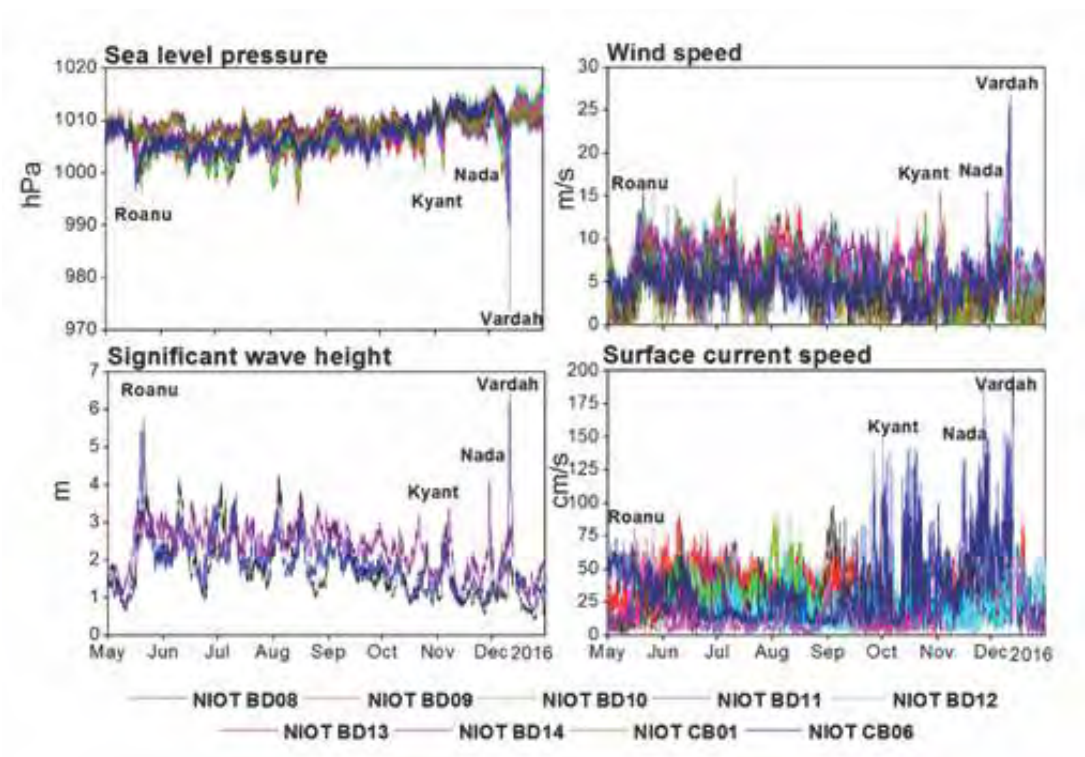
OCEAN OBSERVATION SYSTEMS



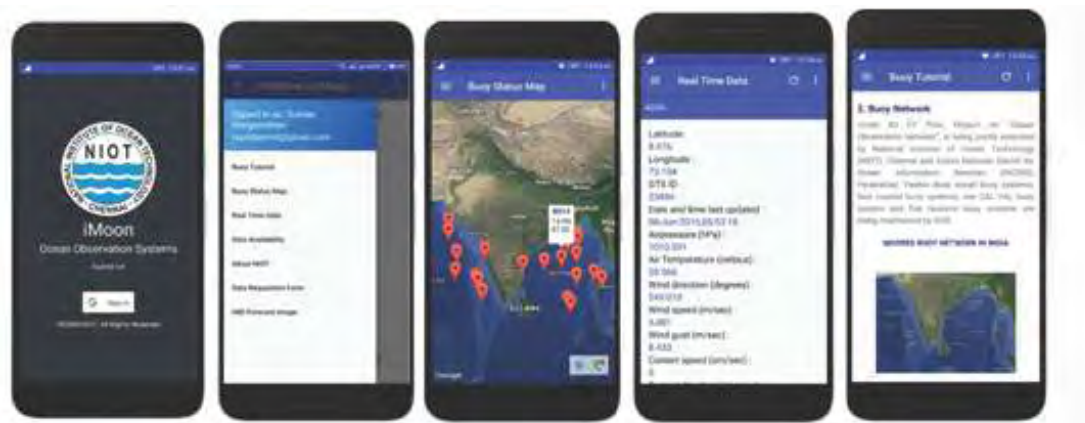
Sagar Avalokan



Chatur system



Significant observation from NIOT buoy systems during cyclones



iMoon screenshots

OCEAN OBSERVATION SYSTEMS

National Institute of Ocean Technology (NIOT) has the mandate to establish and maintain the moored buoy network in the Indian Seas. Considering the importance of continuous measurements of data of high reliability and quality, which is of scientific relevance, optimal numbers of buoys are maintained at strategic locations in Bay of Bengal and Arabian Sea. Also the OOS group carries out technology demonstration of new observation tools, CAL-VAL for ISRO and other collaborative projects with national and international organizations.

The Moored Buoy Network performance is successful, providing valuable data despite many challenges faced. During August 2016 to February 2017, OOS group has completed major tasks which include 46 deployments/retrievals in 7 cruises & Field trips with 77 ship-days covering 6520 nautical miles. OMNI buoy and coastal buoy systems captured the signals of the Kyant (October 2016), Nada (November 2016) and Vardah (December 2016) cyclone passage and transmitted the real time cyclone data to Mission Control Center. CB06 coastal buoy deployed off-Chennai with Rapid mode data transmission during cyclone transmitted high frequency data during recent super cyclone VARDAH during December 2016.

During this period, 84 deployments/retrievals were completed through 15 cruises/field trips with 149 ship days covering 12782 nautical miles. These buoy systems provide valuable data for scientific and oceanographic community. Eleven papers in International Journal and one paper in National Journal has been published with overall impact factor of 31.836, nine posters/papers presented in the International/National conferences by OOS group.

Deep Sea Instrumented Buoys

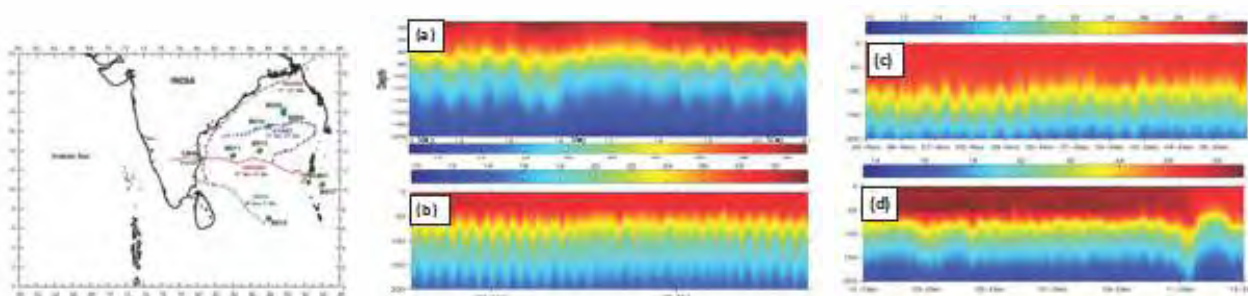
State-of-the-Art next generation deep sea buoy systems are installed in 12 locations which are collecting and transmitting Met, Ocean and subsurface parameters in real time to shore. In addition, 4 coastal buoys with INSAT & GPRS telemetry and CALVAL, a buoy system to validate satellite data are being deployed and maintained successfully. Under Tsunami Buoy programme, two tsunami buoy systems are being maintained by NIOT-OOS.

Cyclone signals captured by Buoy systems (Roanu, Kyant, Nada and Vardah)

Deep ocean buoys deployed by NIOT in the Bay of Bengal have captured the signals of 4 cyclones in 2016, namely Roanu (17th - 22nd May 2016), Kyant (21st - 28th October 2016), Nada (29th November - 2nd December 2016) and Vardah (6th - 13th December 2016). Roanu,

Kyant and Nada were cyclonic storms while Vardah was a Severe cyclonic storm, with a minimum central pressure of 982 hPa and winds of 130 km/hr. The moored buoys NIOT-BD11 and NIOT-CB06 recorded maximum drop in Sea Level Pressure (SLP) around 991 hPa and 974.22 hPa respectively during Vardah and a maximum wind speed of about 130 km/hr. The figure shows the sea level pressure, Wind speed, wave height, Current speed and temperature profiles measured by the buoys during the passage of the cyclones. Upwelling of cooler subsurface waters is observed in NIOT-BD09 during the passage of cyclone Roanu and in NIOT-BD11 during the passage of Vardah.

NIOT reference weather station has also recorded the wind speed and change in the wind direction during passage of cyclone Vardah on 12th December 2016.



Cyclone tracks during 2016 and vertical profiles of temperature in °C recorded by the buoys during (a) cyclone ROANU, (b) cyclone KYANT, (c) cyclone NADA and (d) cyclone VARDAH.

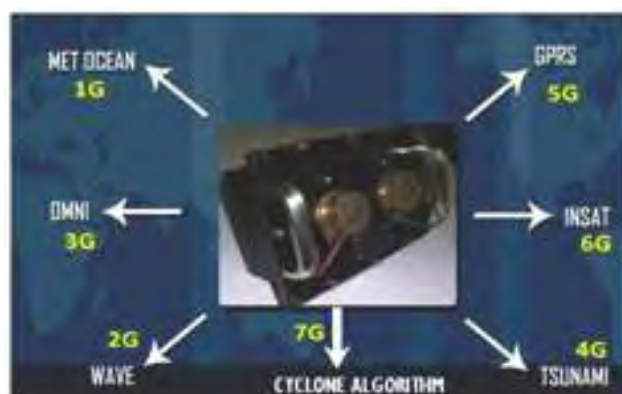
Indigenous Buoy Data Acquisition System - Hridaya

As a part of indigenous development, seven variants of data loggers are developed and working satisfactorily with data/tsunami buoy systems at various locations in the sea. Indigenous Buoy data Acquisition system-Hridaya collects and transmits 106 Met & Ocean parameters in real time to Mission Control Center and also uses a low power processor with hybrid charge controller with facility to transmit data through Inmarsat, INSAT, GPRS and UHF telemetry. It consists of:

- Digital device interface-16 channels, Analog device interface – 16 Channels
- Debug port for Monitoring purpose
- Interface- Inductive, serial, wireless, Camera
- MIL-STD grade circular connectors
- Anodized Marine grade Aluminum alloy ip67 grade enclosure
- Hybrid Charge controller to work with primary and secondary Batteries.

The HRIDAYA-IND series has passed various industrial grade qualification tests in order to work in marine environment:

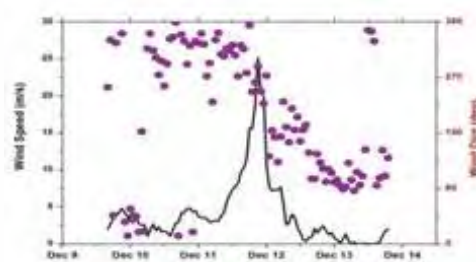
Protection category: IP67 Test, Vibration test: MIL-STD-810E-514.4, Shock test: MIL-STD-810E-516.4, Climatic tests: QM333, Dry heat test, Cold test, Rapid temperature cyclic test, Damp heat (Steady state) test, Damp heat (Cyclic state) test, EMI test, EMC Test, Radiated Susceptibility Test- IEC 61000,4-3,2006, Electrostatic Discharge Immunity - IEC 61000,4-2,2001, Conducted RF Immunity Test - IEC 61000, 4-6, 2004 & Salt and fog test : MIL-STD-810E-509.3



Seven Variants of Data logger

Met Reference Station at NIOT Chennai

A reference station was installed in OOS building on 2nd October 2016 with the aim to evaluate and compare the meteorological parameters with different data loggers like GENI, Data pattern and Campbell. The parameters measured are Wind speed and direction, Air humidity and temperature, air pressure, longwave and shortwave radiation, precipitation etc. Real time data transmission is also available through INSAT telemetry. This system successfully captured the Vardah cyclone effects on 12th December 2016.

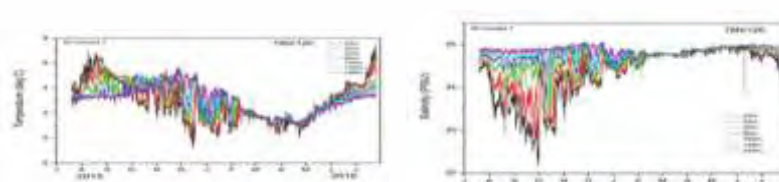


OOS - Reference station & Data Collected during Vardah Cyclone

Arctic Mooring-IndARC phase III

As part of Indian Arctic research program, the IndARC-II moored observatory was recovered and IndARC-III was deployed 78°57' N / 12°01' E, about 1100 km away from the North Pole at a water depth of 192 m during July 2016. The mooring consist of array of oceanographic sensors strategically positioned at discrete depths in the water column.

	Deployed	Retrieved	Days
IndARC II (10 Lakh Data point)	23 rd July 2014	15 th July 2015	357
IndARC II (25 Lakh Data Point)	19 th July 2015	26 th July 2016	373
IndARC III	27 th July 2016	In operation	



Details of IndARC data available and Data graph of IndARC

Remotely operable surface sampling system - Sagar Avalokan

Robo-boat “Sagar Avalokan” a remotely operable surface sampling system has been successfully tested at high seas on 6th February 2017 by OOS team onboard Sagar Nidhi and performance found to be in-line with the expected outcome of the design.

The boat was tested close to 500m in the vicinity of the ship. Functionality tests included stability, micro controller, thruster and other electronic assembly checks along with the remote control operation. The system measured sea surface temperature data and recorded video footages using the camera mounted on the system, which was obtained through Wi-Fi on onboard ship and mobile phones.



Sagar Avalokan during field trial

Design and development of CHATUR (Continuously Hiding Autonomous Tsunami UnderwaterR system)

The conventional deep ocean tsunami buoy systems are with surface buoys which float at sea surface and prone to wear and tear, vandalism, harsh marine environment, cyclone passages etc. Due to this, there is a possibility of missing the warning message during

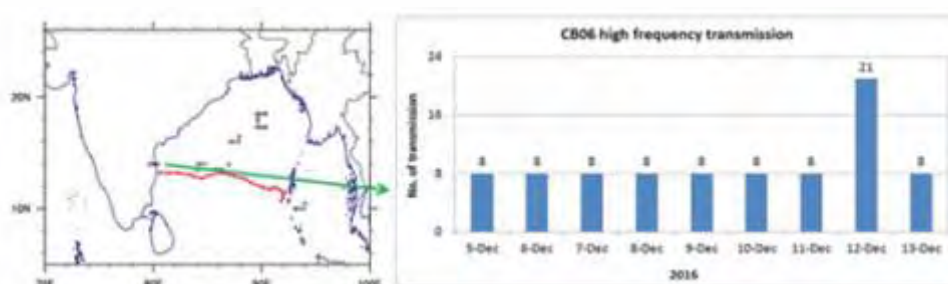
tsunami event. To overcome these constraints, a sub-surface moored buoy system which is power efficient and cost effective, namely CHATUR is proposed which will remain subsurface safely at $\approx 300\text{m}$ depth. The system starts ascending to sea surface when it detects the tsunami message from Bottom Pressure Recorder (BPR). As the system ascends at sea surface, antenna transmits the data to shore station. The sea trial of the system was successfully completed at 366m depth off Goa on 30th March 2017.



Field trial of Chatur off Goa waters

Cyclone-Rapid Mode Data Collection

As required by IMD, rapid mode data collection during cyclone period is implemented in four coastal buoys. The reduction in semidiurnal oscillation of air pressure observations during cyclone passage is utilised to trigger cyclone mode. To resume the normal transmission pattern, the daily average air pressure at the time of cyclone trigger is utilized. The coastal buoy CB06, deployed in Chennai transmitted data in rapid mode during the cyclone Roanu (May 2016) and Vardah (December 2016). The graph shows the data collected during the cyclone period in December 2016.



Cyclone rapid mode data collection during cyclone Vardah

Buoy sensor calibration facility at Ocean Observation Systems of NIOT

Calibration of Sensors

In-house calibration for Precipitation sensor is achieved by using a graduated reference scale and measurement of corresponding voltage response from the precipitation sensor.



Calibration setup and Calibration of precipitation sensor

Calibration of Air Temperature and Air Humidity Sensor

Air temperature and humidity sensor is calibrated using portable humidity generator with chilled mirror (Hydrogen).

Calibration of Data Acquisition System

In order to validate and calibrate the Analog to Digital Converters of Data Acquisition systems the calibration test station shown below is used. This calibration test station generates precise voltage and feeds into the ADC of the Data Acquisition system to be calibrated and measures the output automatically. By performing series of measurement the drift in voltage is measured and correction factor is fed into the data acquisition system.



Calibration setup of Data Acquisition System

Development of Mobile App – iMoon

Mobile app was developed for Android & Windows platform to view the data in real time using smart phones from Met-Ocean and Tsunami buoys. The app is GUI based, handy and the visual observation helps to quickly analyse the data and information on the move.



'iMoon' Mobile app has been developed for Android platform to view the real time data of working buoy systems and the same could be viewed with Google map. Data received in every three hour interval and the same is updated in the app.

Metadata of archived data information of all moored buoys are updated since 2010. Online data request form has been created to reduce the procedures in requesting data for scientific users. Further, daily satellite based weather report of IMD is available. This application can be freely downloaded from the Google play store.

Development of Mooring Analysis software

A dedicated Mooring software (based on the MATLAB Mooring Design and Dynamics) for the analysis of Deep Sea Instrumented Buoy and Tsunami Buoy mooring has been developed. All mooring components have been added in the material database and an analysis has been done for the Deep Sea Instrumented Buoy (BD11). The result of software will be compared with the Orca flex and CABLE software.

VESSEL MANAGEMENT CELL



Concept design of proposed new CRV



VESSEL MANAGEMENT CELL

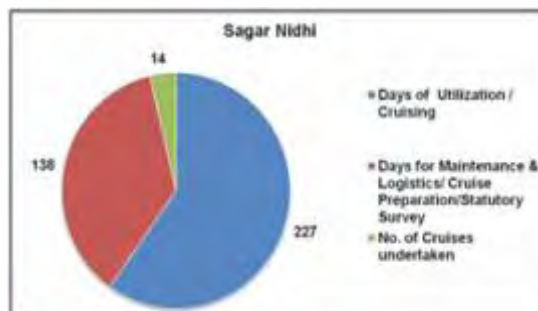
Research Ships of NIOT are versatile ocean observing platforms equipped with advanced scientific equipments and mechanical handling equipments for technology demonstration and oceanic observations, which are on par with International Standards. Vessel Management Cell [VMC] team of ESSO-NIOT is responsible for operational management and maintenance of research ships and scientific equipments onboard. Currently there are three vessels under ESSO-NIOT viz., Sagar Nidhi, Sagar Manjusha and Sagar Purvi. These vessels operate year round, supporting Ministry of Earth Sciences, Govt. of India funded projects. Ocean Research Vessel 'Sagar Nidhi' is India's pride and a state of art ice-class research vessel of the sub-continent. It is built with Dynamic Positioning System [DP-II] of 5m accuracy, with an overall length of 103.6m and draft of 4.2m. She can accommodate 30 scientists with an endurance of 45 days. Sagar Nidhi is the 'first Indian flagged research ship that reached the 66°S latitude, facing 11 storms and 73 nm/hr wind speed, witnessing nature's harshest conditions and awesome breathtaking sceneries.'

ORV 'SagarNidhi' is catering to the ongoing and new programmes of MoES such as Autonomous Coring System (ACS), deep sea mining, Remotely operable Submersible (ROSUB), Remotely Operable Vehicle (ROV), Autonomous Underwater Vehicle (AUV), Southern Ocean Expedition (SOE) and various other research and technology development activities planned by the Ministry. Coastal Research Vessel 'Sagar Purvi' is used for the implementation of the Coastal Ocean Monitoring and Prediction System (COMAPS) and Integrated Coastal and Marine Area Management (ICMAM) programmes of the Ministry of Earth Sciences and to provide services to the other agencies like Universities and Research Institutes for surveys and data collection. Buoy Tender Vessel 'Sagar Manjusha' is involved in the National Data Buoy programmes and other projects of the NIOT and other institutes. VMC is providing research vessels to various users under MoES & research institutes for successful implementation of Ocean related programmes as recommended by JSTAC (Joint Scientific and Technical Advisory Committee).

VMC consists of a team of Engineers who support the research ships on a day to day basis, to ensure the vessels continue in the delivery of data. They collect scientific data and compile the data collected during the expedition. VMC team has implemented a number of innovative engineering solutions on research ships of NIOT, which is helping the scientific users and shipping industry widely.

Vessel Utilization Report during 1st April 2016 to 31st March 2017

Total no. of days=365			
Vessel	Days of Utilization / Cruising	Days for Maintenance & Logistics/ Cruise Preparation/Statutory Survey	No. of Cruises undertaken
SagarNidhi	227	138 (Azimuth Thruster Repair/Installation of LARS, ROV/Annual Survey)	14
SagarManjusha	173	192 (Dry-dock and Afloat Repairs, Engine Overhauling/Bad Weather)	15



SagarPurvi has undergone hull plate repair, IRS survey & inspection at Chowgule Shipyard, Goa during May-June 2016. Dry-dock and afloat repairs were completed at Goa Shipyard Ltd. Due to aging of ship, the steel hull had to be renewed at many places, which lead to extra time and cost.

Scientific Activities

- Successful data collection of temperature profiles, water samples and seabed bathymetry survey off Kavaratti Island, Lakshadweep for Ocean Thermal Energy Conversion [OTEC] Powered Low Temperature Thermal Desalination [LTTD] Plant at Kavaratti, Lakshadweep.[EFW-NIOT]



CTD Deployment,



Plankton net sample collection



Sediment Sampling



- Successful trials of Autonomous Coring System [ACS] in shallow water and deep water at Bay of Bengal [DST-NIOT]. Perfect functioning of shipboard systems and maintenance planning lead to ACS successful trials.
- Search and Rescue operation of missing aircraft AN 32 from 8th August, 2016 to 2nd September, 2016. During this period VMC team onboard Sagar Nidhi has surveyed an area of 12,200 sq.km approximately. In this total area some suspicious features/locations were reported. Sagar Nidhi / ROV was deployed at the designated locations for verification of any debris during 17th – 27th September, 2016. Joint team onboard Sagar Nidhi had verified the most probable locations with multi-beam survey/ROV at the sea floor/Sonar fitted to ROV despite bad weather.
- Successful deployment & recovery of Ocean Observation Systems viz., RAMA moorings, ARGO floats, Drifter buoys, Gliders, Wave buoys, UCTD measurements, Vertical Micro Profiler, IOP Profiler, ADCP measurements using side mount pole. [INCOIS].



- Successful deployment & recovery of Ocean Observation Systems viz., Tsunami buoys, Surface buoys, Met Ocean buoys, Sample collection.[OOS-NIOT]



- Effective utilisation of ships with Class approved cost saving maintenance techniques. These maintenance techniques resulted in increased ships operational time.
- Successful tracking of the flight of India's first Technology Demonstrator Reusable Launch Vehicle (RLV-TD) using ship-borne telemetry system installed onboard SagarManjusha by VMC team & ISRO team jointly.



Antenna Fixed onboard for RLV tracking

- VMC team ensured timely completion of dry-dock and afloat repairs work of Sagar Manjusha at Lavgan Dockyard Private Ltd., Ratnagiri against the planned work completion schedule, due to the continuous efforts. It's an achievement considering the fact that major overhauling of Main Engines/Generators/Annual Survey & etc., were carried out successfully. Ship has been undertaking scientific cruises successfully ever since.

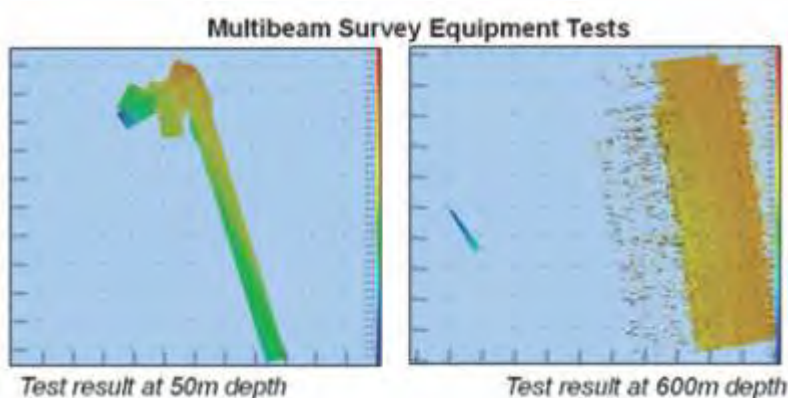
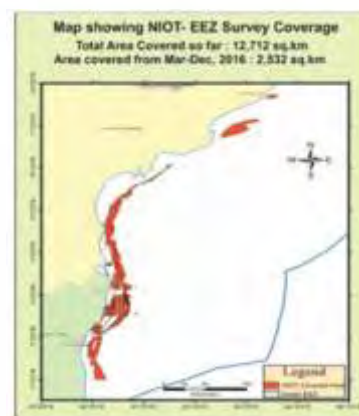
Acquisition of new CRVs

MoES-NIOT is under the process of acquisition of two new Coastal Research Vessels as a replacement for existing CRV to be utilized for shallow water operations along entire Indian coast for the various programmes of MoES. The contract was signed between NIOT & M/s Titagarh Wagons Research vessels based on National open tender for design, construction and delivery of two coastal research vessels .

Efforts of VMC in addressing the Scientific Mission Requirements (SMR) and optimizing the design of Ships based on past experience, in-line with IMU was highly appreciated by the PMCC [Project Monitoring & Coordination Committee]. The efforts made towards documentation and maintenance of records/files pertaining to this project was very well appreciated by the Independent External Monitors [IEMs], PMCC and Integrated Finance Division [IFD], MoES.

Geoscientific Studies of the Exclusive Economic Zone of India [Shallow Water]

- Total area of swath-bathymetry covered so far: 12,712 sq.km.
- Meta data was prepared for a survey area of 8174 sq.km. A survey coverage of approximately 2532 sq.km achieved using Multibeam echo sounder onboard Sagar Manjusha during April to December 2016.
- Multibeam Echosounder system [Reson 7111-100kHz] which is used for EEZ surveys had been tested (during 5th-7th Jan 2017) at shallow and deeper waters immediately after dry docking of ORV Sagar Manjusha and found working satisfactorily.



- Constraints: Non-availability of Shiptime, frequent net entanglement, frequent fishing activities, no auto pilot in CRVs, line survey is practically difficult during night time.

Innovative Engineering Solutions implemented onboard Ships that helped reducing cost of maintenance & enhanced operational time

- Gearbox modification on SagarPurvi:* An innovative engineering solution was implemented for reducing response time of gearbox from 0.86 seconds to 0.43 seconds. Both gearboxes are functioning well with improved manoeuvrability. This was highly appreciated by the scientific community and the same modified gear box clutch mechanism was recommended by Ship staff to be fitted in all future NIOT vessels for the benefit of scientific community. Efforts are appreciated by IRS

surveyors. Coastguard had proposed to avail our technical competence to employ these engineering techniques onboard CG ships.



Modified STBD side Gear Box



Clutch from STBD side gear box

- b) *Ship Based Membrane Distillation Process for Producing Potable Water* - A pilot test was successfully conducted by establishing an experimental setup at VMC. This is planned to be installed on Sagar Manjusha shortly.



Installed setup at VMC-NIOT Building

Cold water tank
Hot water tank
Hot water pump
Cold water pump
VSWR to control flow



DCMD module at VMC-NIOT Building



Schematic of the Proposed Experimental Setup

- c) *Development of SagarNidhi Diesel Generator primary fuel filter*- In-principle DNV approval has been obtained & OEM is being impressed upon.
- d) *EVAC System*-Innovative Engineering solutions were implemented on Sagar Nidhi for better operational convenience viz., sanitary system has been modified by incorporating “reducer elements” to reduce failure rate. System is functioning successfully for the past 8 months.
- e) Old & condemned propeller shafts of CRV's are “Clad welded” by an innovative Engineering method and re-used during recent dry-dock.



Deep pitting on bearing surface



Propeller shaft machining



ND tested welded shaft

- f) Misalignment of 11 mm on the LOS (line of sight) of SagarPurvi propeller shaft was corrected during recent dry-dock with an Engineering technique without replacement of propeller shaft bracket and duly certified by IRS.

- g) Introduction of “innovative split seal with inflatable seal” for CRV's propeller shafts to arrest possible “lip seal” failure.

Research Work

- a) *Ship time gained & Cost savings resulted due to Innovative Engineering Solutions implemented onboard Ships:*

S. No.	Activity [Innovative Engineering Solutions]	Cost Savings [in INR]	Ship time gained
1.	Repairing hole on Sagar Nidhi underwater hull plate	35 Lakhs	25 days
2.	Gearbox modification on SagarPurvi	12 Lakhs	25 days
3.	Indigenization of Primary Fuel filter for Sagar Nidhi	6.24 Lakhs	60 days
4.	Modification of sanitary system onboard Sagar Nidhi by incorporating “reducer elements” to reduce failure rate	5 Lakhs	12 days
5.	Clad welding of Propeller shaft under IRS	7 Lakhs	35 days
6.	Correction of misalignment of 11 mm on the LOS (line of sight) of Sagar Purvi propeller shaft	3 Lakhs	35 days
7.	Introducing innovative split seal with inflatable seal technology for propeller shaft	9.5 lakhs	15 days

**Shiptime was gained since there was no need to procure spares and no additional time was required where above solutions were implemented.*

- b) As part of IVHM [as advised by SAC], AIS data collection and ship-emission measurements are being done as part of environmental indexing to meet IMO regulations. NOx/SOx reduction techniques are being studied based on emission data collected from ships.

- c) *Ballast Water Treatment Techniques for ORV Sagar Nidhi*

An analysis was carried-out to implement Ballast Water Treatment Techniques for ORV Sagar Nidhi to meet regulations of International Maritime Organization (IMO). As a result of optimization, a ballast water treatment system with filtration and ultra violet treatment is being done.

SEAFRONT FACILITY



Bio Fencing at Pamanji site



Water tapping point at Chittedu site



Electrcial Transformer at Pamanji site

SEAFRONT FACILITY

The aim is to create world class Seafront Research Facility (SRF) to enable activities in development and testing of prototype systems, validation of indigenously developed marine systems in the ocean environment.

Land Procurement: Government of Andhra Pradesh allotted 153 acres of sea-front land to NIOT during September 2013, out of which 97.37 acres of Land was taken over during the year 2013-2014. Rest of the land of 56.18 acres is under litigation. Senior Panel Counsel of High Court of Andhra Pradesh has been engaged by NIOT to sort out the land litigation issue. To establish Facility for Administrative Computational Training (FACT) 58.19 acres of land was taken over during 2014 at Chittedu Village Nellore District, Andhra Pradesh.

Construction work up to floor level for the project site office at Chittedu site is in progress. Foundation work for compound wall at Chittedu site also has been started and the work is in progress.



Site office up to floor level at Chittedu.



Compound wall under construction

- d) Foundation work for chain link fencing has been started at Pamanji site and the work is in progress



Construction of foundation for chain link fencing at Pamanji

- In order to prepare the master plan and concept plan for priority buildings proposed to be undertaken in Phase-1 at both sites, open tender was floated on 14.01.16 for engaging architectural consultant. Tender evaluation was carried out by Project Review Coordinating Committee (PRCC) and Technical Evaluation Committee (TEC) and the successful bidder has been identified.
- The work on drinking water supply to FACT Site is completed and the facility is handed over to NIOT during October 2016. The works for laying of pipelines for drinking water supply line for 11 km length to SRF site has been completed.



Water inlet arrangement at Chittedu site



Pump room constructed at water source point for Chittedu site

- The electrical supply from construction purpose for both SRF and FACT site were completed and commissioned



Transformers for construction purpose at Pamanji site



Transformers for Algal Culture

COMPUTER MAINTENANCE CELL

Computer Maintenance Cell (CMC) of the National Institute of Ocean Technology, Chennai was set up in the year 1997 with the objective of providing computational and infrastructure facilities for the research community of the Institute. CMC administers, manages and caters to the needs of different projects, departments within the institute apart from in-house software development and maintenance.



Network Routing Rack

CMC services the campus-wide LAN which caters close to 450 users. LAN has been designed with single mode fibre OFC backbone offering aggregate bandwidth of 1 Gbps.

Apart from the dedicated NIC leased line for 1 Gbps, NIOT maintains a 30 Mbps capacity line also to ensure uninterrupted service to the user community. NKN established through NIC has 2 redundant connections as a failsafe arrangement.

The CMC core infrastructure facilities include several high-end servers with wide variety of operating systems like Windows and Linux for intranet portal, web & mail services, FTP Storage and Application servers running key applications continuously.

Storage facilities include EMC 20 TB and HP 4 TB to support large volume of data.

CMC maintains state of art mailing system, and online software for Stores & Purchase and Finance & Accounts applications built in house to support purchase, asset management, payroll and accounting processes. CMC has been successful in piloting NIC e-tender portal usage and now NIOT uses NIC e-tender portal for all its tender publishing and procurements, having pan-India visibility for its tenders. NIOT is also implementing PFMS (Public Financial Management System) as a part of Ministry of Finance initiative for transparent transactions, for which CMC is providing all the necessary support for its seamless implementation.

CMC also maintains the video conference and telepresence facilities of the campus, and extends support for computational, presentation and Wi-Fi needs for seminars, conferences and workshops. Wi-Fi installations are enabled in Panikkar Hall, Varuna Hall, Rajendra chola Hall and in the Guest House facilities.



Email and Storage Servers



Tele-Presence Facility

Integrated Office Automation System (IOAS)

Integrated Office Automation System (IOAS) is being implemented in NIOT moving towards paperless office as per Government of India guidelines. The system is being continuously improved to enhance the user experience, based on the feedback from the users. During the current year SnP complete module with Tender results, Payment module and RTI modules were made online.



IOAS Home page

Major achievements

- Implementation of majority of modules in IOAS.
- Completion of internal procedural requirements to facilitate switch over to NIC e-tendering process.
- Implementation of PFMS.
- Ensured zero crypto-ransomware instances in NIOT.

Major software's that are being used by various departments and supported by CMC

Drafting and Modelling	Analysis	General Purpose Software's	Project Monitoring / Administrative
AutoCAD* Solid Works Grapher Pro-E Mike C Map AEGIS ITI Simulation	Ansys* Orcaflex CFD - Fluent Surface Modelling Simulation X Mike 21 Plaxis STAAD Pro Arc-GIS* HTRI LMS Sysnoise	MathCAD* Lab View Matlab* Code Vision Conrad	Primavera Micro Soft Project Oracle SAP-2000

*(The items with * are procured and maintained by CMC)*

CAMPUS MAINTENANCE AND DEVELOPMENT

To cater the requirement of research activities of different groups at NIOT campus, following civil & electrical activities have been completed as part of the campus development work.

Construction and Maintenance of Facilities

An electrical panel room for New Integration Bay has been constructed, interior modification work at Marine Biotechnology (MBT) office, interior work at Acoustic Test Facility (ATF), Cyclone Vardah relief work such as civil repair work for replacement of roofing sheets at Main Building and Car parking area, replacement of rolling shutters at New Integration Bay, Common Storage Yard and OOS Bay Extension has been completed.



Panel room



Interior work at MBT



Roofing sheet of car parking shed



Rolling shutter repair work at New Integration Bay

Interior works for newly constructed buildings for seating and laboratory arrangements including electrical, data and voice, fire-fighting systems for Submersibles Integration Facility (SIF) (area 247 sqm), Vessel Management Cell (VMC) extension for office facility (area 360 sqm), Buoy Test Facility (BTF-196 sqm) have been completed.

Supply and installation of material handling lift with capacity of 1000kg and 200 kg at new storage yards are completed. Supply and installation of 20 T EOT crane at Submersibles Integration Facility and 5 T EOT crane at OOS bay extension are completed.



SIF – Ground floor



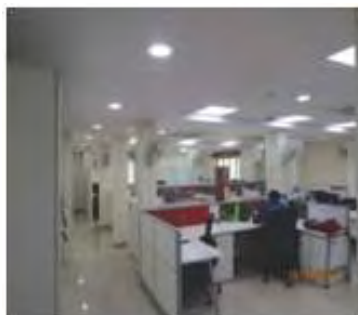
SIF – First floor



OOS Extension – Ground floor



OOS Extension – First floor



VMC – First floor



VMC – Second floor

LIBRARY

Library is one of the prime reference centre for research and development of Engineering and Oceanographic community. Set up in 1994, the library has provided solid research support for 22 years to scientists, researchers, consultants, students and others from all over India. It is one of a kind technical resource center housing a total of about 5500 collections, including books, monographs, journals, reports, bulletins, and hydrographic charts, Hindi books and other reference materials. Scientists, technical staff and administrative staff of NIOT are its members.

The subscriptions include 34 National & International journals (including 11 online journals), 6 Hindi magazines and newspapers. In addition, access to 117 journals is offered online through consortium agreement of Ministry with Science Direct, apart from the SCOPUS database, Science and Nature magazines. User awareness session was also conducted for the benefit of staffs for preeminent utilization of Science Direct online journals.



A view of the book collections at the Library

The NIOT Library has Membership of various institutional libraries like Central Library-IITM, Anna University, and British Council to provide Inter Library Loan facilities (reference services) to the scientific staff.

Scientific papers Published by NIOT Staff in National and international journals are posted under the Digital Repository Services in the Ministry (MoES) and MoES-NIOT website for their effective dissemination within the scientific community. A Mail Alert Service facilitates mail confirmation for every transaction of the user.



Presentation by Elsevier representative to NIOT staff arranged through MoES

Automatic renewal access is also provided to the users within a limited period for reference. The users can also search the document titles through an application (OPAC) available under library link in the Intranet site, Samudra.

IMPLEMENTATION OF OFFICIAL LANGUAGE

Hindi training

- 22 staff members have passed Praveen Hindi course through regular training program.
- 4 staff members have passed Prabodh and 2 staff members have passed Praveen through intensive training program.
- 1 staff member has passed Pragya through correspondence course.

Status of trained staff members: Out of 167 existing staff members, 131 (78.44%) staff members are trained in Hindi as on 31-03-2017 as per roster maintained.

Hindi typewriting course

2 staff members have passed Hindi typewriting course through regular training program. The cash award and personal pay for period of 1 year was granted to the eligible staff members.

Creation of Hindi posts

Junior Hindi Translators – 2 posts and Hindi Typist – 1 post has been created at NIOT for implementation of Official language policy & for meeting statutory requirements and process for filling up the posts is going on.

Hindi Fortnight Celebrations

NIOT celebrates Hindi fortnight every year. During 2016-17, Hindi fortnight was celebrated with enthusiasm between 14th and 27th September 2016. Various competitions were conducted for encouraging staff members to work in Hindi. Staff members participated in large numbers. The staff participated were awarded prizes. Prize distribution function held under the chairmanship of Dr.Purnima Jalihal, Scientist-G, NIOT. Mr.Hariom Rastogi, Dy. Director (Incharge), HTS was the Chief Guest.





Hindi workshops

A total of four Hindi workshops were conducted during the year on various subjects to strengthen the knowledge of the staff members and to motivate them to work in Hindi.

Official Language Implementation Committee meetings

4 meetings of Official Language Implementation Committee (OLIC) meetings were conducted during the year on i) 27-06-2016 (for qtr. ending 30-06-2016) ii) 17-10-2016 (for quarter ending 30-09-2016) iii) 18-01-2017 (for quarter ending 31-12-2016) iv) 25-04-2017 (for quarter ending 31-03-2017).

Quarterly reports for progressive use of Hindi

Quarterly reports (on line) on use of Hindi for the quarter ending 30-06-2016, 30-09-2016, 31-12-2016 and 31-03-2017 were prepared and sent to Regional Implementation Office, Cochin and MoES, New Delhi.

National Conference on Modern Trend in Biotechnology

A 3 days National Conference on "Modern Trend in Bio Technology" was held at NIOT during 19.10.2016 to 21.10.2016 wherein technical session in hindi was conducted on 21.10.2016.

Participation in All India Official Language Conference

NIOT represented in the All India Official Language Conference organized by Parivartan Jan Kalyan Samiti, New Delhi held during May 26-28, 2016 at Trivandrum.

Participation in TOLIC meetings

NIOT represented in the Town Official Language Implementation Committee (TOLIC) meetings held on 10.05.2016 & 28.11.2016 and hosted TOLIC meeting held on 28.11.2016. Besides, NIOT represented in various programs and competitions held from time to time.

INDEPENDENT REVIEW OF NIOT ACTIVITIES

In pursuance of the recommendations of the Expenditure Management Commission of the Department of Expenditure, Government of India, an Independent Peer-Review Committee was constituted by Secretary, Ministry of Earth Sciences (MoES) under the Chairmanship of Dr.K.Kasturirangan, INAE Satish Dhawan Chair of Engineering Eminence, Raman Research Institute, Bengaluru to review the activities and performance of the National Institute of Ocean Technology (NIOT), Chennai. The other members of the Committee were Dr.M.Y.S.Prasad, Former Director, SHAR, Sriharikota, ISRO, Hyderabad, Dr.B.N.Suresh, Former Director, VSSC, ISRO, Bangalore, Dr.N.Vedachalam, Distinguished Professor, Vikram Sarabhai Space Research Centre, Thiruvananthapuram, Prof.M.S.Ananth, Former Director, IIT Madras and Dr.M.P.Wakdikar Scientist G, MoES acted as the Member Convenor. The committee met at NIOT during November 16-17, 2016 and reviewed the activities of NIOT and evaluated its performance.

Detailed presentations covering the objectives, the technical growth, status of various developments, budget and human resources of NIOT were made by the senior scientists, Dr.M.A.Atmanand, Dr.G.A.Ramadass, Dr.R.Kirubakaran and Dr.Purnima Jalihal.

The committee conducted a rigorous review of NIOT activities and was of the view that, with the limited budget and human resource, the performance of NIOT is commendable and NIOT has contributed significantly for the development of technologies in several important areas of ocean science and technology. The committee recommended the following:

The work carried out/being carried out at NIOT has a high potential for future Indian economy and is strategically important. Hence the activities need to be continued, sustained and expanded to meet the National requirements. MoES should redesignate NIOT as the National Centre for Ocean Technologies development in the country. Some technical areas, like ocean energy, desalination and sensors to cater to ocean observation and exploration, need to be taken up at a larger level. NIOT has proved its leadership in the area of ocean exploration with the adoption of best of technology and techniques. To achieve accelerated progress, it is recommended to organize reviews/seminars with stakeholders.

Considering the changing technological needs of the country and the necessity to meet them through the development of ocean technology, it is required to redefine the vision and mission in consultation with civilian, industrial, strategic, academic and scientific stakeholders.



NIOT has reached a level of maturity that they should start initiating plans for major Projects in a mission mode and have to be necessarily pan India in character by involving the National agencies and if necessary with international agencies. These projects by their very nature would call for major human and financial resources and thus need new organizational structures and management culture to execute. For example the ocean observations/desalination/deep sea exploration including mining/marine biotechnology / marine instrumentation and the projects of similar nature have very high potential to meet the National requirements and would fall into this category.

The existing policies in respect of involving the industries, partnering with other national agencies and to utilize the specially trained manpower in ocean development are to be reviewed and revised to enhance the efficiency and output of the Organization.

Ships are the essential tools for NIOT to carry out field trials on a continuous basis. For smooth and speedy operation of the developments undertaken by them, certain operational flexibilities are important and NIOT has to be enabled suitably.

The present administrative and related procedures sometimes lead to inflexibilities in smooth operation. The Committee recommended the review of the same at higher level of management at NIOT and at the Department.

MEETINGS / TRAININGS

- **Brainstorming session for Strategy Document** on Atmospheric and ocean technology was held at NIOT Chennai during April 5-7, 2016. Experts in the fields marine bio technology, atmospheric technology and ocean technology from R&D and academic institutes attended the respective sessions during April 5-7, 2016.
- Study visit of the **Parliamentary committee** took place on June 28, 2016 at Kodaikanal and the committee appreciated the technological achievements of NIOT.
- The **Independent Review Committee** constituted by MOES for reviewing ongoing projects in NIOT under O-STORM (Technology) conducted the meeting for two days in October 2016, completed the review and sent their report on recommendations on October 31, 2016.
- The **Peer Review Committee** meeting Chaired by Dr.K.Kasturirangan, was held on November 16-17, 2016 at NIOT. The committee reviewed the programmes, manpower, budget and other aspects and appreciated the achievements of the institute.
- Brainstorming on Energy - One day session on "Brainstorming on the Roadmap to Ocean Energy Development in India" was conducted on 27th March 2017.



Fifth Session of the IOC Regional Committee for Central Indian Ocean (IOCINDIO-V)

The 5th Session of IOC Regional Committee for Central Indian Ocean (IOCINDIO) meeting was organised in Chennai from 25th to 27th April 2016. This meeting was hosted by National Institute of Ocean Technology, Ministry of Earth Sciences, Govt. of India, Chennai and it was initiated under the agreement between the Ministry of Earth Sciences, Government of India and the Intergovernmental Oceanographic Commission of United Nations Educational, Scientific and Cultural Organization (IOC/UNESCO). Discussion on regional cooperation, scientific understanding, challenges faced in this region such as coastal hazards, monsoonal pattern, climate change, fisheries were held. Dr.M.A.Atmanand, Scientist-G, spoke about ocean technological developmental activities of NIOT which was very well received by the participants. Dr.R.Venkatesan, Scientist-G & Programme Director of Ocean Observation Systems, NIOT coordinated the programme.



Ocean Technology Students' Camp 2016 (OTSC 2016)

Marine Technology Society (MTS) India Section in association with IEEE Oceanic Engineering Society (OES) India Council and National Institute of Ocean Technology (NIOT) organised a one day Ocean Technology Students' Camp (OTSC 2016) on 3rd September 2016 at NIOT Campus. More than 65 students from 15 schools participated in the camp. A quiz competition on Ocean Technology was conducted for students as part of the camp. Fifteen teams participated in the quiz competition. The students were taken to Chennai port during noon session to get knowledge on port activities.



- Dr.J.Thomas Farrar, Associate Scientist, Department of Physical Oceanography, Woods Hole Oceanographic Institution, USA visited National Institute of Ocean Technology (NIOT) during 11th to 14th July 2016 as part of the Indo-US project ASIRI-OMM, under Monsoon Mission programme of MoES. He also delivered a lecture on “Use of Surface Moorings for the Air-Sea Interaction Research at WHOI”.
- Imparted training on met equipment for Met Asst Trainees from Met Training Squadron at Air Force Station Tambaram, on 22nd December 2016.
- OOS coordinated the industrial visit for students on Electrochemistry & Corrosion camp (ECG 2016) held at NIOT campus on 12th August 2016, wherein 90 students and 12 teachers from 12 Schools participated.



CONFERENCES / WORKSHOPS

National Workshop on Ballast Water Management (NWBM 2016)

Organised the first National Workshop on “Ballast Water Management (NWBM 2016)”, on October 7, 2016 at NIOT, Chennai. This was a pioneering initiative towards generation of awareness on ballast water management issues faced by the country.



National Conference on Recent Trends in Biotechnology (BioTrends-2016)

National Conference on “Recent Trends in Biotechnology (BioTrends-2016)”, jointly with Society for Biotechnologists India (SBTI) was conducted at NIOT Chennai, during October 19-21, 2016 and more than 100 participants including research scholars, faculty and scientists from different organizations attended the workshop.



National workshop on Passive acoustic sensors, measurements and calibration

A National workshop on “Passive acoustic sensors, measurements and calibration”, was conducted on 14th October, 2016 at NIOT and researchers and scientists from various organizations such as Navy, Fisheries, IIT and NIO participated.



Ocean Technology Workshop 2016

The Workshop was attended by a total of 66 participants from 13 organisations, and provided them with a common platform to share their experiences and ideas on ocean currents. Experts from Teledyne RD Instruments, Blueview and Codar Ocean Sensors spoke about the latest technologies in their respective fields, and supported the attendees by answering their queries related to the technology and its applications.



STAFF RECREATION CLUB /STAFF WELFARE ACTIVITIES

STAFF RECREATION CLUB (SRC) has conducted various events for kids and family members of NIOT/ICMAM staff members. The SRC has conducted 16 sports events for the staff members (Men/Women) under 42 categories during July / August 2016 and distributed 188 certificates and prizes for the winners. Followed by the prize distributions, a magic show was organized and performed by a Professional Magician at Panikkar Hall on 15th August 2016. The 67th Republic Day was celebrated in NIOT with due honor and gaiety.



Magic show programme



Prize distribution to the children

Independence Day Celebration

The 70th Independence Day celebration was conducted at NIOT on 15th August 2016. Dr.M.V.Ramanamurthy, Scientist G, NIOT hoisted the national flag. The staff recreation club organized various events such as Puzzle arrangement, beading, sack race and musical bus games and prizes were distributed. The prizes for various sports events conducted by SRC for the staffs during July-August 2016 are also distributed on the day.



Republic Day Celebrations

The 68th Republic Day was celebrated at NIOT on 26th January 2017. Dr.Purnima Jaliha, Scientist-G, NIOT hoisted the national flag in front of the main building. All the children of staff members were invited and various competitions like ball collections, duck race, sack race, and lemon and spoon race were conducted and prizes were distributed to the winners.



International Women's Day Celebration

International Women's Day was celebrated during March 8-9, 2017 by conducting various competitions for women. Hon'ble Tmt Justice Pushpa Satyanarayana of Madras High court graced the occasion as Chief guest and delivered a talk on empowerment of women. Prizes were distributed to the winners.



STUDENT AUTONOMOUS UNDERWATER VEHICLE (SAVe)

Ocean Observation System organizes a competition for students pursuing engineering degree to visualize and design an autonomous underwater vehicle. The main focus of this competition is to involve students on the new frontier areas of ocean technology and kindle their innovative thinking in this unexplored area of ocean environment and observation. NIOT will support the winning team with their technical expertise and also sponsor for the International competition being held annually in AUVSI foundation San Diego, USA.

Final phase of National Competition on Student Autonomous underwater Vehicle (SAVe) 2016 held at Euro Retreat, Uthandi, Chennai on 14th December 2016. Six teams demonstrated their working models at the testing facility arranged at the Swimming Pool.



A technical committee inspected the system and interviewed the students on the design and functionality of their AUVs. Indian Institute of Technology, Bombay emerged as the winner followed by Indian Institute of Technology, Kanpur in the second place and National Institute of Technology, Rourkela in the third place.

Dr. Manu Korulla, Chairman of the technical committee interacted and reviewed the student teams during the practice session on 13th December 2016. The committee co-opted the experts Commodore S.Shekhar, Navy Foundation, Inspector General S P Sharma (Retd.), Dr.G.Latha, Head, Ocean Acoustics and Shri S.O.Dinesh Babu, General Manager, Results Marine, to evaluate the student teams. Rear Admiral Alok Bhatnagar, NM, Flag Officer, Tamilnadu, Puducherry Naval Area, Navy Office, Chennai was the Chief Guest of the Competition.

ISO Certification

- NIOT has obtained ISO 9001: 2008 certification for the administrative sections such as Strategic 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 Human Resource Development. Internal audit of the ISO 9001:2008 standards have been completed and the corrective actions taken with regard to Non Conformity reports have been complied with. The surveillance audit was successfully completed for the year 2016.

Visit of Dignitaries

NIOT Foundation day

- On the occasion of the 23rd Foundation Day of NIOT held on 17th November 2016, Dr.K.Kasturirangan, Former Chairman, ISRO was invited as the Chief Guest. A lecture was delivered by the Chief Guest and he visited various facilities of NIOT.



- Mr.Phillip A. Min, Consulate General and Mr.Bharath Kumar from US Embassy, Mr.Ari Nathan, Director, Regional Environment, Science, Technology and Health (ESTH), Office for South Asia based in the US Embassy, Kathmandu visited and appreciated the OOS facilities on 8th April 2016.

SWACHH BHARAT ACTIVITIES

As part of Swachh Bharat Mission, Swachhta Pakhwada was conducted from April 13, 2016 to April 27, 2016 during which a spot competition was organized to identify modes and methods of spreading awareness about caring for the earth and cleanliness. Children of NIOT employees were invited for drawing competition on 'Clean and Green Earth'.

Further, to promote a clean and eco-friendly environment, it was decided by NIOT to utilize the biodegradable waste in a productive manner. The biodegradable waste was segregated into two categories,

- (i) fallen leaves of trees, decaying shrubs and mowed grass from the lawns and
- (ii) vegetable peelings from the NIOT canteen.

The waste was disposed in a proper method to create a zero waste campus.

Fallen leaves of trees, shrubs, lawns and other biodegradable wastes from the canteen are used in the vermiculture process to compost the solid wastes. Vermiculture is artificial rearing or cultivation of worms (Earthworms) that are rich in humus. NIOT manufactures the manure using vermiculture method through Self Help Grouzp. All the biodegradable solid wastes are reused and quality manure is obtained to nurture the lawns and gardens of NIOT in addition to mitigating environmental pollution.



Earthworms (African)



Earth worms are being fed into the pit. Earth worms breakdown the organic matter and create a heterogeneous mixture rich in water-soluble nutrients



Compost harvesting by Self Help Group

NIOT has a canteen which caters to about 300 staff. Type of wastes generated in the canteen include leftover food, tea powder wastes and starch generated from draining of cooked food. Approximately 50 to 75 kg of waste is generated from the canteen. Two biogas plants, Shakthi-Surabhi which is a kitchen waste based biogas plant, of capacity 6m³ each have been installed



Two biogas units adjoining the NIOT canteen

adjacent to the canteen and the biogas is used for heating milk and preparation of tea and coffee in the canteen.

A sewage treatment and re-use plant unit (based on Root Zone Treatment Technology) has been installed in the NIOT campus for treatment of 30 m³ per day of wastewater generated in the campus from the toilets, laboratories and canteen. Sewage generated in NIOT campus is treated using the decentralized wastewater treatment systems (DEWATS) and reused for irrigation of the lawns and maintenance of plants on the campus. There are no mechanical devices like aerators, clarifiers etc, involved in this process making it energy efficient. The process is unmanned requiring negligible maintenance / supervision. The treatment is cost effective as about 25m³ of treated water from the pond is used for horticulture purpose thereby reducing the load on water supply. The entire lawns and gardens of NIOT are being maintained using treated water from the DEWATS system.

NIOT campus is therefore a 'zero discharge' campus as all the bio degradable waste is recycled within the campus and utilized for creating a green campus.

AWARDS

- Dr.R.Venkatesan, Scientist-G, Mr.M.Arul Muthiah, Scientist-D, Dr. K.P. Krishnan, Scientist-D (NCAOR) and Mr.B.Kesavakumar, Scientist-C have been awarded **NATIONAL GEOSCIENCE AWARD – 2014 by the President of India, Shri Pranab Mukherjee** in recognition of significant work/contribution in the field of Glaciology and Arctic & Antarctic Research on 5th April 2016, held at Rashtrapathi Bhavan, New Delhi.



- Dr. M.A. Atmanand, Scientist-G was awarded with Institution of Electrical and Electronics Engineers Inc. (IEEE) Oceanic Engineering Society's (OES) "**Presidential Award**" for his outstanding services to the (IEEE) Oceanic Engineering Society as a volunteer on 21st Sep 2016 during the IEEE/MTS Oceans conference held at Monterey, USA.

- Dr.G.Latha, Scientist F and Head - Ocean Acoustics, received **M.S.Narayanan Memorial Lecture Award of the Acoustical Society of India** for the year 2016 from Prof. M.L.Munjal, on 18th November 2016 at KIIT Gurgaon, and delivered a lecture entitled "Ambient noise measurements in the Polar region and noise characterization".



- Mr. D. Rajasekhar, Scientist-F, Head-VMC received the prestigious '**National Design Award [Mechanical Engineering]**' during December, 2016 for outstanding contribution in the field of Engineering Design that involved implementation of numerous innovative, low cost and highly

- Mr. D. Rajasekhar, Scientist-F, Head-VMC received the Honorable 'Director General Indian Coast Guard Commendation Award' during February, 2017 for repairing the hole on Sagar Nidhi underwater hull in an innovative way in a short time that resulted in ship's sailing for Search and Rescue (SAR) operations of missing Aircraft AN 32 [Indian Air Force].
- Dr. N. V. Vinithkumar, received award for Fellow of the Andaman Science Association, Andaman Science association, ICAR-CARI, Port Blair.
- Dr. T. Satish, received Dr. S. Dam Roy young scientist award, Andaman Science association, ICAR-CARI, Port Blair
- Dr. R. Sendhil Kumar, received Kunnath Pharmaceuticals Award for best original paper presentation (oral) in Herbal medicine and disease management, National Conference on Recent Trends in Biotechnology (BioTrends-2016) and Annual Meeting of Society for Biotechnologists India (SBTI).
- Dr. Mary Leema Thilagam, received IBS Award for best oral presentation in Medical Biotechnology/ application of software technologies in medicine, National Conference on Recent Trends in Biotechnology (BioTrends-2016) and Annual Meeting of Society for Biotechnologists India (SBTI).
- Ms. Pradnya Meshram, received KAPL Award for best oral presentation in Industrial Biotechnology, National Conference on Recent Trends in Biotechnology (BioTrends-2016) and Annual Meeting of Society for Biotechnologists India (SBTI)
- Ms. Archana Vijayabhaskar (PhD student, MBT, NIOT), received Hindi Poster presentation – second prize, National Conference on Recent Trends in Biotechnology (BioTrends-2016) and Annual Meeting of Society for Biotechnologists India (SBTI)

MoES Award

The following staff of NIOT have received the MoES awards for the year 2015-16 during the Foundation Day of Ministry of Earth Sciences (MoES), held on July 27, 2016 at New Delhi.

- The "Certificate of Merit" young Scientists / Engineers Award in the field of Ocean Sciences and Atmospheric Sciences have been awarded to: Shri Prasad Dudhgaonkar, Scientist-D
- The "Award of Best Employees" have been received by the following staff:
Shri A.Vadivelan, Scientific Assistant Gr.'B'
Shri J.A.Rajan, Technician Gr.'B'
Shri P.Jayaprakash, Multi-tasking staff

Patents granted

1.	M.Ashokan, G.Latha, G.Raguraman, A.Thirunavukkarasu	A computer implemented System for transmitting High frequency Ocean ambient noise in Real time (SHOR)	Granted ref no.20 2016 003 923 Dt.24.6.2016	Germany
2.	DhilshaRajapan, Kathiroli.S	*Broad band transducer for marine applications	Granted ref. no.278301 dated 20.12.2016	India

Patents filed

1.	Ashokan M Latha G Raguraman G Thirunavukkarasu A	A computer implemented System for transmitting High frequency Ocean ambient noise in Real time (SHOR)	201641014462 dated 07.05.2016	India
2.	Mary Leema Thilagam Magesh Peter D Kumar T.S ThirupathiT Dharani G KirubagaranR Atmanand M.A	Process for the production of Lutein	201641017567 dated 21.05.2016	India
3.	Muthu Kumaravel S Tata Sudhakar Thangarasu	A wireless based expandable temperature profiling system	201641027237 dated 9.8.2016	India
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A.Malarkodi, G.Latha	Underwater Acoustic Transducer Test Facility	Ocean Digest - Quarterly Newsletter of the Ocean Society of India	2017

Nucleotide Sequence submitted in gene bank = 60

Sl.No.	Authors	No. of Sequences
1.	Meena B, Anburajan L, Rajaguru S, Rajaprabhu G, Senthil Kumar S, Vinithkumar N V, Dharani G, Kirubakaran R.	15
2.	Meena B, Anburajan L, Vinithkumar N V, Dharani G, Kirubakaran R.	18
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4.	Siva Gayathri K, Limna Mol V P, Verma P, Saravanan N, Masilamani Selvam M, Dharani G, Kirubakaran R.	8
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7. Rajaprabhu G, Kirubakaran R, Sureshkumar C, Santhanakumar J, Rasheeda M K, Senthil kumar R, Dharani G, "*Asian seabass (*Lates calcarifer* (bloch, 1790) culture in open sea cages at olaikuda, Tamil nadu south east coast of india*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.

8. Guru Krishna Kumar V, Vijaya Raghavan R, Lokesh B, Krittika R, Sivakumar D, Sharad G, Kirubakaran R, "*High throughput screening of peptidomimetic small molecule inhibitors for Tau protein fibrillization*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
9. Archana J, Ganesh kumar A, Venkatesh S, Noelin Chinnu M, Dharani G, Revathi K, Kirubakaran R, "*Screening of Secondary Metabolites from Deep Sea Fungi*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
10. Mary Leema J.T, Kirubakaran R, Dharani G, Padmini J, Magesh Peter D, Kumar T S, Thirupathi K, Priyanka S, Josephine A, Sucheta S, "*Mass Production of lutein with biomedical application from marine microalgae*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
11. Mary Leema J.T, Kirubakaran R, Stefie M, Sandhya S, Karthik A, Dharani G, Magesh Peter D, "*Effect of hyper and hypo osmotic stress on xanthophyll carotenoids biosynthesis in marine microalgae *Chorella sorokiniana* (NIOT-2)*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
12. Mary Leema J.T, Kirubakaran R, Kiran R, Sreelatha T, Dharani G, Magesh Peter D, "*Comparative evaluation of natural vs synthetic flocculants for the flocculation of marine microalgae *Chorella pyrenoidosa* (NIOT -45)*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
13. Josephine A, Vijay Raghavan R, Kumar T.S, Magesh Peter D, Salman A, Dharani G, Kirubakaran R, "*Genetic modification of marine microalgae for enhancing biofuel production: challenges and prospective*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
14. Srikumar M, Deepa S, Dilip Kumar Jha, Magesh Peter D, Sreelatha T, Vinithkumar N.V, Kirubakaran R, "*Studies on nutraceutical properties of macroalgae based functional food*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
15. Dheenani P.S, Vinithkumar N.V, Dharani G, Kirubakaran R, "*Comparison of antioxidant potential of marine microalgae from Andaman Islands*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.

16. Venkateshwaran P, Manmadhan K, Meena B, Vinithkumar N.V, Sendhil Kumar R, Dharani G, Kirubakaran R, "*Nursey rearing Asian seabass seeds using indigenously designed nursery cages at Andaman and Nicobar Islands*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
17. Pradnya M, Dave R, Joshi H, Kirubakaran R, Venugopalan V.P, "*Green technology to mitigate membrane fouling*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, 19-21 October, 2016.
18. Sendhil Kumar R, Santhana kumar J, Rasheeda M.K, Dilip Kumar Jha, Suresh kumar C, Rajaprabhu G, Manmadhan K, Dharani G, Kirubakaran R, "*An engineering and technological initiative towards farming the ocean*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
19. Priyanka S, Kirubakaran R, Mary Leema J.T, Pankaj Verma, Dharani G, "*Phenotypic and genotypic characterization of zeaxanthin producing dunaliella (chlorophyta) strains isolated from salt pans of Tamil Nadu*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
20. Kumar T.S, Rajakuamar S, Josephine A, Mary Leema J.T, Magesh Peter D, Dharani G, Kirubakaran R, "*Effect of molasses on the enhancement of growth and carotenoids production of marine microalgae strain Chlorella vulgaris*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
21. Manmadhan K, Venkateshwaran P, Vinithkumar N.V, Sendhil Kumar R, Dharani G, Kirubakaran R, "*Evaluation of growth performance of Asian Seabass fish *Lates calcarifer* in open sea cages at North bay, Port Blair, Andaman Islands, India*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
22. Sathish T, Vinithkumar N.V, Kirubakaran R, "*Production of cellulase from *Sargassum cinereum* biomass and evaluation of its saccharification potential for renewable bioenergy*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
23. Venkateshwaran P, Manmadhan K, Meena B, Vinithkumar N.V, Sendhil Kumar R, Dharani G, Kirubakaran R, "*Nursey rearing Asian seabass seeds using indigenously designed nursery cages at Andaman and Nicobar Islands*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.

24. Vishnu Priya P, Pankaj Verma, Dharani G, Ashok Kumar S, Kirubakaran R, "*Taxonomic investigation and bioprospecting evaluation of a novel taxa streptomyces sp. NIOT-Ch-40 isolated from deep sea sediments of Bay of Bengal*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
25. Archana V, Shiv Gayathri Kola, Limna Mol V.P, Saravanan N, Dharani G, Revathi K, Kirubakaran R, "*Role of ferric ion and glucose in Siderofor origins by Vibrio Campbelli*", **National conference on Recent Trends in Biotechnology**, held at NIOT, Chennai, October 19-21, 2016.
26. Kathavate V.S, Amudha K, Adithya L, Ramesh N.R, Ramadass G.A, "*Hydrostatic Behavior of Polymer-Carbon Fiber Reinforced Composite for Subsea Application*", **National Conference on advanced functional materials processing and manufacturing (NCAFMPM-2017)**, CSIR-Central Mechanical Engineering Research Institute, Duragapur, February 2-3, 2017.
27. Arathy R Nair, Tata Sudhakar, "*Modified ANN algorithm for the detection and characterization of Tsunami*", **National conference on disaster mitigation, responsiveness and management**, organized by SSN College of Engineering, Chennai during February 3-4, 2017.

INVITED TALKS

Dr. Purnima Jaliha

- Seawater Desalination – a possible answer to the water crisis?, 28th July at PHD House, New Delhi at the Conference on Water Desalination for 21st century-perspective, opportunities and challenges, organized by PHD chamber of Commerce and Industry, (Guest of Honor).
- The Energy and Water Crisis – Can Oceans be a possible solution, VIT, 2nd November 2016.

Dr. G A Ramadass

- Invited talk on “Underwater Vehicles”, at National Technology Foundation day function, NPOL, Kochi on 11th May 2016.

Dr. M.V.Ramana Murthy

- “Restoration of Beach along Puducherry using Hybrid solution”, conference on Hydraulics, Water Resources, Coastal and Environmental Engineering, Pondicherry Engineering College, Pondicherry, October, 2016.
- “Offshore wind farms for India”, 104th Indian Science Congress at Sri Venkateswara University, Tirupati, January, 2017.
- “Engineering Application of Sea Level Analysis”, Training on Tides and tidal data analysis, INCOIS, Hyderabad, June, 2016.
- “Recent trend in Shoreline Management”, Workshop on Climate Resilient Coastal Protection and Management Project, National Water Academy (NWA), Pune, July, 2016.
- “India and Ocean Economy - An Overview”, Seminar on Indian and the Ocean Economy, Indian Council of Work Affairs, New Delhi, July. 2016.
- “Offshore Wind Development in India”, FOWIND Bangalore, August 2016.
- “Ocean Renewable Energy”, Global Initiative of Academic networks (GIAN), National Institute of Technology Karnataka Surathkal, Mangalore, November 2016.
- “Shoreline Management along Indian Coast - Future directions”, National Symposium on Climate Change and Coastal Vulnerability (TROPMET-2016), Bhubaneswar, Odisha, December, 2016.

Dr.R.Venkatesan

- A guest lecture on “Bio-inspired designs: Summerfest” at VIT University, Vellore on 21st April 2016.
- Chief Guest address at Velammal School on 9th July 2016.
- Invited talk on “Coastal Natural Hazards in Bay of Bengal: Mitigation measures” at Sri Venkateswara University, Tirupati on 25th July 2016.
- Delivered keynote address on “Ocean Technology and Observation” at the International Symposium, CSIR NIO, Goa on 5th December 2016.
- A lecture on "Disaster Mitigation, Responsiveness and Management" during the

conference held at SSN College of Engineering, Chennai on 4th February 2017.

- A lecture on “Ocean Measurements and Research”, at IIT Kharagpur during March 15-16, 2017.

Dr.Dhilsha Rajapan

- Invited talk on “the importance of scientific research and recent achievements” in Convergence 2017 symposium held at Sri Sairam Engineering College, Chennai on 2nd March 2017.

Mr.D.Rajasekhar

- Delivered Key Note address on “Vital Role of Research Ships” during International Conference on Shipping: Indispensable to the World (IMO Theme For 2016).
- Inaugurated the National Conference on Remote Sensing conducted by AMET University & delivered the Key Note address.
- Attended Safety at sea seminar conducted & Pollution Control by Indian Coastguard.
- Invited talk on 'Underwater mapping' at AMET University.
- Participated in Panel discussions in International/National conferences conducted by Institute of Engineers.

Dr.G.Latha

- “Time series observations of ocean ambient noise for acoustical oceanographic applications”, Second Annual meeting of IQOE, January 27-28, 2017, London.
- “Passive acoustic system and time series measurements in shallow waters”, National workshop on Passive acoustic sensors, measurements and calibration, October 14, 2016, NIOT.
- “Application of Soft computing Techniques for estimation of oceanographic parameters”, Workshop on “Computational Intelligence Techniques”, October 20-21, 2016, MIT, Anna University.
- “Underwater Acoustic Communication for Ocean applications”, Inaugural lecture, UPAGRAHA-16, Technical symposium, Sri Vekateswara College of Engineering, Sriperumbudur, August 27, 2016.

Dr.S.Ramesh

- Invited talk on "Marine Geology – Survey, Sampling and Underwater Vehicles" at the National workshop on Climate change impact on the Marine Environment at Bharathidasan University, Trichy on 3rd February 2017.

Dr. G. Dharani

- Invited talk on “Marine Microalgae Culture for Nutraceuticals & Biofuel Production” in National Seminar on ‘Marine Biotechnology Current Trends and Future Perspective’ at Justice Basheer Ahmed Sayeed College for Women on 16th February 2017.

Dr. N. V. Vinithkumar

- Invited talk on “Application of bioinformatics to Mainstreaming of Marine Biodiversity National workshop on Mainstreaming Coastal and Marine Biodiversity of India at ZSI, Port Blair, on 23rd to 25th March 2017.
- A lecture on “Emerging trends in Marine Biotechnology and Marine Bioinformatics: A Perspective” at Department of Ocean Studies and Marine Biology, Pondicherry University for INSPIRE programme conducted between 26th to 30th December 2016.

Dr. G Venkatesan

- “Issues related to Thermal Power Plants” on 21st May 2017 in VIT – Vellore Campus.
- “Research issues and challenges in Ocean technology” on 20th August 2016 in KCG college of Technology, Karapakkam, Chennai.
- “Recent trends in design aspects on desalination system” on 8th August 2016 in AVIT, Kancheepuram district.
- “Clean and Potable Water” on 5th July 2016 in SBIOA Educational trust, Chennai, Tamil Nadu, on account of Technology Vision 2035 conducted by Technology Information, Forecasting and Assessment Council (TIFAC).
- “Research issues and challenges in Ocean technology” on 27th April 2016 in Sri Venkateswara College of Engineering, Sriperumbudur, Tamil Nadu.
- “Studies on small scale OTEC powered Seawater Reverse Osmosis Plant” on 9th April 2016 in Mechanical Engineering Department, Anna University, Chennai, on account of Indo – UK workshop on World Water Day Celebration 2016.

INTERNATIONAL COLLABORATION

- India became a member of IEA-OES with NIOT being the nodal agency on April 27, 2016 allowing India to now have access to advanced R&D components and technologies related to ocean energy being practiced across the world.
- As part of National Monsoon Mission program, India-UK collaborative project on “Impact of ocean atmospheric processes in the Bay of Bengal on the South Asian monsoon - Bay of Bengal Boundary Layer Experiment (BOBBLE)”, has been taken up and the major field experiment in the international waters of Bay of Bengal onboard ORV Sindhu Sadhana commenced on June 24, 2016 with the participation of academic institutions from India and UK
- Under Indo-South African Collaborative programme, NIOT – DEA meeting was held during July 25-29, 2016 on ocean observations. A series of lectures on topics of ocean observations including laboratory sessions was organized by NIOT/INCOIS/ICMAM. The SA delegation is appreciative of the meeting and they look forward for future interaction and signing of MoU.
- Joint collaboration between NIOT & Virginia Tech Centre: A meeting was organized with Virginia Tech Centre for Advanced Research and Education, Chennai on August 9, 2016 for joint collaboration proposal with National Institute of Ocean Technology.
- Indo-US collaboration- Ocean Monsoon and Mixing: As part of Indo-US partnership program Air-Sea Interactions Regional Initiative-Ocean Mixing and Monsoon (ASIRI-OMM), an analysis workshop was held at Indian Institute of Technology Madras during January 4-7, 2017. The analysis workshop was followed by a science meet during January 9-12, 2017 at the same venue. Besides, the platform was used for furthering the ongoing discussions with scientists from Woods-Hole Oceanographic Institution regarding the improvements of buoy mounted sensors as well as quality control of the data. Participants in both the program include scientists from leading oceanographic research institutes in US such as Woods-Hole Oceanographic Institution, Scripps Institution of Oceanography, and Colorado State University as well as several leading research organizations from India. Scientists from OOS actively participated and presented their works in the analysis workshop and science meet.

DEPUTATION ABROAD

S No	Name of the Official	Place of Visit	Purpose	Period
1.	Dr.Purnima Jalihal	Sweden	To attend the 30 th Executive Committee meeting of IEA-OES.	9 th to 12 th May 2016
2.	Dr.Jossia Joseph	USA	To attend the science workshop on the Circulation and Science of the Bay of Bengal	9 th to 13 th May 2016
3.	Shri R.Nishath	Mauritius	To participate in the Scientific Equipments Operation onboard Sagar Nidhi and to assist in the installation, commissioning and listing of repaired STBD azimuth thruster system of ORV Sagar Nidhi	1 st June to 22 nd July 2016
4.	Shri Sheik Meeran Mohideen			20 th April to 22 nd July 2016
5.	Dr.R.Venkatesan	Poland	To attend the Global Ocean Observation System (GOOS) Steering Committee meeting	1 st to 3 rd June 2016
6.	Dr. G.Venkatesan	UK	To discuss about Green House Desalination & Solar Desalination including Cooling System at Aston University, UK	4 th to 13 th June 2016
7.	Dr.M.A.Atmanand	France	To present the reports of the activities at IOCINDIO, Paris, France	7 th to 10 th June 2016
8.	Shri N.Ravi	Mauritius	To oversee the installation, commissioning and listing of repaired STBD azimuth thruster system of ORV Sagar Nidhi	4 th to 22 nd July 2016
9.	Shri P.S.Deepak Sankar			

S No	Name of the Official	Place of Visit	Purpose	Period
10.	Shri B.Kesavakumar	Norway	To participate and to initiate logistic arrangements for the proposed retrieval and redeployment of IndARC multi-sensor mooring in Longyearbyen and Ny-Alesund (Arctic)	20 th July to 1 st August 2016
11.	Shri A.Thirunavukkarasu			
12.	Shri P.Senthil Kumar			
13.	Shri S.Elango			
14.	Shri M.Ashokan			
15.	Shri C.K.Kalaivanan			
16.	Dr.Satheesh C.Shenoi	Japan	To visit JAMSTEC Laboratories in Japan	9 th to 12 th August 2016
17.	Dr.G.A.Ramadass			
18.	Dr. R.Kirubakaran	New York, USA	To participate in the meetings of the preparatory committee to negotiate an agreement on Marine Biological Diversity beyond National Jurisdiction in United Nations	6 th to 9 th September 2016
19.	Dr. G.Dhinesh	Scotland, UK	To attend Technical Session and the pre-conference on Offshore Renewable Energy CORE-2016 jointly organized by IIT Bombay and University of Edinburgh	10 th to 18 th September 2016
20.	Shri Satya Kiran Raju Alluri			
21.	Dr. M.A.Atmanand	Washington, USA	Conference "Our Ocean One future"	12 th to 23 rd September 2016
22.	Dr. R.Venkatesan	USA	To attend the 32 nd Session of the Data Buoy Cooperation Panel (DBCP) and 36 th Session of ARGOS Joint Tariff Agreement meeting at La Jolla, California, USA	17 th to 26 th October 2016

S No	Name of the Official	Place of Visit	Purpose	Period
23.	Dr. Purnima Jalihal	Singapore	To attend the 31 st Executive Committee meeting of IEA-OES at Nanyang Technological University	19 th to 22 nd October 2016
24.	Shri K.Gopkumar	Singapore	To attend the 2 nd Annual Asia-Pacific DSM Summit at Singapore	9 th to 10 th November 2016
25.	Shri N.R.Ramesh			
26.	Dr. R. Kirubakaran	The Netherlands	FA7-High Pressure Retainable water sampler	9 th to 13 th January 2017
27.	Shri N.R.Ramesh			
28.	Shri K.Thirupathi			
29.	Dr. G.A.Ramadass	Japan	To attend the meeting headed by Secretary, MoES with JAMSTEC	25 th to 26 th January 2017
30.	Dr. G.Latha	London, UK	To participate in the Second annual meeting of International Quiet Ocean Experiment under Scientific Committee of Oceanic Research(SCOR) and Partnership for Observations of Global Oceans (POGO)	27 th to 28 th January 2017
31.	Shri AN.Subramanian	Korea	To attend the Symposium and to present two papers for the 10th International Symposium on Underwater Technology 2017	21 st to 24 th February 2017
32.	Dr. M.A.Atmanand	Japan	To attend the IEEE-Region 10 meeting	4 th to 5 th March 2017

MEMBERSHIP IN COMMITTEES

Dr. SSC Sheno

Member/chair of several national and international committees

- Early Career Scientists Award Committee of the International Union of Geodesy and Geophysics (IUGG)
- Sectional Committee of Indian Academy of Science on Earth & Planetary Sciences
- Executive Committee of International Association for Physical Sciences of Ocean (IAPSO)/IUGG
- Editorial Board of Indian Journal of Geo-Marine Sciences, Current Science
- Research Advisory Committee of C-MACS, Bangalore
- Steering Group of Intergovernmental Coordination Group of Indian Ocean Tsunami Warning Services (ICG/IOTWS)
- Indian Delegation to IOC Executive Committee and General Assembly, etc.
- Co-chair, Steering Committee for International Indian Ocean Expedition-2 (IIOE-2) established by Intergovernmental Oceanographic Commission (IOC/UNESCO)
- Chair, Indian Ocean Global Ocean Observing System (IOGOOS)
- Chair, Union Commission for Data and Information of IUGG.

Dr.M.A.Atmanand

- Chair, Intergovernmental Oceanographic Commission for the Central Indian Ocean (IOCINDIO)
- 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).
- Chair IEEE Madras Chapter.
- Associate Editor of IEEE Journal of Oceanic Engineering.
- Member of Society of Underwater Technology (SUT).
- Member of Marine Technology Society (MTS).

Dr. R. Kirubakaran

- Member – Secretary of National Task Force for Ballast Water Management.
- Member, Coastal Aquaculture Authority of India.

- 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.Purnima Jalihal

- Member, Programme Advisory Committee - Water Technology Initiative, Department of Science and Technology (DST).
- Expert Member of RD&D Project Appraisal Committees (RDPACs) for Appraisal of RDD&D proposals for the Development of Ocean Energy in India at Ministry of New and Renewable Energy, New Delhi.
- Dr.SatheeshC.Shenoi and Dr.PurnimaJalihal – Indian Representatives in the Executive Committee for the Ocean Energy Systems under the International Energy Agency.
- Member of Expert Panel for OCEANERA-Net which is a cooperation between European countries and regions to support research and innovation in the ocean energy sector supported by the European Union. Only non European reviewer for funding of ocean energy proposals.
- Expert Member for IMPRINT, a flagship national initiative of the MHRD for proposal evaluation in the Water Resources & River Systems domain.
- Chairperson of Indian Desalination Association (South Zone) Executive Committee

Dr.M.V.Ramana Murthy

- Member, Pondicherry Coastal Zone Management Authority.
- President, Ocean State Forecast Projects INCOIS.
- National Experts, "Constitution of Panel of Experts, Climate Resilient Coastal Protection and Management Project, CWC.
- Member, Bureau of Indian Standard, on Cyclone Resistant Structures Sectional Committee, (CED-57).
- Member, Bureau of Indian Standards, Ports, Harbours and Offshore Installation Sectional Committee (CED-47).
- Member, Indian Road Congress (IRC) committee on Specialized Bridge Structures including Sealinks (B9).
- Corresponding Member, Indian Road Congress (IRC) committee on Loads and Stress (B2).

- Member, National Coastal Zone Management Authority, NCZMA.
- Member, "Expert Appraisal Committee for Proposal involving violation of EIA Notification, 2006", "Ministry of Environment, Forest and Climate Change".

Dr. G.A. Ramadass

- Member, IEEE Oceanic Engineering Society

Dr.R.Venkatesan

- Steering Committee Member (Asia/Oceania) of Global Ocean Observation System (GOOS) of UNESCO IOC Paris nominated by Government of India.
- India is represented in Data buoy cooperation panel by NIOT. Dr.R.Venkatesan elected as Vice chairman for Asia in the meeting held at WMO Headquarters, Geneva, Switzerland during 19th – 28th October 2015.
- Chair of international Tsunameter Partnership and Chair of Working group on Vandalism and is member of Indian Ocean Buoy programme and Moored buoy task force.
- Chairman for IEEE Oceanic Engineering Society India Chapter.
- National Consultant on Oil spill contingency plan for SACEP –NORAD- IMO project nominated by Government of India
- Chairman of Marine materials committee of Marine Technology Society USA.
- Chairman for the Marine Technology Society (MTS) India Section.
- Nominated for the international bodies as Steering Committee member of DOOS - Deep ocean observing system and steering committee member of ocean SITES.
- Elected as council member of Institution of Engineers(India)
- Editorial Board of two international Journals viz Journal of Shipping and Ocean Engineering and Journal of Ocean System Engineering

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
- Doctoral committee Member, Anna University, Chennai
- Doctoral committee Member, VIT , Vellore

Mr.D.Rajasekhar

- Technical Expert Member of Marine Engineering and Safety Aids Sectional Committee TED 19 under Bureau of Indian Standards [BIS].
- Expert Member for acquisition of Polar Research Vessel and Three new Research Vessels for NCAOR/MoES.
- Expert member constituted by DG Shipping on the fixation of port limits, provided inputs considering scientific interests such as shallow water survey, equipment trials in shallow waters and etc.
- Member Secretary – Joint Scientific and Technical Advisory Committee.
- Expert Member in Ship acquisition-GSI.
- Member Secretary – Project Monitoring and Coordination Committee-Acquisition of Two CRVs for NIOT/MoES.
- Chairman-Staff Welfare Committee, NIOT.
- Member in Technical Evaluation Committee (TEC) for Construction of India's Third Antarctic Station Bharati in Antarctica.
- Expert Member of Ship Acquisition Committee of Tamil Nadu State Fisheries Department.

Dr.G.Latha

- Member, Expert Committee for Young Scientist, Earth & Atmospheric science, Science and Engineering Research Board (SERB), Government of India.
- Member, Expert Committee for preparation of RFP for development of Decision Support System for cyclone warning, IMD
- Member, Acoustic Society of America.
- Member, IEEE Ocean engineering Society.
- Member, Marine Technology Society
- Member, India Meteorological Society.
- Member, Doctoral Committee, Anna University.
- Member, Doctoral Committee, Vellore Institute of Technology.
- Member, Doctoral Committee, Sathyabama University, Chennai.
- Life Member, Ocean Society of India

Mr Tata Sudhakar

- Member for Sai Ram Institute of Technology for reviewing DST Projects
- PRB committee member for procuring ARGO float for INCOIS
- Technical and Financial Evaluation committee towards MET Ocean Surface Flux Mooring for Ocean Mixing and Monsoon Project (OMM)
- Vice Chairman for Institute of Electronics and telecommunication engineering, Chennai Chapter
- JUARY for 7th international engineering project competition at Vel Tech University
- Participation of Industrial Institution Partnership for Vel Tech University

Dr.S.Ramesh

- Life Member, Ocean Society of India
- Executive Council Member, Tamilnadu Geologists Association

Cdr Gopkumar Kuttikrishnan

- Fellow, The Institution of Engineers (India)
- Member, The Institute of Marine Engineers (India)
- Senior Member, Indian Institution of Industrial Engineering
- Member, Society of Automotive Engineers (India)

Mr. N. Vedachalam

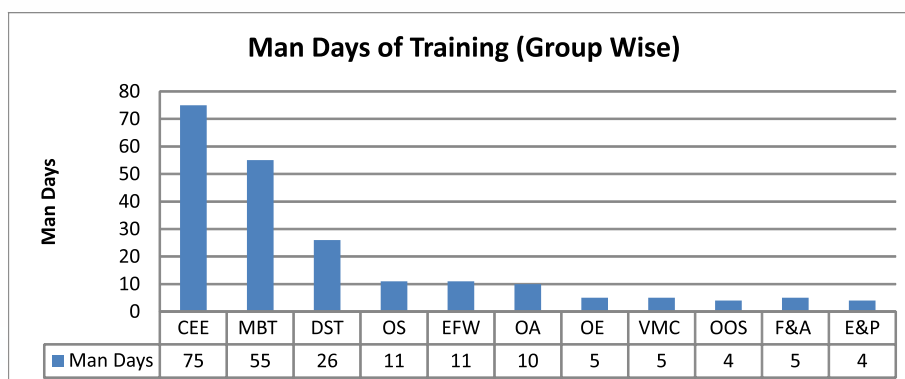
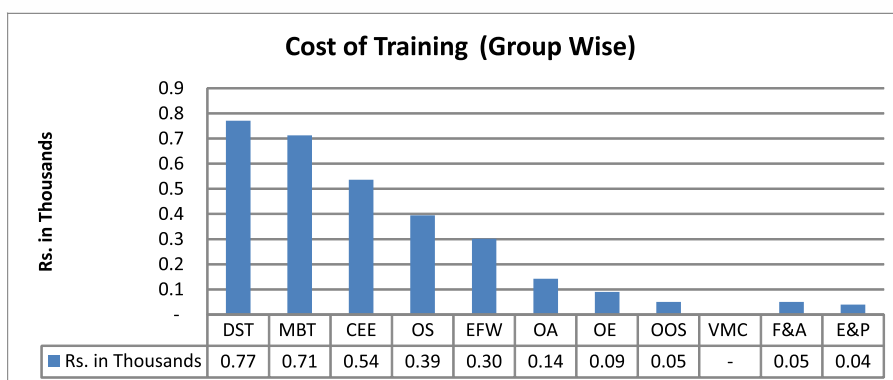
- Member, Marine Technology Society
- Member, Society for Underwater Technology
- Member, International Society of Offshore and Polar Engineers,
- Member, IEEE OES

HUMAN RESOURCE DEVELOPMENT

The section organizes training courses in the areas of engineering, software, project management, personality development, product trainings etc. Besides the external training courses, efforts are also made to conduct extra mural lectures by eminent personalities in other fields are beneficial for the employees.

The department also provides both short term (4 weeks to 6 months) and long term (one year or so) project training to students pursuing M.Tech or their equivalent degree programmes, at different educational institutions spread over the country in the field of ocean technology to fulfil their academic degree requirements. The project topics are ensured to bring value addition to NIOT activities from the student community. Around 88 students completed the project works in various departments of NIOT. About 87 UG students did their short term internships (minimum 2 weeks maximum 4 weeks) during the summer and winter vacation.

With regard to the staff external training, the section has coordinated trainings cumulating about 211 man-days costing about Rs.3 Lakhs. The section-wise break up is shown in the following graphs. The table with the technical and extramural training details is also presented.



Training/workshop underwent by NIOT Scientists and Technical Staff

Sl. No.	Name of the Staff	Training Programme and Conducted by	Duration
1.	Dr. L. Anbu Rajan Scientist - C	Hands on Workshop on "Next Generation Sequencing Analysis", at School of Life Sciences, Chennai	25 th Apr to 29 th Apr 2016
2.	Mrs. D Shyamala Varthini Scientist - C	Training Week on "Marine Modelling", at DHI India, New Delhi	2 nd May to 6 th May 2016
3.	Dr. Prasun Goswami Project Scientist - I	Hands on training on "Analysis of Seawater Quality Parameters (salinity and nutrients) under SWQM program", at ICMAM, Chennai	9 th May to 13 th May 2016
4.	Dr. D. Kezia Senior Research Fellow		
5.	Mr. S. Ramasundaram Scientist - D	Conference of Chief Information security officers of Ministries/Departments of Government of India organized by Intelligence Bureau, New Delhi.	25 th May 2016
6.	Dr. D. Sathianarayanan Scientist - D	National Seminar on "Porous Ceramics", at Raman Auditorium, AC Tech, Anna University, Chennai	27 th May 28 th May 2016
7.	Dr. K. Jossia Joseph Scientist - D	Science meet under Indo-US collaboration ASIRI-OMM, IISc. Bangalore	22 nd Jun to 29 th Jun 2016
8.	Mrs. Simi Mathew Project Scientist-I		
9.	Mr. K. N. Navaneeth Project Scientist-I		
10.	Mr. Phiros Shah Project Scientist-I		
11.	Mr. Phanindra Reddy SRF		
12.	Anand Kishore Scientist-B		
13.	Mr. Biswajit Halder Scientist-B		

Sl. No.	Name of the Staff	Training Programme and Conducted by	Duration
14.	Mr.P.Senthil Kumar Project Scientist-II	Interactive session on Mathematical modeling and simulation of underwater vehicles, IITM	30 th May 3 rd Jun 2016
15.	D.Gowthaman, Project Scientist-I		
16.	Jagadeesh Kadiyam Project Scientist-I		
17.	Mr.Elango Project Scientist-I		
18.	Mr.T.Raghu Project Scientist-I		
19.	K.Ramesh Scientific Assistant Grade C		
20.	Mr. Sridhar Muddada Scientist – C	STARCCM+ FOUNDATION Training at ITPL, Bangalore	7 th Jun to 9 th Jun 2016
21.	Mr.Satya Kiran Raju Alluri Scientist – C		
22.	Mr. D Magesh Peter Scientific Assistant, Grade B	A Workshop on "Evaluation of Research Projects for Planning the 36th – Indian Scientific Expedition to Antarctica" ,at NCAOR, Goa	9 th Jun to 10 th Jun 2016
23.	Mr.Yogiraj Gosavi Project Scientist - I	Training course on "Tides and Tidal Data Analysis", INCOIS, Hyderabad	13 th Jun to 17 th Jun 2016
24.	Mr.Gummadi Anil Kumar Project Scientist - I		
25.	Mr. M Vadivelu Project Senior Executive	"Leave Rules" at Regional Training Centre, Chennai	15 th Jun 2016

Sl. No.	Name of the Staff	Training Programme and Conducted by	Duration
26.	Mr.Arunraj K S Project Scientist - I	International Training course on "Emerging Trends in Ocean Observations and Ocean Data Analysis", organized by ITCO Ocean, ESSO-INCOIS, Hyderabad and POGO, UK	4 th Jul to 15 th Jul 2016
27.	Dr. Jossia Joseph Scientist - D		
28.	Mrs.Simi Mathew Project Scientist- I		
29.	Mr.K.N.Navaneeth Project Scientist - I		
30.	Mr.Phiros shah Project Scientist- I		
31.	Mr. V Sundramurthi Scientific Assistant Grade - B	"Basic Pump Design and Pump Material Selection", at Grundfos Pumps India Private Limited, Chennai	7 th Jul to 8 th Jul 2016
32.	Mr. N.R.Ramesh Scientist – E	"Programme in Use if Gleeble in Material Processing", at IIT Madras, Chennai	15 th Jul to 16 th Jul 2016
33.	Dr. D. Sathianarayanan Scientist – D		
34.	Mrs. K Vasanthi Executive	"Pay Fixation & FRSR" at Regional Training Centre, Chennai	18 th Jul 19 th Jul 2016
35.	Mr. M Vadivelu Project Senior Executive		
36.	Mrs. Anuradha Assistant Manager		
37.	Mrs. Vatchala Kuppuraman Senior Executive		
38.	Ms. T. Sreelatha Project Scientist - I	"LC Method Development Course", at Waters (India) Pvt. Ltd, Secunderabad	9 th Aug to 10 th Aug 2016

Sl. No.	Name of the Staff	Training Programme and Conducted by	Duration
39.	Ms. Sucheta Sadhu Project Scientific Assistant	National Conference on "New Trends in Biomedical and Pharmaceuticals Application of Marine Natural Products", NCMNP-2016 at Sathyabama University, Chennai	10 th Aug to 11 th Aug 2016
40.	Mr. C Balaji Project Scientist - I	"Basic Pump Design and Pump Material Selection", at Grundfos Pumps India Private Limited, Chennai	18 th Aug to 19 th Aug 2016
41.	Dr. S Sundararajan Scientist - D	"EIA – Professional Development Program", at NI-MSME, Hyderabad	22 th Aug to 24 th Aug 2016
42.	Dr. Prince Prakash Jeba Kumar, Scientist - D		
43.	Mr. T. Lokesh Project Scientist - I	"Hypack India 2016" at Bogmallo Beach Resort, Goa	29 th Aug to 31 st Aug 2016
44.	Mr. T Karthikeyan Project Scientific Assistant		
45.	Ms. Swathi Priyanka Project Scientific Assistant		
46.	Mr. Rajaprabhu Senior Research Fellow	International Conference on "Microalgae and Cyanobacterial Biotechnology (MACB-2016)", at Bharathidasan University, Tiruchirappalli	30 st Aug to 1 st Sep 2016
47.	Dr. V.P. Limna Mol Project Scientist - I	"Flow Cytometry: Basics & Application", at IIT Madras, Chennai	1 st Sep to 2 nd Sep 2016
48.	Mr. K Sriram Project Scientist - I	"Starccm+ C-D Adappco" Training at CD-adapco, Bangalore	7 th Sep to 9 th Sep 2016
49.	Mr. S. Ragumaran Project Scientist - I	National Workshop cum Hands on Training on "DNA barcoding – Molecular Analysis & Bioinformatics Approaches", at Islamiah College, Vaniyambadi	8 th Sep to 10 th Sep 2016
50.	Ms. S. Shanmuga Priyaa Project Scientist I	"Satellite Meteorology and Oceanography Research and Training (SMART)", Training Programme at Space Application Centre (ISRO), Ahmedabad	19 th Oct to 21 st Oct 2016
51.	Mr. S. Shankar Project Scientist I		

Sl. No.	Name of the Staff	Training Programme and Conducted by	Duration
52.	Mr.Kudadiya Tushar Project Scientist - I	Training on "Indian Ocean Currents: Data, Processing and Applications", at INCOIS, Hyderabad	7 th Nov to 11 th Nov 2016
53.	Mr.Arunraj K S Project Scientist - I		
54.	Dr. Vijaya Ravichandran Scientist - F	Pre-Conference Workshop for the 6 th Asian Regional Conference on "Geosynthetics" at CBI&P, New Delhi	7 th Nov to 11 th Nov 2016
55.	Mr.A.S.Kiran Scientist - D		
56.	Mr.C.Janarthanan Scientist - D	"Basic Pump Design and Pump Material Selection", at Grundfos Pumps India Private Limited, Chennai	10 th Nov to 11 th Nov 2016
57.	Dr. M Kalyani Scientist - C	"HYDRO-2016" International Conference at CWPRS, Pune	8 th Dec to 10 th Dec 2016
58.	Dr.N.V.Vinith Kumar Scientist - E	International Conference on "Climate Change Adaption and Biodiversity: Ecology Sustainability and Resource Management for Livelihood Security", at ICAR-CARI, Port Blair	8 th Dec to 10 th Dec 2016
59.	Dr.T.Sathish Project Scientist - I		
60.	Mr.R.Vijayaraghavan Project Scientist - I	"Liquid Chromatograph-Mass Spectrometer", at Waters (India) Pvt. Ltd, Bangalore	20 th Dec to 21 st Dec 2016
61.	Dr.J Mary Leema Thilakam Scientific Assistant Grade B		
62.	Mrs.L.Jenitha Juliet Junior Assistant	Programme on "Change Over from ISO 9001:2008 to ISO 9001:2015", at National Productivity Council, Chennai	22 th Dec to 23 rd Dec 2016
63.	Mr.G.Raguraman Scientific Assistant Grade C	Labview Proficiency Improvement Program – "Certified Labview Developer (CLD)", at NI Systems (India) Pvt. Ltd, Bangalore	19 th Dec to 23 rd Dec 2016

Sl. No.	Name of the Staff	Training Programme and Conducted by	Duration
64.	Dr. T Sreelatha Project Scientist - I	“Gas Chromatograph-Mass Spectrometer”, Training at Shimadzu Analytical (India) Pvt. Ltd, Mumbai	26 th Dec to 27 th Dec 2016
65.	Mr. S B Pranesh Scientist - D	“Experimental Stress Analysis”, at M/s. Dynates, Bangalore	5 th Jan to 6 th Jan 2017
66.	Mr. Arunraj K S Project Scientist - I	IRAD-2017, India Conference on “Radar Meteorology” at IIT Kharagpur	8 th Jan to 11 th Jan 2017
67.	Dr. J Santhana Kumar Scientific Assistant Grade B	Advanced Training on “Aquaculture Nutrition and Feed Technology”, at ICAR, Central Institute of Brackishwater Aquaculture (CIBA), Chennai	19 th Jan to 28 th Jan 2017
68.	Dr. V P Limna Mol Project Scientist I	Zeiss Confocal Workshop on “Revolutionize Your Confocal Imaging”, at Zeiss India Office, Bangalore	30 th Jan to 1 st Feb 2017
69.	Ms. Arathy R Nair Project Scientist - I	National Conference on “Disaster Mitigation, Responsiveness and Management”, at SSNCE, Kalavakkam	3 rd Feb to 4 th Feb 2017
70.	Mrs. K Amudha Scientist – D	“Science and Sustainability in India”, for Women Scientists (under DISHA Scheme) at National Institute of Advanced Studies (NIAS) Bangalore	27 th Feb to 3 rd Mar 2017
71.	Ms. Bhavana Singh Bondili Project Scientist – I		

Extra Mural Lectures Delivered by Eminent Personalities

Prof.V.Swaminathan, Professor of Psychology and Head In charge, Department of Social Work, University of Madras, delivered a lecture on “Personality Development”, on 10th June 2017.



Dr. C Sylendra Babu, In charge for the Tamil Nadu Coastal Security Group, delivered a lecture on “Role of Police in Coastal Security”, on 5th July 2017



Dr.Cendhilynathan, Chief brain and spine surgeon at Apollo and Excellent Care Hospital, delivered a lecture on “Illness to Wellness”, on 28th July 2017.



ADMINISTRATION

Following are the details of the manpower position during the period from 01.04.2016 to 31.03.2017 at NIOT.

(a) Staff Strength

NIOT has a total strength of 171 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.	Director	01	-	01
2.	Scientific	89 + (2)*	88 + (2)*	01
3.	Technical	54	54	NIL
4.	Administrative	18	18	NIL
5.	Official Language Hindi	03	-	03
6.	Multi-Tasking Staff	06	06	Nil
	Total	171 + (2)*	166 + (2)*	05

(2)* adjusted against the scientific posts of NCESS, Trivandrum

(b) Appointments

Sl.No	Name	Post	Date of Appointment
1.	Cdr Gopkumar Kuttikrishnan (Mechanical)	Scientist-F in NIOT On permanent absorption consequent on his premature retirement from Navy	12.04.2016
2.	Shri Trishanu Shit (Civil)	Scientist-C	28.12.2016

(c) Superannuation

Sl.No	Name	Post	Date of Superannuation
1.	Dr. S.Kathiroli (Civil)	Scientist-G	31.07.2016

(d) Promotions under Modified Flexible Complementing Scheme

Sl.No	Name	Post	With effect from
1.	Shri D. Balaji (Mechanical)	Scientist 'D'	01.07.2016
2.	Shri Biren Pattanaik (EEE)	Scientist 'D'	01.07.2016
3.	Shri Bolem Srinivas (Computer Science)	Scientist 'D'	01.07.2016
4.	Shri Prasad Dudhgaonkar (Mechanical)	Scientist 'D'	01.07.2016
5.	Shri Sridhar Muddada (Mechanical)	Scientist 'D'	01.07.2016
6.	Ms Sayanti Bardhan (E&I)	Scientist 'C'	01.07.2016
7.	Shri M.Sankar (Mechanical)	Scientist 'F'	25.07.2016
8.	Dr Sathia Narayanan (Mechanical)	Scientist 'E'	25.07.2016
9.	Smt Bala Naga Jyothi (ECE)	Scientist 'D'	01.01.2017
10.	Shri Devender Gujjula (Mechanical)	Scientist 'D'	01.01.2017
11.	Shri A. A.Gnanaraj (Mechanical)	Scientist 'D'	01.01.2017
12.	Shri S.B.Pranesh (Mechanical)	Scientist 'D'	01.01.2017
13.	Shri T.R.Libin (ECE)	Scientist 'D'	01.01.2017
14.	Shri Doss Prakash (ECE)	Scientist 'C'	01.01.2017
15.	Dr Dhilsha Rajapan (Physics)	Scientist 'G'	07.02.2017
16.	Shri C.R.Deepak (Mechanical)	Scientist 'F'	07.02.2017
17.	Shri N.Vedachalam (EEE)	Scientist 'F'	07.02.2017
18.	Shri V.Suseentharan (EEE)	Scientist 'E'	27.03.2017

(e)Promotion under Career Progression Path

Sl.No	Name	Promoted to	With effect from
1.	Shri G.V. Reddy	Dy. Chief Admin. Officer	01.07.2016
2.	Shri A Karthikeyan (Mechanical)	Scientific Asst.-Gr.'C'	01.07.2016
3.	Shri Meenatchi Sundaram (EEE)	Scientific Asst.-Gr.'C'	01.07.2016
4.	Shri G Vengatesan (E&I)	Scientific Asst.-Gr.'C'	01.07.2016
5.	Shri Shijo Zacharia (EEE)	Scientific Asst.-Gr.'C'	01.07.2016
6.	Shri K S Sajeew (Mechanical)	Scientific Asst.-Gr.'C'	01.07.2016
7.	Shri R Sridharan (Mechanical)	Scientific Asst.-Gr.'C'	01.07.2016
8.	Smt D Latha (ECE)	Scientific Asst.-Gr.'C'	01.07.2016
9.	Shri Y V Narasimha Rao (EEE)	Scientific Asst.-Gr.'C'	01.07.2016
10.	Shri M Saravanan (ECE)	Scientific Asst.-Gr.'C'	01.07.2016
11.	Smt T Sasikala (ECE)	Scientific Asst.-Gr.'C'	01.07.2016
12.	Smt T Thamarai (ECE)	Scientific Asst.-Gr.'C'	01.07.2016
13.	Shri G Raguraman (EEE)	Scientific Asst.-Gr.'C'	01.07.2016
14.	Shri V Chandran (Mechanical)	Scientific Asst.-Gr.'C'	01.07.2016
15.	Shri L Sivakumar (EEE)	Scientific Asst.-Gr.'C'	01.07.2016
16.	Smt P M Rajeshwari (ECE)	Scientific Asst.-Gr.'C'	01.07.2016
17.	Shri K Ramasundaram (Mechanical)	Scientific Asst.-Gr.'C'	01.07.2016
18.	Shri E Chandrasekaran (Mechanical)	Scientific Asst.-Gr.'C'	01.07.2016
19.	Shri D Muthukumaran (EEE)	Scientific Asst.-Gr.'C'	01.07.2016
20.	Shri M Murugesan (Mechanical)	Scientific Asst.-Gr.'C'	01.07.2016
21.	Shri S Sundar Jesuraj (ECE)	Scientific Asst.-Gr.'C'	01.07.2016
22.	Shri B O Vishwanath (EEE)	Scientific Asst.-Gr.'C'	01.07.2016
23.	Smt K Jayanthi (ECE)	Scientific Asst.-Gr.'C'	01.07.2016
24.	Shri R Suresh (Civil)	Scientific Asst.-Gr.'C'	01.07.2016
25.	Shri K Ramesh (EEE)	Scientific Asst.-Gr.'C'	01.07.2016
26.	Shri T P Rangamaran	Joint Manager (F&A)	01.07.2016

(f) Resignations:-NIL

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 2016 – 2017

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

Year : 2016 – 17 (April 2016 to March 2017)

Progress in 2016 - 2017						
	Opening Balance as on 01.04.2016	No. of applications received as transfer from other Pas u/s 6(3)	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	20	18	0	1	34
First Appeals	0	0	4	0	1	3

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
0	0	0	0	0	0	0	0	0	1	0	0	0	0

Amount of Charges Collected (in Rs.)		
Registration Fee Amount	Additional Fee & Any other charges	Penalties Amount
210	896	-



RTI Annual Return Information System (2016 - 2017)	
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 (2016 – 2017)	
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. S.S.C. Shenoi, Director, NIOT, Chennai



INDEPENDENT AUDITOR'S REPORT

To

The Chairman & Members

Governing Body of National Institute of Ocean Technology, Chennai

Report on the Standalone Financial Statements

We have audited the financial statements of National Institute of Technology (NIOT), NIOT Campus, Velachery --Tambaram Main Road, Pallikaranai, Chennai 600 100 which comprise the Balance Sheet as at March 31, 2017 and the Income & Expenditure Account and Receipts and Payments account for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.

Basis of our Opinion

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by Institute of Chartered Accountants of India. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the entity in accordance with the ethical requirements that are relevant to our audit of the financial statements and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion

Responsibilities of Management and those charged with governance for the Financial Statements

NIOT's Management is responsible for the preparation and fair presentation of the financial statements in accordance with the aforesaid Accounting Standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the entity's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the entity or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the entity's financial reporting process.



Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements

Legal and regulatory

1. We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purposes of our audit.
2. In our opinion, proper books of accounts as required by the law have been kept by National Institute of Ocean Technology so far as it appears from our examination of those books.
3. The Balance Sheet and Income and Expenditure account and Receipts & Payments Account dealt with by this report are in agreement with the books of account.
4. In our opinion, the Balance Sheet and Income and Expenditure account and Receipts & Payments Account dealt with by this report is prepared in accordance with the applicable Accounting Standards issued by the Institute of Chartered Accountants of India except the non-compliance stated below.

Opinion

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid standalone financial statements give the information required by the act in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India, of the state of affairs of the Institute as at March 31, 2017 and excess of income over expenditure and its Cash flows for the year ended on that date subject to

Non – accounting of Leave encashment and Gratuity on accrual basis in accordance with Accounting Standards 15 issued by the Institute of Chartered Accountants of India. The impact of the same could not be quantified in the absence of actuarial valuation of Retirement benefits.

Place: Chennai
Date: 01/08/2017

For Gopalaiyer and Subramanian
Chartered Accountants
Firm's Registration Number: 000960S

K.K.A. Ramanujan
K.K.A. Ramanujan
Partner
Membership No: 209498



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
BALANCE SHEET AS AT 31ST MARCH 2017

		<i>(Amount in Rupees)</i>	
LIABILITIES	Schedule	31.03.2017	31.03.2016
CAPITAL FUND	1	3,396,128,581	3,495,329,306
RESERVES AND SURPLUS	2	331,894,045	312,502,701
earmarked / SPONSORED PROJECT FUNDS	3	-203,615,688	262,433,558
CURRENT LIABILITIES AND PROVISIONS	4	1,744,470,833	1,459,629,347
TOTAL		5,268,877,772	5,259,894,912
ASSETS			
FIXED ASSETS	5	2,383,844,985	2,542,848,130
INVESTMENTS - OCEAN TECHNOLOGY AND EARMARKED / SPONSORED PROJECT FUNDS	6	1,000,812,629	1,045,526,507
INVESTMENTS - OTHERS	7	1,202,231,304	1,060,177,174
CURRENT ASSETS, LOANS, ADVANCES, ETC.	8	681,988,854	881,343,101
TOTAL		5,268,877,772	5,259,894,912
Significant Accounting Policies	15		
Contingent Liabilities and Notes to Accounts	16		

Date: August 1, 2017
Place: Chennai 600 100



For National Institute of Ocean Technology, Chennai

[Signature]
JOINT MANAGER
(F&A)

[Signature]
DIRECTOR

As per our Report of even date
For Gopalaiyer and Subramanian
Chartered Accountants
FIRM REGN.NO.000960S

[Signature]
K.K.A.RAMANUJAN
PARTNER
Memb No: 209498



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2017

		<i>(Amount in Rupees)</i>	
INCOME	Schedule	2016-17	2015-16
Scientific and Technical Consultancy Services		13,865,172	97,716,228
Grants-in-aid - Ocean Technology Programmes	9	702,634,065	451,567,444
Interest Earned	10	65,509,199	62,994,310
Other Income	11	13,390,722	13,868,123
TOTAL (A)		795,399,158	626,146,105
EXPENDITURE			
Expenditure on Scientific and Technical Consultancy Services		7,166,656	54,765,240
Establishment Expenses	12	180,014,503	166,392,706
Administrative Expenses	13	48,060,868	43,036,207
Expenditure on Ocean Technology Programmes	14	431,014,732	352,737,936
TOTAL (B)		666,256,760	616,932,089
Interest & Other Incomes Earned during the Year 2016-17 under the programme "Ocean Technology" refundable to Ministry of Earth Sciences, Government of India transferred to Schedule 4 - Current Liabilities & Provisions	4	78,899,921 43,543,962	76,862,433 -110,599,405
Balance being excess of Income over Expenditure transferred to Schedule 1- Capital Fund			
Appropriations on Scientific and Technical Consultancy Services			
General Reserve Fund		6,368,590	40,917,748
Staff Welfare Fund		329,926	2,033,240
Significant Accounting Policies	15	795,399,158	626,146,105
Contingent Liabilities and Notes to Accounts	16		

As per our Report of even date
For Gopalaiyer and Subramanian
Chartered Accountants
FIRM REGN.NO.0009605

For National Institute of Ocean Technology, Chennai

Date: August 1, 2017
Place: Chennai 600 100



[Signature]
JOINT MANAGER (F&A)

[Signature]
DIRECTOR

[Signature]
K.K.A. RAMANUJAN
PARTNER
Memb No: 209498

[Circular Stamp]
Gopalaiyer and Subramanian *
FRN 0009605
Chennai
600 017
* Chartered Accountants *

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

(Amount in Rupees)		
SCHEDULE 1 - CAPITAL FUND	31.03.17	31.03.16
BALANCE AS AT THE BEGINNING OF THE YEAR		6,130,023,779
Add: Additions during the year	565,998,200	326,125,854
Add: Excess of Income over Expenditure	43,543,962	-
Less: Surrender of Grants to MoES	372,000,000	-
Less: Excess of Expenditure over income	-	110,599,405
Less: Provision for depreciation	324,137,476	2,801,873,608
Less: Provision for loss/unserviceable assets	12,605,410	48,347,314
(For details : Sub-schedule-A)		-2,634,694,473
BALANCE AT THE YEAR END	3,396,128,581	3,495,329,306



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

Sub-schedule: A attached to and forming part of Schedule-1 of the Balance Sheet as on 31st March 2017

CAPITAL FUND

S. No.	Name of the Fund	Balance as on 01.04.16	Additions during the year	Surrender of Grants to MoES	Total (3+4+5)	Depreciation	Provision for loss/unserviceable assets	Balance as on 31.03.17 (6-7-8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	CAPITAL FUND (Created out of MoES Grants)							
1	Land & Buildings Fund	348,925,217	-	-	348,925,217	20,915,695	-	328,009,522
2	A&N Centre Infrastructure Fund	215,344,615	25,500,000	-	240,844,615	926,139	-	239,918,476
3	General Equipment Fund	28,611,620	5,000,000	-	33,611,620	5,199,047	-	28,412,573
4	Ocean Technology Equipment Fund	1,444,423,713	501,228,368	372,000,000	1,573,652,081	79,778,886	12,233,776	1,481,639,419
5	Earmarked Projects Capital Fund	1,568,623,546	34,269,832	-	1,602,893,378	217,317,709	371,634	1,385,204,035
	GRAND TOTAL	3,605,928,711	565,998,200	372,000,000	3,799,926,911	324,137,476	12,605,410	3,463,184,025



Sub-Schedule : A

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

(Amount in Rupees)

SCHEDULE 2 - RESERVES AND SURPLUS		31.03.17		31.03.16	
Reserves created out of Technical / Consultancy Projects					
i.	General Reserve Fund				
	As per last Account	269,275,852		209,545,102	
	Additions during the year	26,031,435		60,073,907	
	Deductions during the year	797,834	294,509,453	343,157	269,275,852
	Sub - Total		294,509,453		269,275,852
ii.	Staff Welfare Fund				
	As per last Account	2,311,699		238,095	
	Additions during the year	488,992		2,079,327	
	Deductions during the year	-	2,800,691	5,723	2,311,699
	Sub - Total		2,800,691		2,311,699
iii.	Scientific & Technical Consultancy Project Equipment Fund				
	As per last Account	40,915,150		48,564,265	
	Additions during the year	77,801		16,800	
	Less: Depreciation on the assets created	122,804		135,145	
	Less: Depreciation on the assets of Kalpasar Consultancy Projects	6,286,246	34,583,901	7,530,770	40,915,150
	Sub - Total		34,583,901		40,915,150
GRAND TOTAL (i+ii+iii)			331,894,045		312,502,701



Schedule -2

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

SCHEDULE-3 EARMARKED / SPONSORED PROJECT FUNDS

(1) Details / Grants pertaining to	(2) Balance as on 1.4.2016	Add: Receipts		(5) Expenditure Revenue	Less: Expenditure		(8) Balance as on 31.03.17
		(3) Grants Received	(4) Other Receipts and Interest		(6) Project Equipment/WIP	(7) Surrender of Grants	
A. MoES GRANTS							
a. OCEAN RESEARCH VESSELS							
Operation and Maintenance of Coastal Research Vessels 'Sagar Purvi & Sagar Paschimi'	-197,115,808	41,700,000	1,510,325	81,896,083	2,852,713	-	-238,654,279
Operation and Maintenance of 'BTV Sagar Manjusha'	44,988,838	90,000,000	268,526	182,196,698	842,498	-	-47,781,832
Operation & Maintenance of Research Vessel 'Sagar Nidhi'	44,506,337	100,000,000	2,371,480	337,221,796	3,148,275	-	-193,492,254
Acquisition of two Coastal Research Vessels (CRVs)	218,187,040	-	9,923,183	1,024,579	-	-	227,085,644
b. OCEAN OBSERVATIONS							
Ocean Observation Network	15,528,729	250,000,000	2,541,387	235,890,363	18,733,215	-	13,446,538
c. OCEAN SURVEY & MINERAL RESOURCES							
Scientific studies and technology development for exploration and extraction of Gas Hydrates	37,013,055	-	3,115,449	26,374,459	8,426,401	-	5,327,644
Seabed Survey using Multibeam Sonar System - EEZ Programme	7,051,689	-	453,753	646,704	-	-	6,858,738
d. RESEARCH, EDUCATION, TRAINING & OUTREACH							
User Oriented M.Tech Course on 'Ocean Technology Management'	498,000	-	-	-	-	-	498,000
e. OTHER PROGRAMMES							
Seawater Quality Monitoring	1,136,567	2,690,000	-	1,926,787	266,730	-	1,633,050
Ocean Observation System - Indian ARGO	2,953,268	-	155,240	-	-	3,108,508	6,437,182
Information Technology and E-Governance activities	7,706,203	-	507,769	1,776,790	-	-	-
Development and deployment of low cost data met buoys	4,984,787	-	303,867	-	-	5,288,654	-
SUB-TOTAL - A	187,438,705	484,390,000	21,150,979	868,954,259	34,269,832	8,397,162	-218,641,569
B. OTHER GOVERNMENT GRANTS							
NCAOR - Southern Ocean Expedition Cruise	73,090,313	-	1,853,085	308,723	-	60,000,000	14,634,675
CSIR Fellowship	4,540	484,866	-	473,200	-	-	16,206
INSPIRE Faculty Awardees selected under INSPIRE Faculty Award Programme-CSIR-NEIST,DST	1,900,000	-	-	345,807	-	1,554,193	-
National Post- Doctoral Fellowship to Dr.Ramesh Chatragadda,SERB, DST, India	-	720,000	-	345,000	-	-	375,000
SUB-TOTAL - B	74,994,853	1,204,866	1,853,085	1,472,730	-	61,554,193	15,025,881
TOTAL-A+B	262,433,558	485,594,866	23,004,064	870,426,989	34,269,832	69,951,355	-203,615,688



Schedule-3

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

SCHEDULE 4 - CURRENT LIABILITIES & PROVISIONS		(Amount in Rupees)	
		31.03.17	31.03.16
A. STATUTORY LIABILITIES			
Tax Dues		1,962,470	1,942,361
CPF Contribution		3,435,497	2,065,776
NPS Contribution		565,527	504,373
			4,512,510
B. OTHER CURRENT LIABILITIES			
Pay & allowances for the month of March 2017		27,105,182	24,571,939
Outstanding Liabilities		656,346,181	482,177,450
Earnest Money & Retention money		63,373,790	52,768,096
Interest & Other Incomes Earned during the Year 2016-17 under the programme "Ocean Technology" refundable to Ministry of Earth Sciences, Government of India transferred to Schedule 4 - Current Liabilities & Provisions		78,899,921	76,862,433
Project Advances (Vide Sub-Schedule:B)			
		825,725,074	636,379,918
		912,782,265	818,736,919
TOTAL (A+B)		1,744,470,833	1,459,629,347



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SUB-SCHEDULE: B FORMING PART OF SCHEDULE-4 OF THE BALANCE SHEET AS AT 31ST MARCH 2017

Details / Grants pertaining to (1)	Balance as on 1.4.2016 (2)	Add: Receipts		Less: Expenditure		Transfer / Adjust ments (7)	Balance as on 31.03.17 (8)
		Received (3)	Other Receipts & Interest (4)	Revenue (5)	Capital (6)		
PROJECT ADVANCES							
Scientific and Technical Consultancy Services	65,402,468	22,406,791	14,541,648	7,292,787	77,801	10,036,678	84,943,641
<i>On Deposit</i> : Procurement of self propelled barge	4,233,305	-	337,711	-	-	-	4,571,016
<i>On Deposit</i> : Installation of 1 lakh litres per day capacity Seawater Low Temperature Thermal Desalination Plants at Agatti, Andrott, Minicoy, Amini, Kiltan & Chetlat Islands	749,101,146	-	74,191,760	25,298	-	-	823,267,608
TOTAL - B	818,736,919	22,406,791	89,071,119	7,318,085	77,801	10,036,678	912,782,265

Sub-Schedule: B



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NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

SCHEDULE 5 - FIXED ASSETS

(Amount in Rupees)

S.No	DESCRIPTION	GROSS BLOCK		DEPRECIATION		Total upto 31.03.17	Provision for loss / unserviceable assets Total upto 31.03.17	NET BLOCK	
		Cost/Valuation as on 01.04.16	Additions during the year	Deletions	Cost/Valuation as on 31.03.17	Upto 01.04.16	Additions during the year	As on 31.03.17	As on 31.03.16
A.	FIXED ASSETS created out of MoES Grants								
	Lands-Freehold								
	1 NIOT Campus, Palikaralai	35,367,827	-	-	35,367,827	-	-	35,367,827	35,367,827
	Freehold Land -Doligunji A&N Islands	3,729,070	-	-	3,729,070	-	-	3,729,070	3,729,070
2	Seafront Facility - Land at Nellore, Andhra Pradesh	108,150,055	-	-	108,150,055	-	-	108,150,055	108,150,055
	Buildings								
	Buildings & Infrastructure at NIOT Campus	507,675,651	5,319,300	-	512,994,951	295,658,575	20,915,695	196,420,681	212,017,076
	Farm Buildings at ANC-NIOT	27,893,543	-	-	27,893,543	18,645,598	926,139	8,321,806	9,247,945
3	Equipment								
	General Equipment	104,105,217	6,532,979	-	110,638,196	83,687,944	5,199,047	21,751,205	20,417,273
	Equipment of Ocean Technology Programmes	1,435,083,025	88,963,749	297,440	1,523,749,334	982,306,963	79,778,886	414,850,168	418,031,057
	Equipment of Earmarked / Sponsored Projects	4,215,334,461	27,371,175	1,275,098	4,241,430,538	2,704,640,264	217,317,709	1,306,620,020	1,497,091,888
TOTAL UNDER (A)		6,437,338,849	128,187,203	1,572,538	6,563,953,514	4,084,939,344	324,137,476	2,095,210,832	2,304,052,191
B	Capital work in progress	197,880,790	56,169,462	-	254,050,252	-	-	254,050,252	197,880,790
C	Fixed Assets created out of Scientific & Technical Consultancy Projects								
1	Scientific & Technical Equipment	12,974,046	77,801	-	13,051,847	12,210,106	122,804	718,937	763,940
2	Assets created out of Kalpasar Project	114,866,958	-	-	114,866,958	74,715,748	6,286,246	33,864,964	40,151,210
GRAND TOTAL (A+B+C)		6,763,060,643	184,434,466	1,572,538	6,945,922,571	4,171,865,198	330,546,526	2,383,844,985	2,542,848,131

Schedule-5



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

<i>(Amount in Rupees)</i>		
<u>SCHEDULE 6 - INVESTMENTS - OCEAN TECHNOLOGY & EARMARKED / SPONSORED PROJECT FUNDS</u>	31.03.17	31.03.16
a. Deposits with Banks	1,000,812,629	1,045,526,507
TOTAL	1,000,812,629	1,045,526,507

<i>(Amount in Rupees)</i>		
<u>SCHEDULE 7 - INVESTMENTS - OTHERS</u>	31.03.17	31.03.16
Funds received for rendering Scientific and Technical Consultancy Services	83,574,512	65,362,454
b. General Reserve Fund	287,859,453	265,858,518
c. Staff Welfare Fund	2,760,307	2,033,240
d. Deposits from other Agencies	828,037,032	726,922,962
TOTAL	1,202,231,304	1,060,177,174

(All the investments are with Nationalised Banks in Short Term Deposits)



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

SCHEDULE 8 - CURRENTS ASSETS, LOANS & ADVANCES		<i>(Amount in Rupees)</i>	
		31.03.17	31.03.16
A.	CURRENT ASSETS		
	<i>Balance with Banks in Savings Accounts</i>		
B.	LOANS AND ADVANCES		
i	<i>Capital Advances</i>		
	Land Acquisition for Sea Front Facility at Nellore, Andhra Pradesh	33,257,025	276,635,358
	Development of Infrastructure facilities at ANCOST, NIOT, Port Blair		
	Construction of Marine Finfish Hatchery for NIOT at Pamanji, Nellore District, Andhra Pradesh	72,779,945	72,779,945
	Construction of Facility for administrative, Computation and training site office (Phase-I), SENTRY posts, Security room and RCC compound wall for NIOT at Chittedu, Nellore District, Andhra Pradesh	23,059,868	14,431,699
	Construction of Sea Front Research Facility (SRF) including Security room building, Chain Link Fencing and Unpaved Road including providing IEI & Fans for NIOT at Pamanji Village, Nellore District	49,934,000	-
		2,795,645	-
		1,254,373	-
ii	Staff Advances		
	Non-Interest bearing Advances to employees	402,264	5,271,802
	Interest bearing Advances to employees	309,135	192,921
iii	Advances and other amounts recoverable in cash or in kind for value to be received		
	Imprest Advance made to M/s.Shipping Corporation of India Limited	333,491,165	344,803,621
	Recoverable from Revenue Authorities	18,898,707	41,589,092
	Prepaid Expenses	11,781,675	10,697,525
	Reimbursable expenses	2,224,239	1,330,897
	Project Advances	37,592,991	37,875,944
	Advance Payment to Suppliers	16,013,498	4,006,694
	Other Receivables	6,956,210	6,726,277
iv	Interest accrued but not due		
	Personal Computer Advance/Motor car advance to employees	35,419	16,907
	Investments from Ocean Technology Programmes/Earmarked/Sponsored Project Funds	12,707,632	26,127,528
	Investments from Scientific & Technical Consultancy Projects	2,453,010	2,002,780
	Investments from General Reserve Fund	6,663,327	6,244,546
	Investments from Staff Welfare fund	40,384	46,087
	Investments made out of Deposits from other Agencies	49,338,341	30,563,480
	TOTAL	681,988,854	881,343,101

Schedule-8



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

<u>SCHEDULE 9 - GRANTS</u>	(Amount in Rupees)	
	2016-17	2015-16
Grants-in-aid received for Ocean Technology Programmes	1,157,500,000	599,000,000
Add: Amount of Interest & Other Incomes earned during the year 2015-16	76,862,433	83,967,444
Less: Amount allocated for Capital Expenditure and transferred to Capital Fund		682,967,444
(1) Equipment of Ocean Technology Programmes	501,228,368	221,400,000
(2) Building & Infrastructure Activities at NIOT, Chennai & ANCOST, Port Blair, A&N islands	25,500,000	5,000,000
(3) General Equipment	5,000,000	231,400,000
TOTAL	702,634,065	451,567,444



Schedule-9

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

<u>SCHEDULE 10 - INTEREST EARNED</u>	<i>(Amount in Rupees)</i>	
	2016-17	2015-16
On Savings Account	2,197,900	3,972,870
On Term Deposits	63,311,299	59,021,440
TOTAL	65,509,199	62,994,310

<u>SCHEDULE 11 - OTHER INCOME</u>	<i>(Amount in Rupees)</i>	
	2016-17	2015-16
Rent Received	854,691	615,775
Sundry Receipts	12,536,031	13,252,348
TOTAL	13,390,722	13,868,123



Schedule-10 & 11



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

	<i>(Amount in Rupees)</i>	
	2016-17	2015-16
SCHEDULE 12 - ESTABLISHMENT EXPENSES		
Pay & Allowances	161,855,081	152,475,314
CPF Contribution	3,435,497	2,065,776
NPS Contribution	6,589,219	5,853,529
Terminal Benefits - Leave Encashment	-	127,999
Medical Reimbursements	2,340,863	1,466,590
Children's Education Allowance	2,375,111	2,395,356
Leave Travel Concession	3,418,732	2,008,142
TOTAL	180,014,503	166,392,706

	2016-17	2015-16
SCHEDULE 13 - ADMINISTRATIVE EXPENSES		
Computer Maintenance/LAN/Software / Maintenance of Plant & Machinery	8,482,052	8,014,817
Electricity & Water Charges	8,238,139	9,151,201
Campus Maintenance Expenses	14,546,123	9,994,605
Vehicles Running and Maintenance	1,245,928	1,700,711
Conveyance Expenses	928,329	1,372,771
Travel Expenses	3,179,596	3,415,993
Subscriptions to Journals & Bulletins	1,653,621	610,290
Expenses on Seminars & Workshops	63,497	119,407
Communication Expenses	1,211,939	1,186,521
Printing and Stationery	983,172	737,097
Advertisement & Publicity	507,379	331,892
Rent, Rates and Taxes	1,497,739	1,289,435
Hospitality Expenses	1,071,438	1,289,239
Professional charges	1,436,189	1,222,884
Loss on sale of Fixed Assets	121,976	61,538
Auditor's Remuneration	75,520	69,000
Other Administrative Expenses	2,818,231	2,468,806
TOTAL	48,060,868	43,036,207



Schedule-12 & 13

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2017

SCHEDULE 14 - EXPENDITURE ON OCEAN TECHNOLOGY PROGRAMMES		(Amount in Rupees)	
		2016-17	2015-16
Ocean Energy and fresh water		42,654,348	34,232,400
Inter-Institutional R&D and In-House development & development of Upgraded Version of Soil Tester (<i>Part of Deep Sea Mining Programme</i>)		5,384,053	18,077,639
Marine Sensors & Electronics		14,659,051	11,735,146
Technical Criteria Atlas		27,537,378	24,490,981
Development of Ocean Acoustics		28,940,755	25,992,259
Ocean Electronics		41,804,607	18,070,704
Ocean Sciences & Technology for Islands		62,467,692	62,038,981
Development of Technologies for Offshore Structural component		48,940,169	53,863,620
Sea Front Facility		4,148,072	2,464,097
Shoreline Management		50,503,484	26,306,375
Pre-project activities of large scale desalination plant and studies on complex offshore components and thermal components		38,664,975	8,471,006
Integrated Deep Sea Mining System for Mining of Polymetallic Nodules upto 6000m Depth		39,891,137	60,442,968
Establishment of Low Temperature Thermal Desalination (LTDD) Plant at Tuticorin Thermal Power Station		14,510,689	66,279
Development of Manned and Unmanned Submersible		10,752,902	6,239,752
Pre-investment activity of the two proposed National Oceanarium @ Puduchery and Diu		155,420	245,729
TOTAL		431,014,732	352,737,936

Schedule-14



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULE-15 : SIGNIFICANT ACCOUNTING POLICIES

1. GENERAL INFORMATION:

- (i) The Government of India under the Gazette Notification Resolution No.DOD/16-TE/16/92 dated 1st September 1993 established the National Institute of Ocean Technology. The main objectives of the Institute are:
 - (a) to apply the knowledge and experience gained through research in ocean sciences to develop technical know-how and capabilities in specific fields of ocean technology such as seabed mining, ocean energy, etc.
 - (b) to assist the ocean scientists in development of suitable ocean engineering and instrumentation systems such as data buoys, observation platforms, underwater vehicles, etc.
 - (c) to develop necessary technologies for the fast emerging concept of Coastal Zone Management for comprehensive and sustainable development of the coastal belt and islands of the country and
 - (d) any other objectives relating to Ocean Technology as may be set by the Ministry of Earth Sciences (MoES).
- (ii) National Institute of Ocean Technology (NIOT) has been registered under Tamilnadu Societies Registration Act, 1975 on 5th November 1993 under the Registration No.541/93.
- (iii) NIOT functions under the administrative control of the Ministry of Earth Sciences (MoES) and provides necessary technological inputs in such areas of Ocean Development as MoES may decide.
- (iv) The Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India vide their letter No.11/358/98-TU-V dated 15th June, 2010 recognized National Institute of Ocean Technology, Chennai as a Scientific and Industrial Research Organization for a period up to 31st March 2013. The renewal of recognition as a Scientific and Industrial Research Organisation by Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India vide their letter No.11/358/98-TU-V dated 9th May 2013 for a period from 1st April 2013 to 31st March 2016 and vide letter No. 11/358/98-TU-V dated 23rd March 2016 accorded renewal of recognition from 1st April 2016 to 31st March 2019.
- (v) The Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India vide their letter No.11/358/98-TU-V dated 23rd March 2016 has accorded exemption for availing Customs Duty in terms of Government Notifications No.51/96-Customs dated 23rd July 1996 and No.24/2007-Customs dated 1st March 2007 and Central Excise duty exemption in terms of



Government Notifications No.10/97-Central Excise dated 1st March 1997 and No.16/2007-Central Excise dated 1st March 2007 and the registration is valid upto 31st March 2019.

- (vi) The Director of Income Tax (Exemptions), Chennai vide order No.DIT(E) No.2(582)/04-05 dated 22.3.05 granted registration under Section 12AA of the Income Tax Act, 1961 as a Public Charitable Trust.
- (vii) The Institute has been notified as Scientific Research Institution under Section 35(1)(ii) of the Income Tax Act 1961 read with Rules-5C and 5E of the Income Tax Rules, 1962 vide Notification No.45/2012 (F.No.203/51/2011/ITA-II) dated 29th October 2012 from Assessment year 2011-12.
- (viii) The enterprise is a level II entity as defined in preface to Accounting Standards issued by the Institute of Chartered Accountants of India. Accordingly, the enterprise has complied with all the accounting standards applicable to small and medium size entities unless otherwise stated.

2. ACCOUNTING CONVENTION:

The accompanying financial statements have been prepared under the historical cost convention basis in accordance with the generally accepted accounting practices (GAAP) in India and comply with the mandatory accounting standards unless otherwise stated.

The preparation of the financial statements in conformity with GAAP requires management to make estimates and assumptions that affect the reported balances of assets and liabilities and disclosures relating to contingent assets and liabilities as at the date of financial statements and reported amount of income and expenditure during that period. Difference between actual results and estimates are recognised in the period in which results are known / materialised

3. RECOGNITION OF INCOME:

- (i) Government grants are accounted on accrual basis when there is reasonable assurance that the Institute will comply with the conditions attached to them and the grants will be received.
- (ii) Revenue from Technical / Scientific services is accounted on completed service contract method of accounting which recognises revenue in the statement of Income and Expenditure account only when the rendering of service under a contract is completed or substantially completed.
- (iii) All other items of income/ expenditure are accounted on accrual basis in accordance with Accounting Standard-9 issued by the Institute of Chartered Accountants of India.



4. FIXED ASSETS:

- (i) Fixed Assets are carried at cost *less* depreciation.
- (ii) The Cost of an asset comprises its purchase price and other relevant expenses attributable for bringing the assets to usable condition.

5. DEPRECIATION:

- (i) Depreciation is provided on the written down value method at the rates and manner specified in Income Tax Act, 1961.
- (ii) Depreciation relating to Ocean Technology programmes (funded by Government grants) and Equipment of Earmarked Funds / sponsored projects are charged to the assets and deducted from the respective Capital Funds.
- (iii) Depreciation on assets created out of NIOT's internal generation are charged to the assets and deducted from Scientific and Technical Project Equipment Fund created out of Technical/Consultancy Projects.

6. VALUATION OF INVENTORIES:

Purchases of raw materials, consumables and other inputs are restricted to minimum requirement of Research Programmes taken up and or on hand and thus stores is not maintained. These items are charged at cost to the respective projects on receipt and inspection.

7. RESEARCH AND DEVELOPMENT EXPENDITURE:

- (i) Research and Development expenditure on Ocean Technology is charged to Income & Expenditure Account in the year in which the expenditure is incurred.
- (ii) Research and Development expenditure on Scientific and Technical Consultancy Services are accumulated separately under 'Project Advances' which are carried net of such expenditure till completion of the project. The expenditure is charged to Income & Expenditure Account in the year of completion of the project.

8. EARMARKED FUNDS:

The Institute is receiving funds each year for certain specified project / schemes for the purpose of acquiring assets and meeting revenue expenses. The receipts and utilization of these specified funds for the projects / schemes are shown in Schedule-3.



9. RATE OF EXCHANGE:

Transactions in foreign currencies are recorded at the exchange rate prevailing on the date of transaction. Foreign currency monetary assets and liabilities are translated at year end exchange rates and resultant difference, if any, is recognised as exchange loss or gain as the case may be.

10. UNIFORM FORMAT OF ACCOUNTS FOR CENTRAL AUTONOMOUS BODIES:

The accounts are presented as per the Uniform Format of Accounts for Central Autonomous Bodies.

11. LONG TERM EMPLOYEE BENEFITS

a) Defined Contribution Plan:

The enterprise had the following defined contribution plans:

- (i) Contributory Provident Fund (CPF) scheme for its staff who have joined before 1st January 2004 and is administered by the Institute
- (ii) New Pension Scheme (NPS) for its staff who have joined after 1st January 2004 and is administered by the PFRDA.

The above mentioned schemes are classified as defined contribution plan as the enterprise has no further obligation beyond making the contributions. The enterprise's contributions to the defined contribution plan are charged to Income & Expenditure Account on accrual.

b) Other Terminal Benefits:

Gratuity, Leave encashment are recognised in Income and Expenditure Account in the year in which they are paid.

**For NATIONAL INSTITUTE OF
OCEAN TECHNOLOGY**



JOINT MANAGER (F&A)

DIRECTOR

**As per our Report of even date
For Gopalaiyer & Subramanian
Chartered Accountants
Firm Reg. No: 000960S**

**K.K.A. RAMANUJAN
Partner
M. No: 209498**

**Date: August 1, 2017
Place: Chennai 600 100**



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULE- 16 : NOTES ON ACCOUNTS

1. Contingent Liabilities

A case was filed by one of the Contract employee of NIOT against NIOT in Hon'ble Madras High Court for payment of terminal benefits for the contract services rendered. On the direction of the Hon'ble Madras High Court to settle the terminal benefits by NIOT, a clarification petition was filed by NIOT to obtain a clear direction on the applicability of Gratuity, PF and emoluments. Liability towards payment of terminal benefits would works out to Rs.1,27,007/- approximately.

2. Pending Capital commitments

Autonomous Coring System was procured from M/s. Williamson & Associates, USA at a cost of US\$ 57,40,950/-. Out of the above, as per terms & conditions, NIOT had paid Rs.23,41,74,645/- (US\$ 48,43,959.75/- – 84.38% of the contract value) and capitalised the payments made as per the Accounting Standards-10 issued by Institute of Chartered Accountants of India. Pending capital commitment on account of the above contract is Rs.5,88,42,560/- (US\$ 8,96,990.25 – 15.62% of the contract value).

3. Defined Benefit Pension Scheme

Governing Council of NIOT during its 43rd meeting approved the implementation of Defined Benefit Pension Scheme through LIC for NIOT employees. During 2011-12, an initial premium of Rs.13,98,570/- was paid out of General Reserve Fund of the Institute. Pursuant to Finance Committee/Governing Council resolution dated 10/11th February 2016 to call back the premium from LIC of India, NIOT had initiated necessary action to get back the amount paid.

4. Retirement Benefits to employees

The regular employees of Central Autonomous Bodies are eligible for Death-cum Retirement Gratuity and Leave Encashment. As per the Accounting Standards-15, the approximate accrued liability in respect of Retirement Benefits is to be provided in the Books of Accounts. The accrued liability in respect of NIOT regular employees as on 31st March 2017 are as follows:

a.	Liability in respect of Gratuity	: Rs. 7,10,43,444/-
b.	Liability in respect of Leave Encashment	: Rs.10,35,99,792/-
		=====
	TOTAL	: Rs.17,46,43,236/-
		=====



5. Insurance claim

(a) During the sea trials of Deep Sea Mining Test platform, aramid rope and cable used for launching and operation got twisted during the recovery operation. A huge swell occurred at this stage and both the aramid rope and cable were snapped from the system causing loss of some of the sub-systems in the test platform. The incident was immediately reported on 18th December 2012 to United India Insurance Company with whom a comprehensive policy was taken for sea trials. The approximate cost of the items lost is reported to be Rs.97.80 lakhs (approx.) as per the Book value. The loss is being assessed by the Surveyor of the Insurance Company and NIOT is pursuing the claim. Pending settlement of the above claim, NIOT had provided for loss of assets amounting to Rs.115.54 lakhs.

(b) The Coastal Research Vessel 'Sagar Paschimi' acquired by the Ministry of Earth Sciences (MoES) for studying coastal pollution, coastal surveys and near shore multidisciplinary work was partially sunk at Visakhapatnam Fishing Harbour on 12th October 2014 due to the impact of HUD HUD Cyclone. The insurance claim settlement in settlement of vessel was fully settled by insurance company in financial year 2015-16 and the money received was surrendered to MoES. A separate claim for the scientific equipments onboard Sagar Paschimi has been lodged with M/s. United India Insurance Company Limited and is under active consideration.

(c) Due to unprecedented floods that occurred in Chennai during November-December 2015, some of the assets of NIOT were partially / fully damaged. NIOT had made claim for totally damaged asset and refurbishing the partially damaged assets which are covered under insurance, with M/s. United India Insurance Company Limited, Chennai for a sum of Rs.15.96 crores. Pending settlement of the above claim, NIOT had made provision for fully damaged assets amounting to Rs.3.68 crores.

6. Loss of assets during sea trials

During the sea trials of Deep Sea Mining for testing the in-situ soil tester on 25th November 2016, due to dynamic load on the cable caused due to unforeseen weather-sea conditions at Central Indian Ocean Basin, the in-situ soil tester with associated accessories / equipments were lost in the sea. The committee constituted by the Director submitted its report that the loss of equipments is not due to negligence of the individuals and recommended that the loss be written off and duly accounted as per procedure. NIOT is in the process of writing off losses as per GFR 223(3)(v). Pending receipt of the approval of the competent authority to write off the loss in the books, NIOT had provided for the loss of assets amounting to Rs.1.26 crores.

7. Ocean Technology

During the 12th Plan Period, Ministry of Earth Sciences has classified the programmes viz., Ocean Energy and Fresh water, Establishment of Low Temperature Thermal Desalination (LTTD) Plant at Tuticorin Thermal Power Station, Pre-project activities of large scale desalination plant and studies on



complex offshore components and thermal components, Inter-Institutional R&D and In-House development & development of Upgraded Version of Soil Tester, Integrated Deep Sea Mining System for Mining of Polymetallic Nodules upto 6000m Depth, Manned and Unmanned Underwater Vehicles, Marine Sensors & Electronics, Ocean Electronics, Ocean Acoustic, Technical Criteria Atlas, Shoreline Management, Development of Technologies for Offshore Structural component, Ocean Sciences & Technology for Islands, Manpower, Operational Expenses & Maintenance of NIOT, Sea Front Facility and Pre-investment activity of the two proposed National Oceanarium at Puduchery & Diu as OCEAN TECHNOLOGY and the Administrative Orders for these programmes has been issued by the Ministry of Earth Sciences, Government of India accordingly. During the financial year 2016-17, the Society received an amount of Rs.1,15,75,00,000/- as Grants-in-aid for the Ocean Technology Programmes from the Ministry of Earth Sciences, Government of India.

8. Earmarked Funds

The Society during the financial year 2016-17 received an amount of Rs.48,43,90,000/- as Grants-in-aid towards Earmarked Funds from the Ministry of Earth Sciences and other Government Institutions in the form of recurring and non-recurring grants as specified under Schedule-3.

9. An amount of Rs.7,68,62,433/- being Interest and Other Income earned during the year 2015-16, shown under Current Liabilities is being accounted as Grants Received as this has been adjusted while releasing Grants by Ministry of Earth Sciences, Government of India during the year 2016-17.

10. Projects and Utilisation Certificates

The Project Review Board reviews the progress of the various projects periodically, including the financial budgets.

In respect of project advances given by the Society to academic institutions and R&D organisations for collaboration during execution of the projects, such institutions / organisations renders the utilisation certificates along with the statement of expenditure for the year ending 31st March of each financial year and accounted in the respective projects as revenue expenditure.

The assets created out of such collaboration are retained in the academic institutions and R&D organisations and an undertaking with a declaration that without the written consent of the Society, encumber or alienate any mortgage lien or charge by way of hypothecation, pledge otherwise, or dispose of the assets. If the assets are transferred to NIOT, necessary stock entry will be made for such transfer and will be merged with the Fixed Assets by credit to the Capital Fund.



- 11.** Figures shown in the accounts are rounded off to the nearest rupee.
- 12.** Previous year figures have been regrouped / merged wherever necessary.
- 13.** Schedules 1 to 16 are annexed to and form an integral part of the Balance Sheet as at 31st March 2017, Income and Expenditure Account and Receipts and Payments account for the year ended on that date.

Signatures to Schedule **1** to **16**



**For NATIONAL INSTITUTE OF
OCEAN TECHNOLOGY**

JOINT MANAGER (F&A)

**Date: August 1, 2017
Place: Chennai 600 100**

DIRECTOR

**As per our Report of even date
For Gopalaiyer &
Subramanian
Chartered Accountants
Firm Reg. No: 000960S**

**K.K.A. RAMANUJAN
Partner
M. No: 209498**



NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH 2017

RECEIPTS		2016-17	2015-16	PAYMENTS	2016-17	2015-16
I. Opening Bank Balances		276,635,358	113,269,357	I. Expenses	155,854,567	146,781,808
				a) Establishment Expenses	42,175,273	38,550,887
				b) Administrative Expenses		
II. Grants Received				II. Payments made against funds for various projects		
a) Ocean Technology Programmes	1,157,500,000		599,000,000	a) Ocean Technology Programmes	468,903,024	292,104,115
b) Earmarked Project Grants from MoES	484,390,000		959,400,000	b) Earmarked Projects from MoES	656,724,795	842,705,888
c) Sponsored Project Grants from other sources	1,204,866		2,334,018	c) Sponsored Projects from other sources	980,027	3,358,143
				d) Deposit from other agencies	7,128	1,091,369
III. Scientific & Technical Consultancy Services				III. Scientific & Technical Consultancy Services		
	34,527,424		54,240,013		16,426,282	75,277,620
IV. Short term deposits matured				IV. Short term deposits made		
	2,056,040,768		1,213,566,419		2,016,556,128	1,140,671,211
V. Interest Received				V. Purchase of Fixed Assets		
a. Ocean Technology	17,339,112		13,023,491		117,678,813	72,195,110
b. Earmarked / Sponsored Project funds	18,459,011		6,934,954			
VI. Other Incomes				VI. Other Payments		
	17,548,281		8,336,738		599,817,237	160,618,471
VII. Any Other Receipts				VII. Closing Bank Balances		
	44,735,480		79,884,990		33,257,025	276,635,358
TOTAL		4,108,380,300	3,049,989,980	TOTAL	4,108,380,300	3,049,989,980

(Amount in Rupees)

For National Institute of Ocean Technology, Chennai

As per our Report of even date
For Gopalaiyer & Subramanian
Chartered Accountants
F.R.NO.000960S


JOINT MANAGER (F&A)


DIRECTOR

Date: August 1, 2017
Place: Chennai 600 100


FRN 000960S KRA
Chennai
600 017
Chartered Accountants
Ramanujan
Partner
M.No.209498





National Workshop on “Ballast Water Management (NWBM 2016)” was conducted on October 7, 2016 at NIOT, Chennai and participants from various organizations attended the workshop. This was a pioneering initiative towards generation of awareness on ballast water management issues faced by the country.

National workshop on “Passive acoustic sensors, measurements and calibration” was conducted on October 14, 2016 at NIOT and researchers and scientists from various organizations such as Navy, Fisheries, IIT and NIO participated.



International Women's Day was celebrated during March 8-9, 2017 by conducting various competitions for women. Hon'ble Tmt Justice Pushpa Satyanarayana of Madras High court graced the occasion as Chief guest and delivered a talk on empowerment of women. Prizes were distributed to the winners.



National Institute of Ocean Technology

(Ministry of Earth Sciences, Govt. of India)

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