Deployment of In-situ Soil Tester at CIOB

Sagar Bhoomi-Indian Tsunami system

Mining system launching at 3420m in Bay of Bengal

Cone operation at 5418m depth

Kalpeni Plant

Annual Report 2019-20

National Institute of Ocean Technology

(Ministry of Earth Sciences, Govt. of India)

NIOT celebrated its Silver Jubilee on 3rd November 2019 at NIOT, Chennai. Hon'ble Vice President of India Shri.M.Venkaiah Naidu, graced the occasion as the Chief Guest and addressed the gathering. Honourable Governor of Tamil Nadu Sri Banwarilal Purohit and Hon'ble Minister of Earth Sciences Dr. Harsh Vardhan graced the occasion along with other Ministers and dignitaries.

As part of Silver Jubilee celebrations an invited conference was held during August 19-20, 2019. Dr.M.Rajeevan, Secretary MoES delivered the presidential address. The Former Secretaries Dr.Harsh K.Gupta, Dr.P.S.Goel, Dr.Shailesh Nayak and Founder Director Prof. M. Ravindran graced the occasion.

Towards the UN decade of Ocean Science for sustainable development (2021-2030), a "Regional Planning Workshop for Northern/Central Indian Ocean Countries & ROPME Sea Area", was conducted during 8-10 January 2020 at NIOT, Chennai. 15 countries from the IOCINDIO region & outside participated.

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 2019-20

1	Dr.M.Rajeevan Secretary to Govt. of India Ministry of Earth Sciences, New Delhi	Chairman From 7th December 2015
2	Shri.B.Anand, I.A.S. AS &FA Ministry of Earth Sciences, New Delhi	Member From 6th March 2018 till 31st March 2020
3	Dr.Vipin Chandra Joint Secretary Ministry of Earth Sciences, New Delhi	Member From 21st August 2017
4	Dr.P.S.Goel, Chairman-SAC,NIOT & Former Secretary, NIOT	Member From 16th September 2016
5	Dr.S.S.C.Shenoi Director, INCOIS Hyderabad	Member From 30th May 2017
6	Dr.S.A.Sannasiraj HOD, Dept. of Ocean Engg., IIT Madras	Member From 9th May 2018 till 20th February 2020
	Dr.K.Murali HOD, Dept. of Ocean Engg., IIT Madras	Member From 21st February 2020
7	Shri.S.Anantha Narayanan Former Director, NPOL, Kochi	Member From 9th May 2018
8	Dr.M.V.Ramana Murthy Director, NCCR, Chennai	Member From 30th May 2017
9	Dr.M.P.Wakdikar Advisor, Ministry of Earth Sciences, New Delhi	Permanent Invitee From 30th May 2017
10	Dr.B.N.Suresh Former Director, ISRO	Member From 9th May 2018
11	Representative, Niti Aayog, New Delhi	Permanent Invitee From 30th May 2017
12	Dr. M.A. Atmanand Director, NIOT, Chennai	Member Secretary From 8th February 2018

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FROM THE DIRECTOR'S DESK

I am privileged to present the Annual report for the financial year 2019-20, as the Director during the Silver Jubilee celebrations of the Institute. The success of the Institute is attributed to the untiring efforts of the staff members who made commendable progress in the development of technologies for societal applications and national capacity building under the aegis of the Ministry of Earth Sciences, Government of India.

It was a great honor for us to host The Honorable Vice-President of India, Shri. Venkaiah Naidu on 3rd November 2019 at NIOT during our Silver Jubilee celebrations, who inspired us through his motivational talk. During the occasion, the Hon'ble Governor of Tamilnadu Shri Banwarilal Purohit; Hon'ble Union Minister for Science and Technology, Earth Sciences, Health & Family welfare, Dr.Harsh Vardhan and Hon'ble Deputy Chief Minister of Tamilnadu, Shri O Panneerselvam were our esteemed Guests of Honor. Other dignitaries including Shri.D.Jayakumar Minister for Fisheries, Personnel and Administrative Reforms, Govt. of Tamilnadu, Shri.R.B.Udayakumar, Minister for Revenue, Disaster Management and Information Technology, Govt. of Tamilnadu, and Dr. M.Rajeevan, Secretary, Ministry of Earth Sciences graced the occasion.

I would like to highlight that during 2019-20, significant progress has been made towards the development of technologies pertaining to societal activities like island desalination, ocean observations, marine biotechnology marine energy, coastal protection; niche areas like deep-ocean mineral exploration and harvesting, marine sensors and systems; infrastructure development including the sea-front facility and the acquisition of new coastal research vessels. I am confident that these developments will significantly contribute to societal needs and national capacity building.

After understanding the socio-economics of the eco-friendly Low Temperature Thermal Desalination (LTTD) plants that are installed and operated in three islands of the Union Territory of Lakshadweep, a 1.5 Lakh litres per day capacity LTTD plant is commissioned in Kalpeni Island. Efforts are in progress for installation of LTTD plants in five more islands and realization of an Ocean Thermal Energy Conversion based desalination plant at Kavaratti Island of Lakshadweep. Establishment of two units of 1 Million litres per day capacity LTTD plant at Tuticorin Thermal Power Plant premises is undertaken for enabling energy recovery from the condenser reject heat.

Continuous efforts are made for the successful maintenance of the Indian Moored Buoy Network comprising twelve buoys in the Northern Indian Ocean, four along the coasts, one at Kongsfjorden in Arctic, two for monitoring and reporting of the tsunamis, and one for validating satellite measurements. These observational platforms have successfully captured the Essential Ocean Variables for weather and climate predictions. They were instrumental in tracking six cyclones, which immensely supported the Indian Metrological Department for advanced warning. Two years of ambient noise data has been collected from the Indian Arctic mooring and subsequently re-deployed in 2019. As a part of the Coordinated Arctic Acoustic Thermometry Experiment (CAATEX), our team participated and incorporated an acoustic receiver system in the mooring operated

by the Nansen Environmental and Remote Sensing Centre, Norway. Efforts are undertaken towards the commercialization of four different buoy technologies so that they serve other societal applications.

To address the increasing coastal health challenges, a strategic investment agenda for the East Coast of India to enhance the coastal resilience is being prepared. The beach protection measures implemented using submerged dykes at Kadalur-Periyakuppam village and near-shore reef for Puducherry beach nourishment have borne fruit. They are being continuously monitored for performance assessment. A north Indian Ocean tide application was dedicated to the ocean community, as a part Co-tidal model for the Gulf of Khambhat, by the Secretary-MoES.

As an effort to enhance seafood production through advanced technology, a 2m diameter open fish cage culture system with remote monitoring feature has been developed and successfully demonstrated.

In the ocean renewable energy sector, technologies for developing wave-powered navigation buoys has been transferred to the industries. For carrying out the exploration of the futuristic unconventional hydrocarbon resource, Gas Hydrates, a sea-bed based Autonomous Coring System capable of long-core sampling from deep-ocean sediments demonstrated its capability to drill up to 100m below the sea floor at 230m and 60m below the sea floor at 1070m depth in the Krishna-Godavari basin.

Many technologies developed have been transferred to the industry. In the marine biotechnology domain, a Multiplex Polymerase Chain Reaction (PCR) kit capable of detecting virulent Enterococcus faecalis in food, water and environment samples was developed and the technology was transferred to M/s SAAI Electro Biogenic (I) Pvt. Ltd. Technology for enabling the production of Lutein from marine micro-algae, used in the treatment of age-related macular degeneration was developed and transferred to M/s Vectrogen Biologicals Pvt Ltd. For fostering deep-ocean exploration, the NIOT-developed deep-water and shallow-water Remotely Operated Vehicle (ROV) technologies have been transferred to Bharat Electronics Limited and Larsen &Tubro Heavy Engineering. A custom-built shallow-water ROV has been provided to MoES-Centre for Marine Living Resources and Ecology (CMLRE) to enable increased spatio-temporal biodiversity studies.

For enabling deep-ocean manned missions, a manned submersible capable of carrying 3 persons upto a depth of 6000m with an operational endurance of 12 hours is under development, for which Det Norske Veritas-Germanischer Lloyd (DNV-GL) is identified as the certification agency. The titanium alloy personnel sphere of the manned submersible is developed with the help of the expertise from the Indian Space Research Organization.

A deep-sea Autonomous Underwater Profiling Drifter and profiler system suitable for operation upto 500m water depth was developed and tested off the coast of Chennai. Sub-seabed Imaging SONAR has been designed and a side-scan synthetic aperture SONAR is also under development. A deep-water scientific autonomous underwater vehicle is also being realized through an international firm.

For enabling deep-ocean poly-metallic nodule demonstration mining in the UN International Sea Bed Authority-allocated polymetallic nodule site in the Central Indian Ocean Basin, a crawler-based mining machine has been successfully developed and tested for locomotion in the soft seabed at a water depth of 3430m. For characterizing the seabed and to optimize the crawler locomotion systems, the NIOT-developed in-situ soil tester was successfully deployed at a water depth of 5418m.

Infrastructural development is another major activity being taken up. As a part of vessel infrastructure, two new coastal scientific research vessels Sagar Tara and Sagar Anveshika were commissioned during August 2019 and February 2020, respectively. The two deep-ocean scientific research vessels Sagar Manjusha and Sagar Nidhi have been utilized effectively for scientific exploration and technology demonstration purposes. A revised master plan for seafront Research Facility at Pamanji and infrastructures for pre-investment and testing facilities for conducting algal culture consisting of raceway ponds, store room and pump room have been developed.

The department-related Parliamentary Standing Committee on Science and Technology, Environment, Forest & Climate Change reviewed the activities of the Institute on December 28, 2019 and appreciated the progress. The second subcommittee to the committee of Parliament on official language reviewed the implementation of Hindi Language on January 14, 2020 and expressed satisfaction.

As a part of the Silver Jubilee celebration technical discussions were held during August 2019 in the presence of the Secretary-MoES, Former Secretaries DOD/MoES including Dr.Harsh K. Gupta, Dr.P.S.Goel and Dr.Shailesh Nayak, Founder Director of NIOT Prof.M.Ravindran, Directors of other MoES organizations and distinguished scientists from other organizations and NIOT. A coffee table book on NIOT was released and a panel discussion on the 'Future of NIOT' was held along with the participation of eminent delegates from the US, UK, Japan, France and Singapore.

I express my sincere gratitude for the support and encouragement shown by the Chairman, Governing Council- NIOT and the members of Governing Council. I thank the Chairman and Members of the Scientific Advisory Council, Finance Committee and Advisors, Scientists and members of staff of the MoES for all their support to deliver the activities mentioned in the report.

I thank the scientific and administrative community of NIOT for their consistent efforts in contributing to all the technological developments for India's strategic blue frontier.

The editorial committee under the leadership of Dr.Latha who prepared this Annual report on time deserves special mention.

I will be retiring in September 2020. May I thank Dr.Rajeevan, Secretary and all former secretaries who supported me in guiding this Institute and bringing it as the topmost Ocean Technology institute in the country in the civilian sector. I wish all success to the further growth of the NIOT in the years to come.

Thank you one and all.

(M.A.ATMANAND)

MAJOR ACCOMPLISHMENTS OF THE YEAR 2019-20

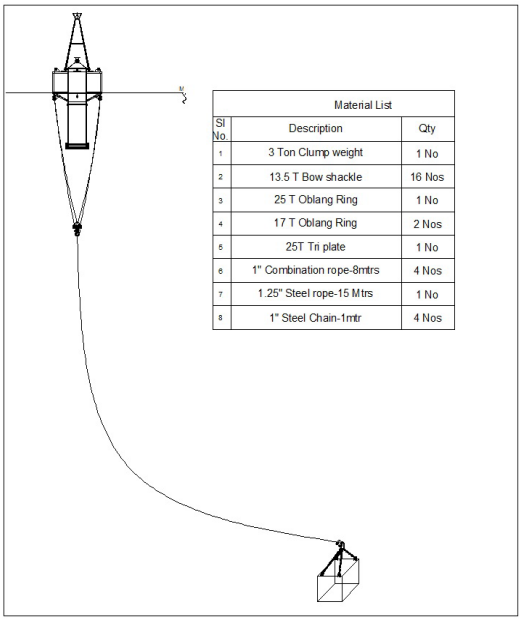
- Commissioning of 1.5 Lakh liters per day capacity Low Temperature Thermal Desalination plant in Kalpeni Island of UT Lakshadweep.
- North Indian Ocean Tide (N.I.O.T) Tide App was developed and predicted tide at Gulf of Khambhat published.
- Signing for Transfer of Technology with industries for commercialization of wave powered navigational buoy on 26 July 2019 at MoES.
- Shallow water personnel sphere for the Manned Submersible was manufactured and tested at 180m water depth off Chennai.
- Seabed locomotion trials on soft sediment soil in the Bay of Bengal at a depth of 3420 m using a crawler type mining machine in Feb 2020. Seabed soil assessment at the Central Indian Ocean Basin in the ISA allocated polymetallic nodule (PMN) area, at a depth of 5418 m using an In-situ Soil Tester in Apr 2019.
- Shallow water Remotely Operated Vehicle, built in-house was handed over to Centre for Marine Living Resources and Ecology (CMLRE), Kochi and hands-on training given to CMLRE personnel for carrying out biodiversity studies.
- Autonomous Coring System (ACS) was deployed off Nellore in the Bay of Bengal at a depth of 230m depth and subsea drilling was carried out successfully up to 101.5 m below the sea floor successfully. Further ACS was deployed at Gas hydrates site, KG Basin in the Bay of Bengal at a depth of 1070 m depth and subsea drilling was carried out successfully up to 60 m below the sea floor.
- The OMNI buoy systems captured the signals of six cyclones and supported IMD by providing the real time observations of surface meteorological and oceanographic parameters.
- Indigenously developed sub sea bed imaging system has been tested in shallow waters off Chennai.
- The Ocean Acoustics team of NIOT, with the support of OOS and NCPOR, has successfully retrieved in July 2019 the independently moored autonomous ambient noise system in the Kongsfjorden Arctic that was deployed in July 2018 near INDARC system and continuous data obtained.
- 'C' - profiler system operable up to 500m depth has been developed and tested in the field.
- Multiplex PCR kit for detection of virulent *Enterococcus faecalis* in food, water and environment samples was developed and the technology was transferred to M/s SAAI Electro Biogenic India Private Limited, Chennai, through National Research Development Corporation (NRDC).
- Technology for production of pharmaceutical important lutein from marine microalgae for treatment of age related macular degeneration was developed and the technology was transferred to M/s Vectrogen Biologicals Private Limited, Hyderabad through NRDC.
- Acquisition of two new vessels Sagar Tara and Sagar Anveshika completed. Sagar Tara was successfully taken over on 16th August, 2019 and Sagar Anveshika on 14th February 2020.

ENERGY AND FRESH WATER

The group strives to develop and demonstrate technologies related to harnessing of ocean renewable energies and generating fresh water from the ocean. Development of technologies for Low Temperature Thermal Desalination (LTTD) using coolant water discharge from thermal power plant and offshore deep sea cold water, wave energy conversion using floating devices such as navigational buoy, marine hydrokinetic turbine development and Ocean Thermal Energy Conversion (OTEC) are the focal areas of research.

Wave energy powered navigational buoy

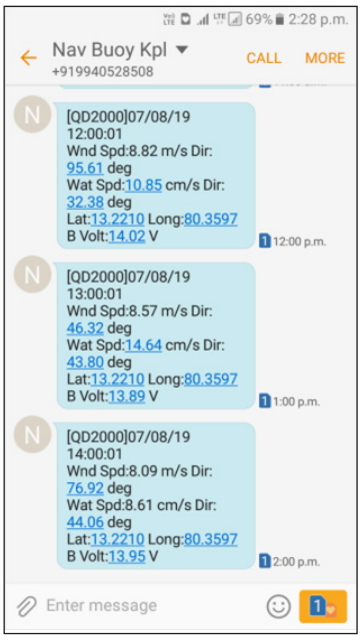
After years of R&D in the area of wave energy, the team has developed a product that is designed to function as a navigational aid to ports and harbours and also function as an observation buoy. Successful demonstration and continuous operation of wave powered navigational buoy off Kamarajar Port Ltd (KPL) paved the way for Transfer of Technology (ToT) to industries. ToT agreement was signed with three reputed firms in July 2019 for commercialization of this technology on industrial scale. This wave energy device is based on oscillating water column principle. The buoy houses the navigational lamp, instruments for performance monitoring and sensors for oceanographic measurements. It is under continuous operation near navigational channel off KPL, Chennai at 18 m of water depth. Generated electrical energy is used to power a beacon lamp for guiding ships and sensors for measuring wind and water current speed, temperature and location. These data are transmitted every hour to port's signal station and to NIOT in real time through GSM/GPRS communication as shown in Figure below. A typical monthly recorded wind and current data off KPL is also shown in Figure.



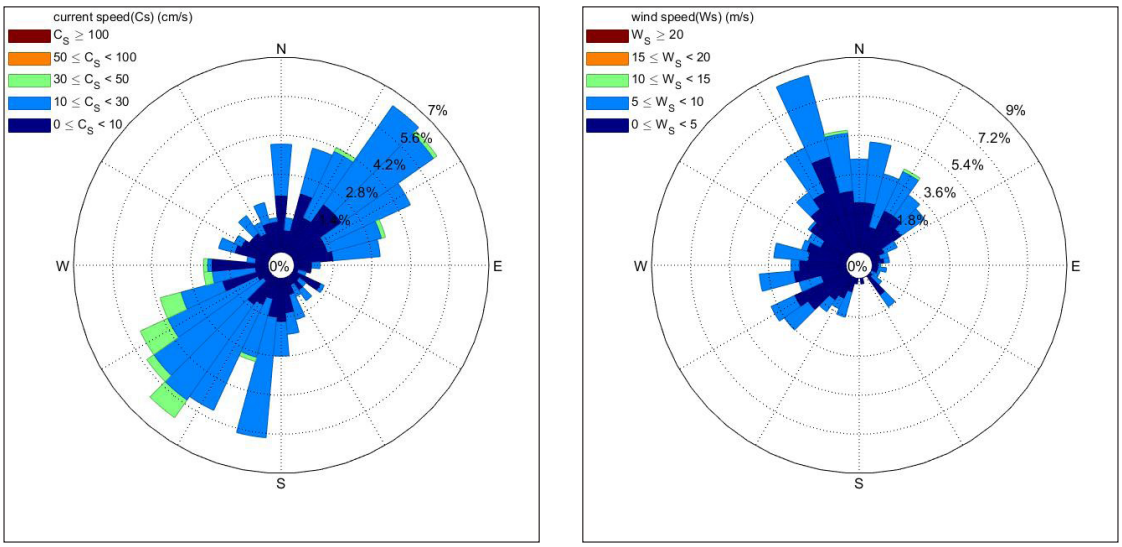
Material List

Sl No.	Description	Qty
1	3 Ton Clump weight	1 No
2	13.5 T Bow shackle	16 Nos
3	25 T Oblang Ring	1 No
4	17 T Oblang Ring	2 Nos
5	25T Tri plate	1 No
6	1" Combination rope-8mtrs	4 Nos
7	1.25" Steel rope-15 Mtrs	1 No
8	1" Steel Chain-1mtr	4 Nos

Single point mooring for the buoy



Snapshot of message communicated on real time basis to port and NIOT

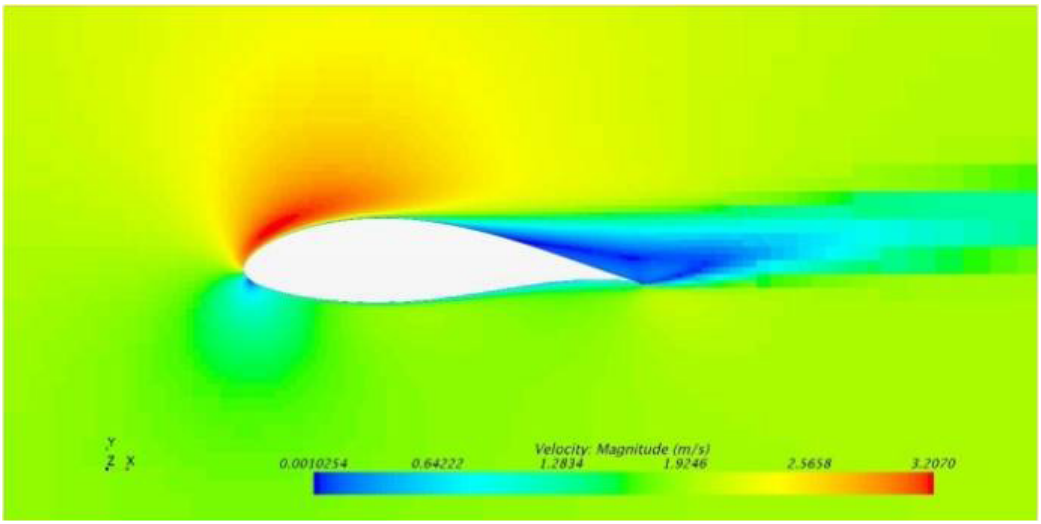


Recorded wind and water current measurements off KPL

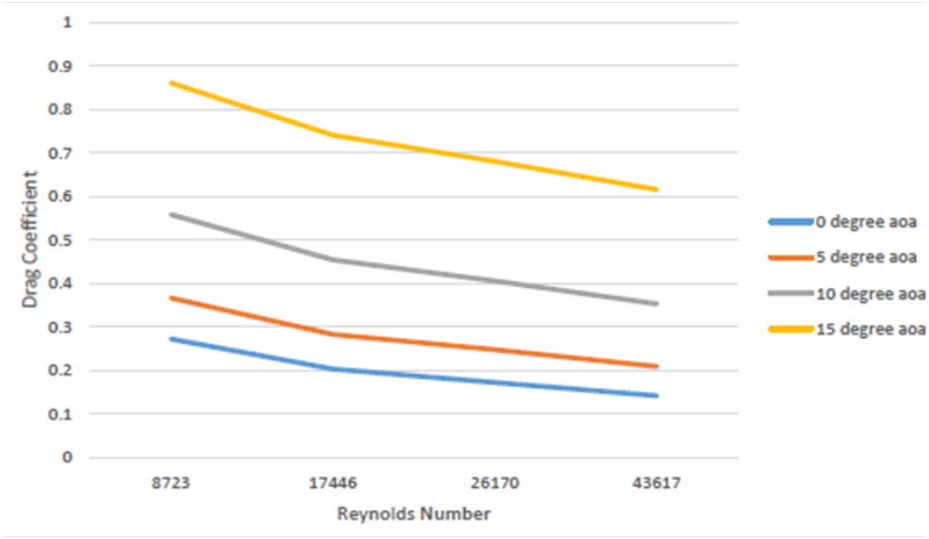
Further efforts are now towards implementing 4 nos. of wave powered navigational buoy in Andaman & Nicobar Islands with funding from Andaman Administration. This all-weather indigenously developed product can replace solar powered ones which are imported.

Studies of axial flow turbine for harnessing hydrokinetic energy in ocean currents

Computational Fluid Dynamics (CFD) studies continued on ocean current turbine as part of the joint developmental work on axial flow turbine with University of Edinburg, UK. NIOT's work was presented in the close out meeting at University of Edinburgh on 28 October 2019. Further studies on lift and drag characteristics of the turbine blade were carried out for further blade optimization. Figure shows the predicted results at mid-section of NACA 63-8XX profile used in 1.2 m dia. turbine blade.



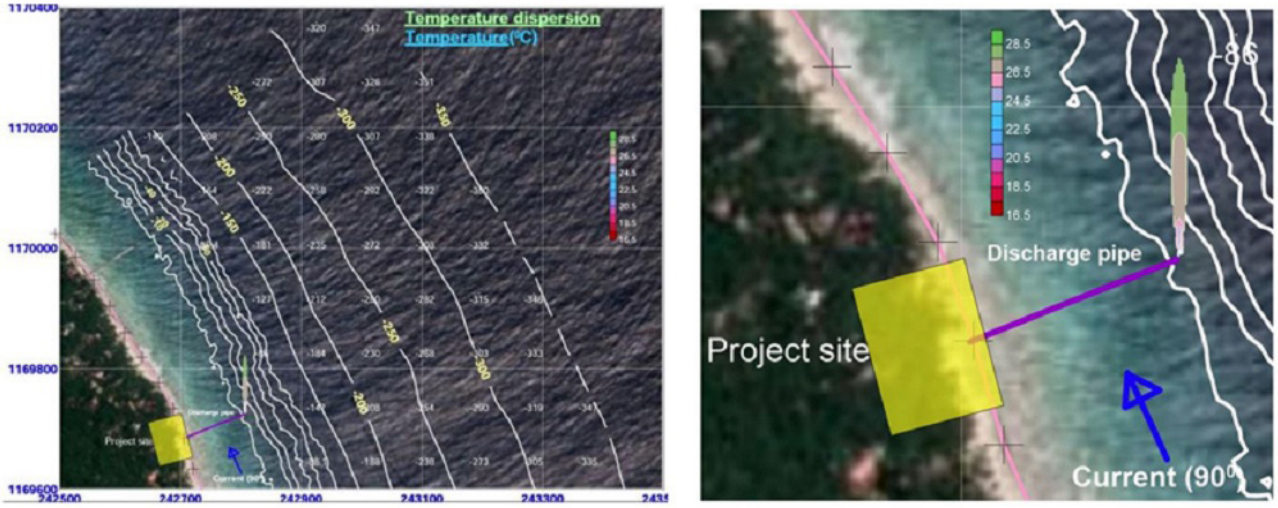
Velocity contour at 10° angle of attack



Drag coefficient Vs Reynolds no.

OTEC powered desalination plant at Kavaratti

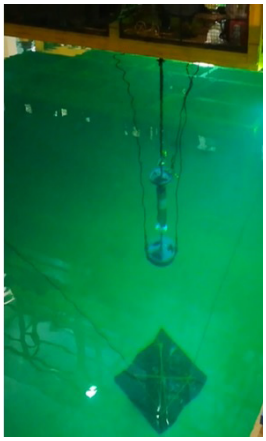
Towards efforts for establishment of an OTEC powered desalination plant of 100m^3/day capacity at Kavaratti, a revised EIA report was prepared and submitted to Lakshadweep Coastal Zone Management Authority (LCZMA). The studies on the dispersion and dilution of cold water and nutrient as shown below were presented to the technical committee of LCZMA at NIOT in June 2019 and LCZMA granted the No Objection Certificate (NOC) for the project. Meetings were held with various experts and Technical & Financial Evaluation Committee (TFEC) members to finalize the tender document. The tender document on turnkey mode was prepared and uploaded after incorporating comments from experts and consultants. A Prebid Meeting was held at NIOT with experts and potential bidders.



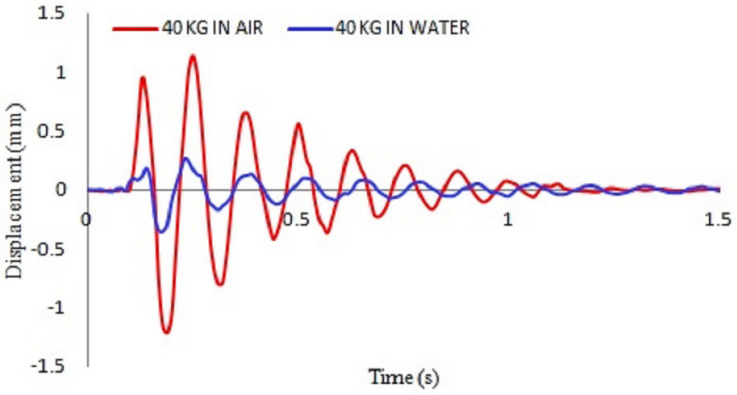
Simulated temperature contours around discharge area

Meanwhile, as part of the in-house studies on the behavior of the long HDPE pipeline, experiments were carried out for the estimation of natural frequency in air and water. The pipe test specimen was fixed at the top end and the clump weights fixed at the bottom end of the pipe with acoustic release as shown in the Figure below. The comparison of displacements obtained from the measured accelerations in air and water is shown in Figure. Further experiments are being carried out in Acoustic Test facility to find added mass. Also experiments are being designed for the study of Vortex Induced Vibration (VIV).

Experimental setup in air medium



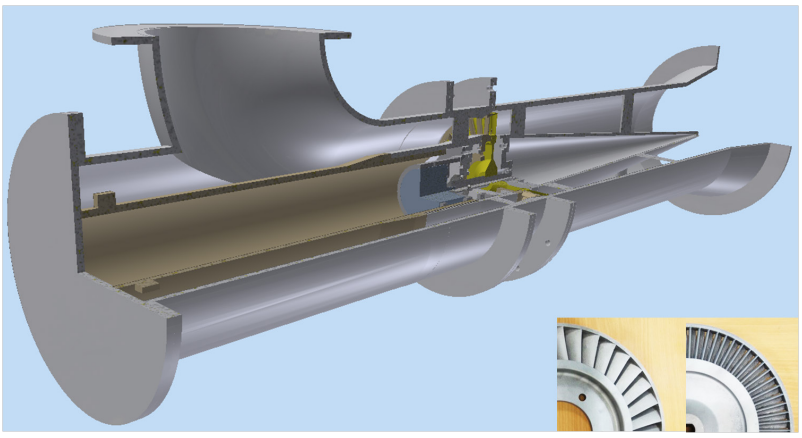
Experimental setup in water medium



Displacement time history during decay test

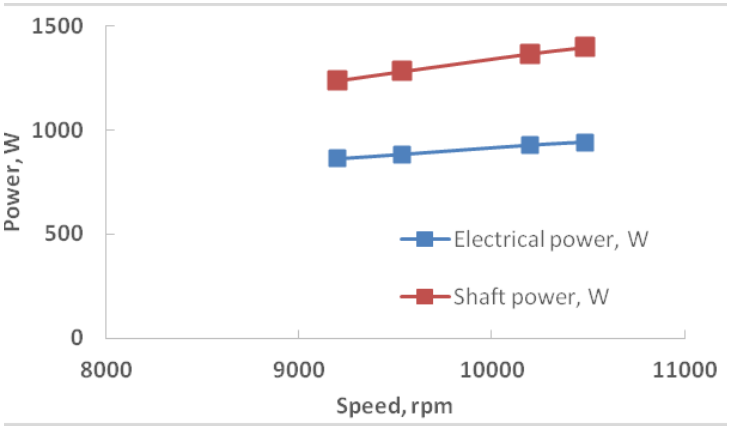
OTEC-Desalination laboratory at NIOT

A laboratory scale Open Cycle-OTEC (OC-OTEC) based desalination test facility has been made fully operational in NIOT premises. This facility is equipped with a heater and a chiller to maintain requisite temperatures for warm and cold water supply respectively. The OC-OTEC facility comprises of a flash chamber that can handle warm water flow of 30m^3/h and a shell and tube condenser of heat duty of about 200 kW with maximum cold water flow of 30 m^3/s. Vacuum system of 150 m^3/h capacity maintains the desired pressure level for sustaining flash evaporation process. In this facility a power module comprising of a turbine and generator was tested successfully. This turbine was completely developed in-house. The turbine is of axial flow type with a single stage of expansion. Turbine stator and rotor image is shown below.



Open cycle OTEC turbine Ø 268 mm assembly for open cycle OTEC laboratory

It has a tip diameter of 268 mm and it works at a design pressure ratio of 1.4 at water vapour mass flow rate of 0.045 kg/s. A high speed permanent magnet synchronous generator (60V, 2 kW at 20000 rpm) is coupled to the turbine shaft. Several tests are being conducted to understand the parametric sensitivity for water and power generation. Figure shows the power generated for various turbine speeds at vapor flow rate of 0.046 kg/s.



Generated power from power module at various speeds

A comprehensive Supervisory Control and Data Acquisition System (SCADA) have also been developed to monitor various parameters during testing. The system is programmed to calculate and display instantaneously various parameters like system pressures, temperatures, electric power, turbine torque, vapour mass flow rate, heat exchange rates, outlet vapour dryness fraction etc. This system now can be replicated for the SCADA system of the upcoming OTEC Desalination plant.

2X1 MLD LTTD plant using condenser reject from Tuticorin Thermal Power Station

As part of the establishment of 2x1 MLD LTTD plant at Tuticorin Thermal Power Station (TTPS) premises, the tender was opened and two bids were received. Upon techno commercial evaluation of bids, only one was found to qualify and their price bid was opened. It was understood that the price quoted was too high for which a Price Negotiation Committee (PNC) was constituted to examine cost quoted by bidder. On recommendation of the PNC, the bidder revised the quoted price and resubmitted it. The same is under scrutiny at MoES.

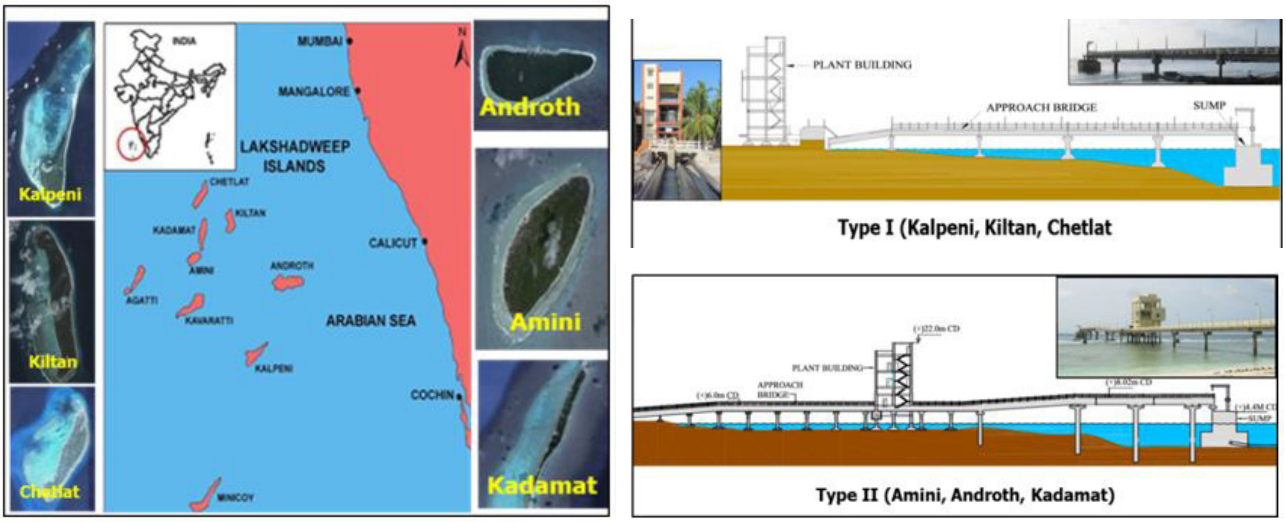
OCEAN STRUCTURES AND ISLAND DESALINATION

The group is focused on the Development of technologies for offshore structural components which are detailed below:

- Establishing desalination plants in the Islands of Union Territory Lakshadweep and providing drinking water to islands.
- 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.

Establishment of 1.5 Lakh liters per day capacity Low Temperature Thermal Desalination plant Amini, Chetlat, Kadamat, Kalpeni, Kiltan and Androth Islands of UT Lakshadweep

Establishment of Low Temperature Thermal Desalination (LTTD) plants with a capacity 1.5 lakh litres per day in six islands of UT Lakshadweep (Kalpeni, Amini, Kadamat, Androth, Kiltan and Chetlat) was taken up at cost of Rs. 187.87 crores after preparation of Detailed Project Report (DPR) based on bathymetry survey, geotechnical and oceanographic investigations. The three plants at Androth, Amini and Kadamat are located in intertidal area and other three plants at Chetlat, Kiltan and Kalpeni are located on land, as shown below.



Desalination work in Lakshadweep Islands

The major challenges include construction of marine structure, deployment of deep sea cold water pipe under complex site and environmental conditions with difficult logistic constraints due to remoteness of islands. The intake structure in Kalpeni was initially constructed in lagoon and launched into the lagoon where further construction is carried out. The structure was towed to its final location in floating condition and placed at final location based on hydrodynamic stability analysis. Deep sea cold water pipe was successfully deployed with one end connecting to the sump at shallow water and the other end at about 400m depth to draw cold water at temperature of 11^0C. Process equipment such as flash chamber, condenser, sea water pumps, vacuum system and control system were installed and commissioned on 9th January, 2020 to generate fresh water.

Construction activities in Kalpeni island

The plants at Amini and Chetlat are nearing completion and other islands (Kadamat, Androth and Kiltan) are in progress as shown below.

Activities in Amini island

Construction activities in Chetlat island

Construction activities in Kadamat island

Construction activities in Androth island

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

After successful commissioning of beach restoration project, many state governments have approached MoES-NIOT for technical advice. The coastline of Puducherry was monitored for its performance through process based measurements. The volume of sediment in the near shore profiles improved after implementation of submerged reef resulting in a formation of wide beach and wave rotation as predicted in the numerical model compared well with near shore measurements. The reef structure acted as substrata for marine growth attracting more fishes thereby enhancing livelihood of fishermen community, demonstrating the function of multipurpose reef.

Performance of reef in Puducherry coast

Wave structure interaction studies

The response of ocean structures to hydrodynamic forces (wave and currents) is nonlinear and complex. The existing standards do not have reliable methods to estimate wave forces on coastal structure. Wave Structure interaction studies were taken up to address such needs and the method to estimate forces on structures through full scale experiments and Numerical Modelling. Full scale experiments are being conducted on intake structure at Agatti Island, where wave and tidal measurements have been recorded since March 2012 to till date by bottom mounted directional wave recorders which measures both incident and reflected waves. An extensive array of pressure transducers is fixed on the intake structure to measure the incident wave pressure. Standardization for estimation of wave loads on marine structures and development of numerical tools for estimation of wave loads is in progress.

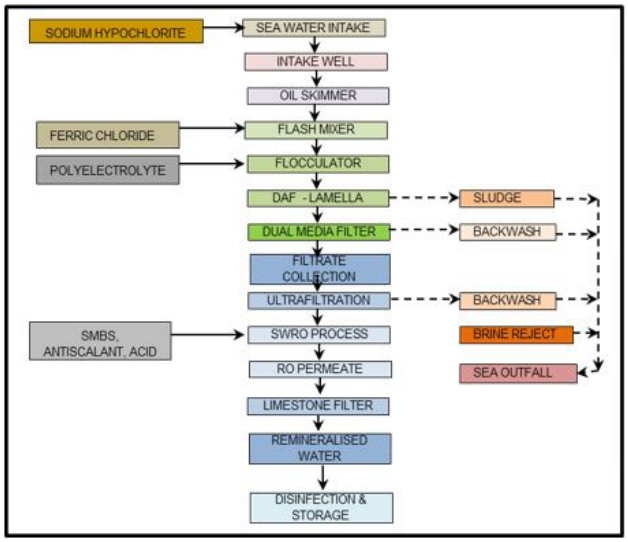
Based on the inputs from the studies, Indian Road Congress is in the process of evolving guidelines for estimation of wave loads on structures, for which a sub-committee was constituted with MoES-NIOT coordinating the activities.

Industrial projects

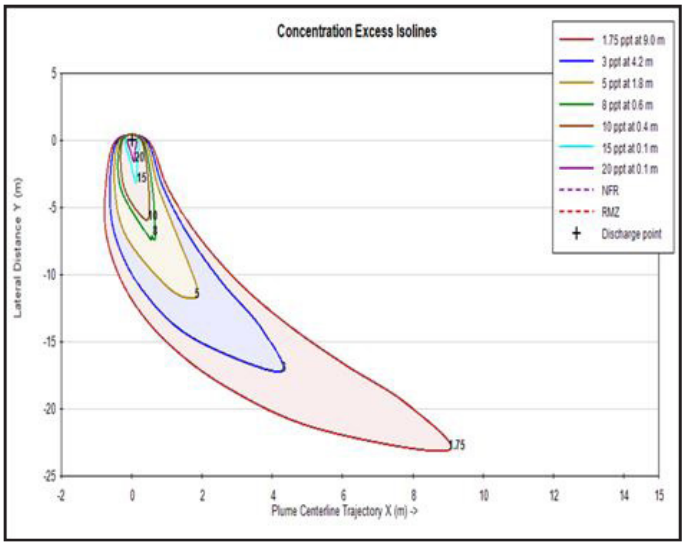
Establishment of RO desalination plants in Paradip and Kamarajar Port

NIOT is involved in preparation of Detailed Project report and Project Management Consultancy for establishment of 10 MLD Sea Water Reverse Osmosis (SWRO) desalination plant in Paradip Port Trust and 1 MLD SWRO desalination plant in Kamarajar Port premises.

Detailed field collection carried out to identify the intake and outfall locations of RO plants. Brine dispersion modelling carried out to devise technology for proper dispersion in releasing the residual brine into the sea to negate any environmental impact. Feasibility report and Detailed Project report was prepared and submitted to Port Authorities. Environmental Impact Assessment report was prepared and Coastal Regulatory Zone (CRZ) clearance obtained for Odisha Coastal Zone Management Authority (OCZMA) and Ministry of Environment Forest Climate Change (MoEF&CC) for establishment of 10 MLD RO plant in Paradip Port.



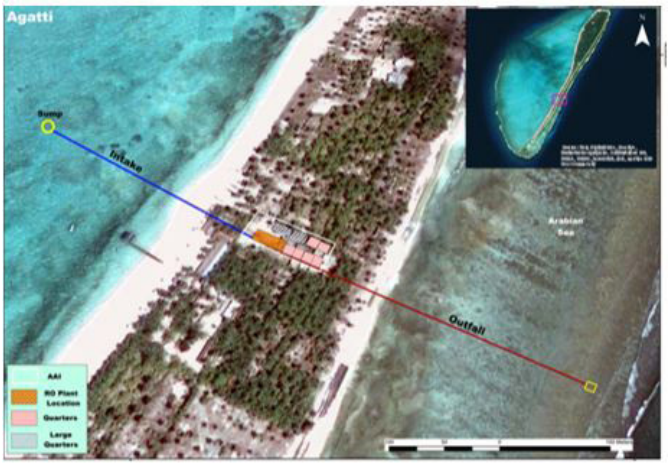
SWRO process design



Near field Brine dispersion

Establishment of RO desalination plants in UT Lakshadweep

UT Administration has requested NIOT to establish 50 KLD RO desalination plant in Kadamat and Bangaram islands of UT Lakshadweep. CRZ clearance obtained from Lakshadweep Coastal Zone Management Authority and the work initiated. Plant building is completed in Kadamat and Bangaram islands and installation of pipes and erection of RO skids in process.



Location of intake and outfall

Kadamat-Plant building

DEEP SEA TECHNOLOGIES

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, hydro-thermal sulphides etc. and for other oceanographic, polar and industrial applications.

Progress Achieved

Design and development of 6000 m depth rated Manned Submersible

Towards development of technology for deep ocean mineral exploration and scientific studies, indigenous design and development of 6000 m depth rated manned submersible is in progress with inter-ministerial collaboration.

Based on the need, preliminary design is completed for the development of a 6000m depth rated Manned Submersible which is capable of carrying 3 persons with operation endurance of 12 hours and emergency support of 96 hours.

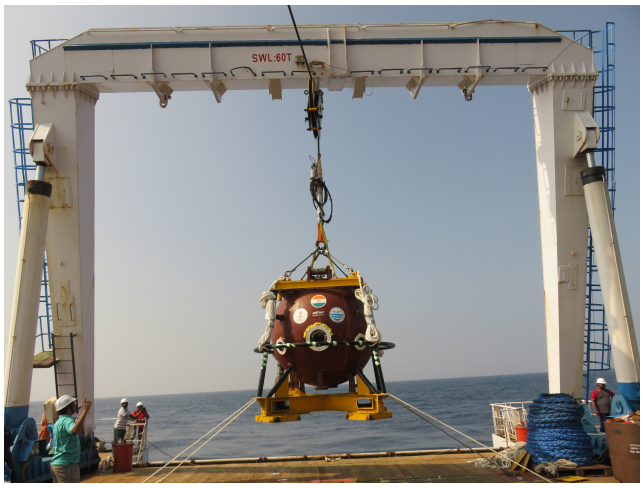
Conceptual view of the Manned Submersible

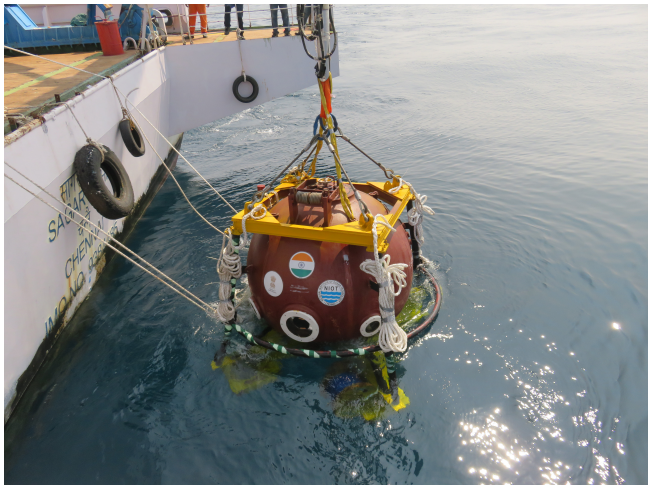
Certification and classification of the submersible

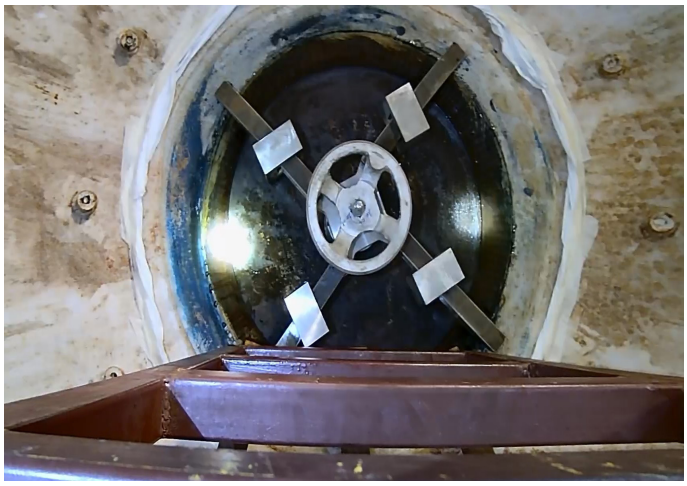
The certification and classification process of manned submersible is an important and mandatory requirement to verify acceptable levels of personnel safety throughout the manned submersible operating range. M/s. Det Norske Veritas-Germanischer Lloyd (DNV-GL), Norway was identified as the certification and classification agency and a contract was signed for the certification and classification of the manned submersible. A Pre-design workshop was conducted by DNV-GL team at NIOT during Feb 2020.

Personnel sphere

As intermittent activity, a 2.1m diameter shallow water personnel sphere of 25 mm thick shell thickness capable of housing 3 persons was manufactured using carbon steel in Chennai. The material selection, fabrication and the qualification of the sphere was witnessed by American Society Mechanical Engineers (ASME) and Det Norske Veritas (DNV) surveyors. The acrylic windows, entry hatch and penetrator plates were integrated onboard Sagar Nidhi. The depth qualification for the personnel sphere was successfully carried out at a depth of 180m in Bay of Bengal during Jan 2020.







Shallow water Personnel Sphere deployment, testing and internal view onboard Sagar Nidhi

A 6000m depth-rated 2.1m diameter titanium alloy personnel sphere is being developed in association with VSSC-ISRO for the 6000 m depth rated manned submersible.

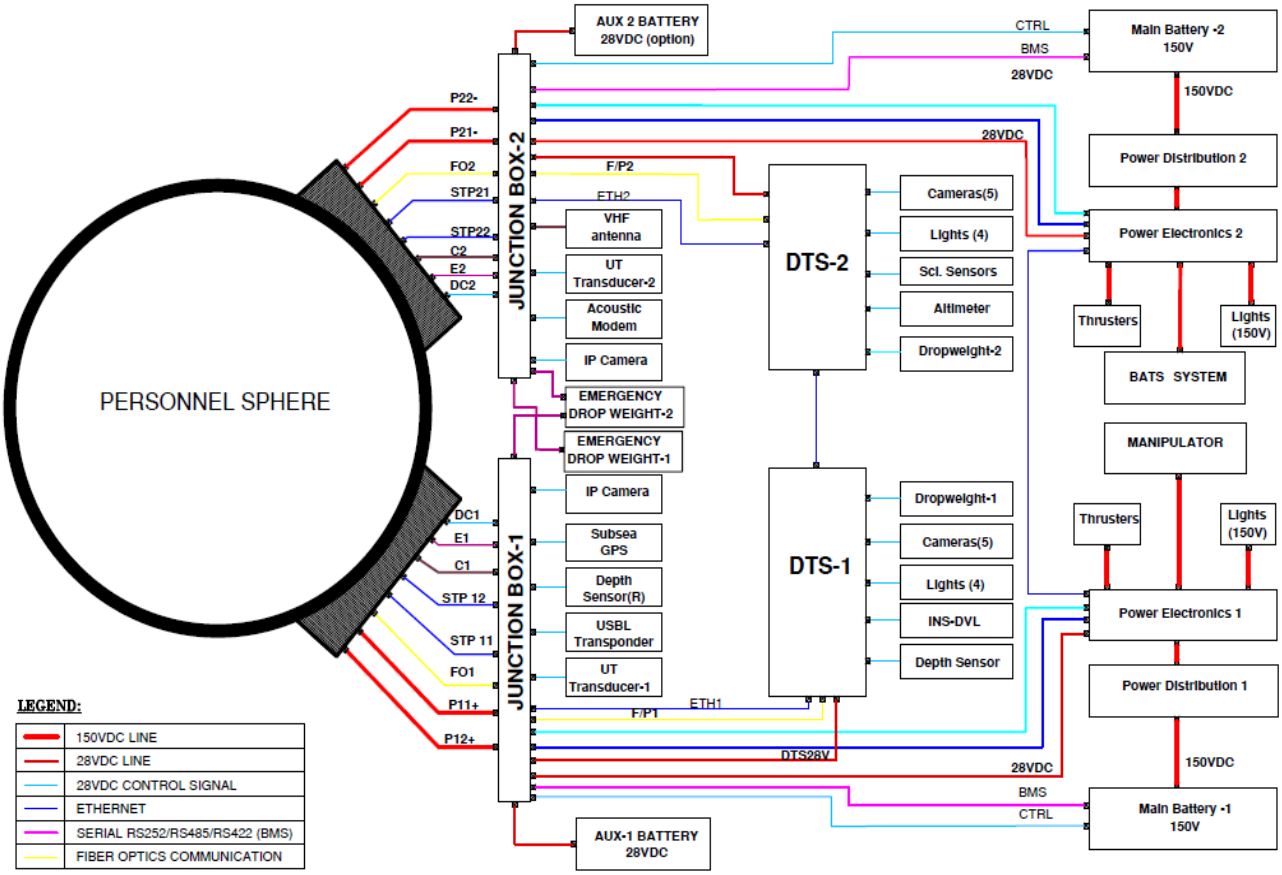
Vehicle General Arrangement

After carrying out preliminary general arrangement, optimization is being done iteratively by taking into account of the dimensions and weight of the subsystems for achieving the hydrostatic stability and hydrodynamic shape. Detailed mass budget of the submersible is completed with an estimate of uncertainty. Interaction is in progress with Ocean Engineering Department of IITM, Chennai for validation of shape and stability studies.

Power and signal interface architecture

The interface definition and description for the electrical and electronics systems are carried out based on system engineering approach with the aid of N-squared diagram. The axis symmetric architecture complies

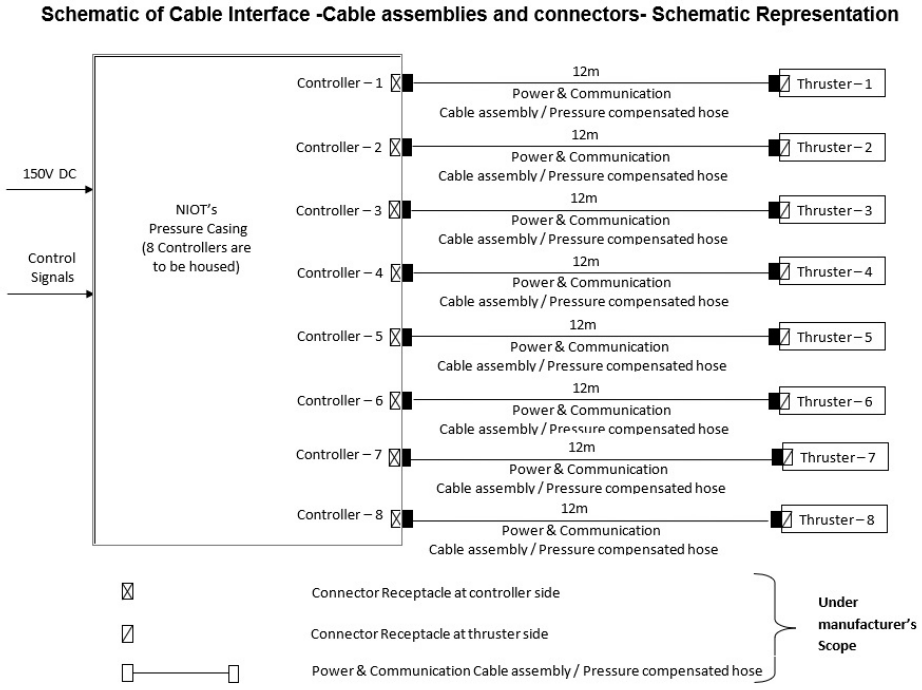
with the DNV-GL rules; provides redundancy and fault tolerance, against water entry in pressure-rated enclosures and to avoid single point failures. In order to ensure safety to the personnel, operating voltage inside the personnel sphere is limited to 28 VDC which is fed through electrical penetrators from the main and auxiliary batteries. The emergency jettisoning functions are controlled directly through the electrical penetrator.



Interface cable assembly architecture using penetrator assembly

Batteries and Thrusters

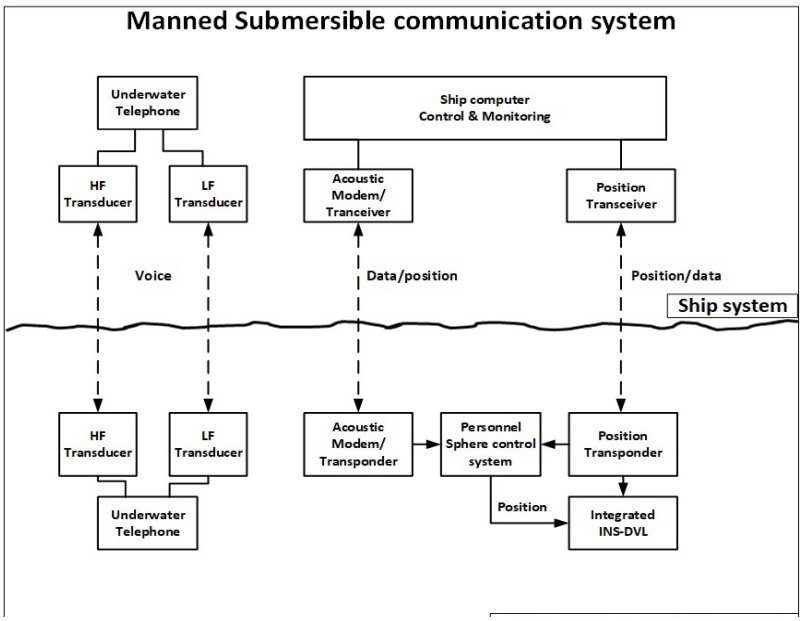
The manned submersible is powered by 100 kWh battery packs for operating the propulsion thrusters, hydraulic power units, ballast pump & lights. Based on the unparalleled safety, higher reliability and reduced footprint, pressure-compensated Lithium Polymer (Li-Po) batteries are finalized and order has been placed for the same. Eight thrusters are used for propelling and manoeuvring the submersible in six degrees of freedom and order was placed with international firm for its realization.



Schematic of Thrusters configuration and Order placed thrusters from Techno dyne, USA

Navigation and Communication System

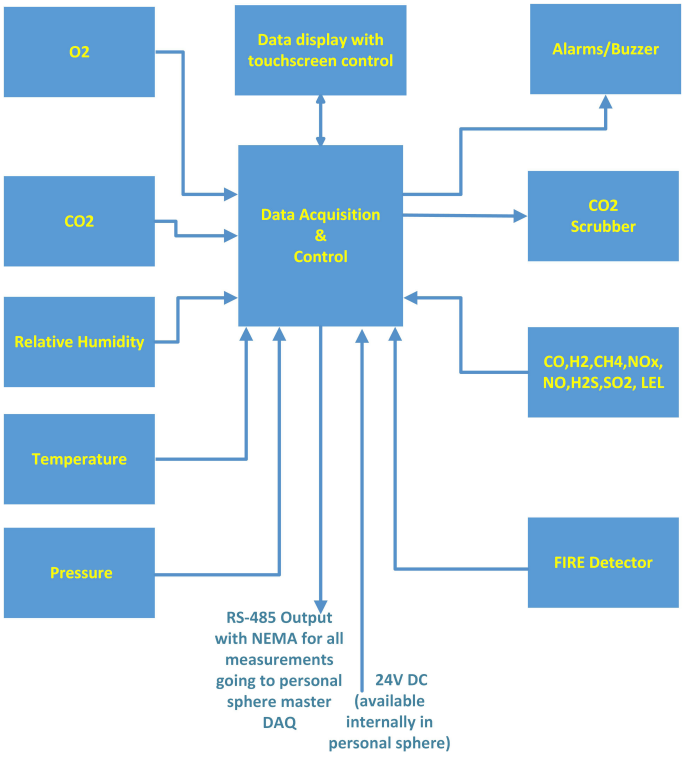
The submersible navigation and communication system, which is essential for effective operation and retrieval of the submersible, was designed based on the DNV-GL certification agency requirements. The Navigation system comprises a 6000m depth-rated integrated Inertial Navigation System (INS) and Doppler Velocity Log (DVL) with depth sensor, subsea GPS and Acoustic position transponders. The Integrated INS-DVL and subsea GPS has been realized and tested at lab and in-house water tank for its envisaged functionality. The Acoustic data communication system is used for exchanging critical vehicle parameters between the submersible and the deployment vessel. The data communication system was realized with 7-17 kHz, 10 km range and tested. The voice communication between the submersible and the deployment vessel is being realized using mutually independent acoustic telephones operating at 27 kHz @ 6 km range and 10 kHz @ 10 km range.



Submersible communication scheme and the realized Integrated Inertial Navigation System

Human life support system design

The life support system inside the personnel sphere is designed to cater to the needs of 3 aquanauts for a normal period of 12h and 96h in case of emergency. The personnel sphere life support system comprises oxygen supply, CO_2 removal, humidity control, environment monitoring, fire surveillance, fire extinguishing and emergency breathing systems. The oxygen supply system comprises of cylinders of each 1.3 L capacity so that the O_2 concentration is maintained with 19 to 23%. A CO_2 removal system was developed based on soda lime scrubbers with a 5 kg capacity with a scrubbing rate of 75 L/hour. Oxygen supply system and CO_2 scrubber was tested with human being in acclimatization chamber and confirmed to maintain oxygen partial pressure of 21% and the concentration of CO_2 had not increased above 2500 ppm. The monitoring sensors network is designed to meet the DNV-GL requirements.

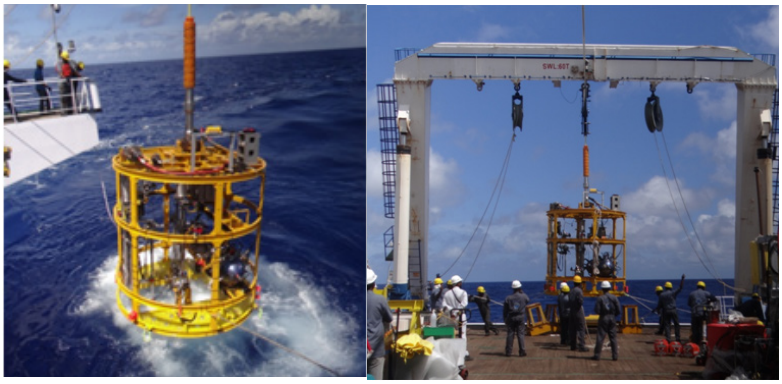


Schematic of Life support system sensor network

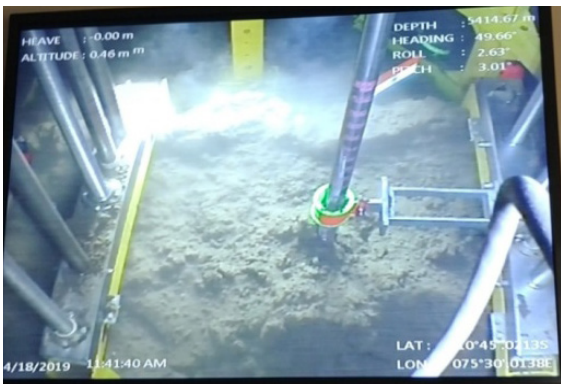
Design and development of In-situ Soil Tester (IST)

Towards assessment of deep sea floor bearing strength at the Central Indian Ocean Basin (CIOB) Poly-metallic Manganese Nodule (PMN) Area for the deployment and operation of Integrated Mining System, an In-situ Soil tested was designed and developed.

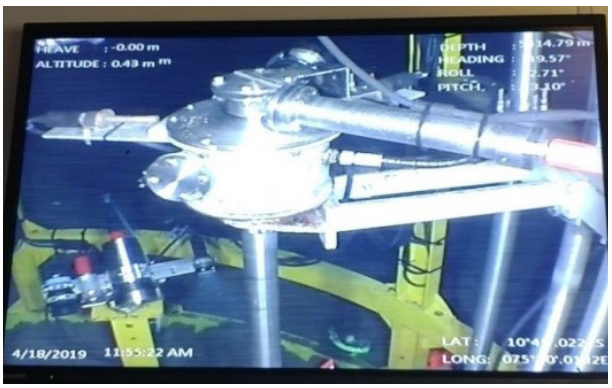
Deployment of the In-situ Soil Tester was undertaken in the International Seabed Authority (ISA) allocated PMN area in the CIOB to assess the sea bed soil and nodule bearing conditions. The system was deployed to a depth of 5418 m. The seabed soil was assessed to be non-clayey, powdery, non-adhering type and firm to support the underwater weight (2.2 ton) of the soil tester. Hence the soil bearing strength was greater than 5 kPa.



Deployment of IST at CIOB



Cone operation at 5418m depth



Vane operation at 5418m depth

Medium Voltage Variable Frequency Drives (MVVFD)

MVVFDs are essential to control, start and operate high power medium voltage subsea electric motors of the mining machine and the high-pressure pumping unit, over a very long umbilical cable, viz. 7000 m. Variable frequency drives also need to be compact and portable for transport to ship during the sea trials of the mining systems and amenable for onboard installation. MVVFDs of 250 kVA and 500 kVA capacity were procured and tested exhaustively and tuned for different umbilical cable setting through experimental acceptance tests. The total harmonic distortion measured at the motor end was less than 10% as per the IEEE 519 standards.

Umbilical Cable Mechanical and Electro-optical Termination:

The deep sea winch installed onboard the ship for deployment and retrieval of the deep sea mining has a 7000 m aramid armoured umbilical cable. The existing termination set required renewal before the sea trials in February 2020. As the planned cruise to the CIOB was very critical for the project, the same was undertaken by the project team with in-house resources and expertise. Two resin moulded test sets were first prepared and qualified by actual load testing to breakage. Thereafter the actual termination work was undertaken onboard the ship and the sea trials were conducted.

Making the Cable Termination ready

Cable Break load Testing

Assessment of Mining Machine Locomotion to Sustain Higher Bearing Loads

The capability of the locomotion system to undertake safe motion on soft soil was assessed experimentally in a bentonite soft soil test tank, at overall bearing load equivalents of 3.5 and 4.0 T weight. After proving the system operation on a sand test track, two of the crawler tracks of the mining machine were run in the soil test tank at speeds of 0.15 - 3.0 m/s (same as that planned on the seabed). Preliminary results thus indicated the suitability of the mining machine to be sized to 3.5 T underwater weight for motion without sinking in soft sediment soil during crawler locomotion.

Testing on sand bed

Testing on bentonite soil bed

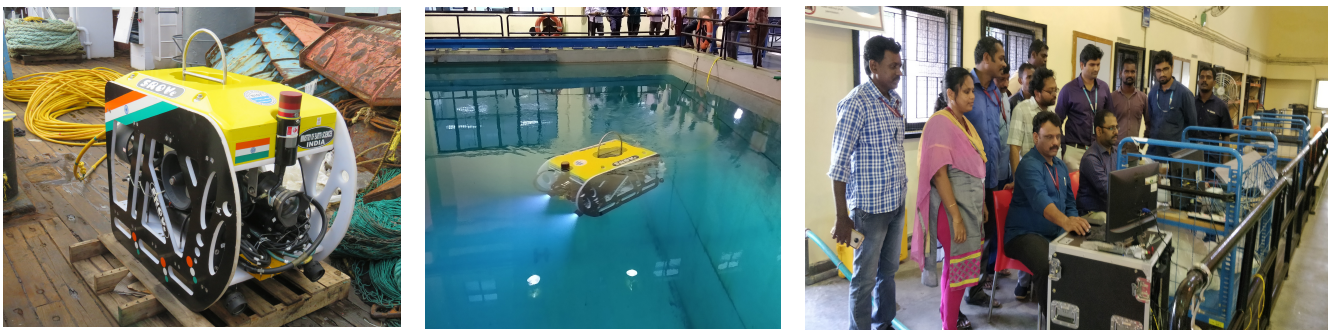
Seabed Locomotion Trials Feb-Mar 2020

As a part of the system qualification in deep ocean, the Seabed Locomotion Trials was undertaken in the Bay of Bengal, 13° 3.9' N, 81° 5.0' E, at 3420 mdepth. This was the first time that the experimental mining machine locomotion systems had been lowered and tested at such high depths since the beginning of the programme.

Seabed locomotion trial at 3420 m in Bay of Bengal

Design and development of Remotely Operated Vehicle

A 500m depth rated shallow water Remotely Operated Vehicle (ROV), similar in design to the existing polar cum shallow water ROV (PROVe) was developed and qualified for enabling shallow water biodiversity studies. Data telemetry and control, power and mechanical systems were developed in-house. Subsystems were assembled, integrated and tested at Laboratory and Acoustic Test Facility (ATF). Hands on training for ROV operations with deck power, control, launching and retrieval system was given to CMLRE scientists/ engineers at In-house water tank, ATF during June 2019. The shallow water ROV and subsystems were mobilized to onboard FORV Sagar Sampada for open ocean operation training. Assembly and integration and pre-dive test of ROV were conducted with CMLRE personnel during August 2019. As per Transfer of Technology agreement training was given to BEL, Bangalore for ROV operation at ATF, NIOT during December 2019.

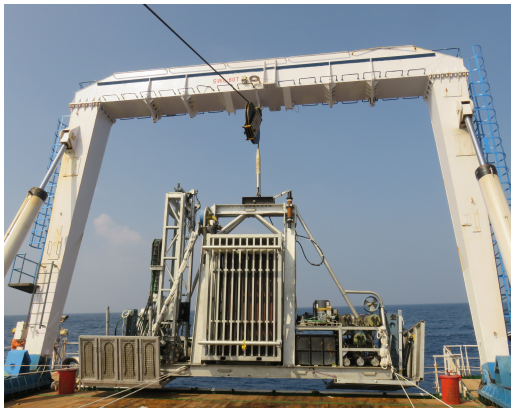


Shallow water ROV developed for CMLRE and training to BEL, Engineers at ATF

Development of Wire-line Autonomous Coring System

A Wire-line Autonomous Coring System (WACS) capable of taking long core samples for a length of 100m below the sea floor up to 3000m water depths was developed in association with Williamson & Associates, USA. The WACS system assembly, integration and deployment were carried out on-board Sagar Nidhi for underwater drilling at shallow and deep waters with in-house expertise.

The WACS system was deployed off Nellore in the Bay of Bengal at a depth of 230m depth and subsea drilling was carried out successfully up to 101.5 m below the sea floor by 25 hour continuous operation by an all-Indian crew. The WACS system was deployed at Gas hydrates site, Krishna Godhavari (KG) Basin in the Bay of Bengal at a depth of 1070 m depth and subsea drilling was carried out successfully up to 60 m below the sea floor by 30 hours continuous operation. All surface and subsurface subsystems include Electrical, Electronics, Hydraulics of WACS were tested and qualified at deep waters. Deep water drilling brought out two horizons of paleo-venting carbonate platform at 18 meters below seafloor (mbsf) and 50 mbsf at gas hydrate site (1070 m water depth) of KG basin.



ACS deployment

Subsea drilling view

Calyptogena Sp.(18mbsf)

Authigenic carbonates (50mbsf)

OCEAN ACOUSTICS

The Ocean Acoustics group has been focusing on development of acoustic systems for Passive Acoustic Monitoring in the ocean and further analysis along with ancillary data such as CTD, wind/wave/rainfall, sea ice and sediment for acoustical oceanographic applications, underwater communication and coastal surveillance. The indigenously developed Autonomous Noise Measurement System (ANMS) is used for systematic data collection in the deep waters of Indian Ocean and Arctic regions. The group is maintaining a nationally accredited Acoustic Test Facility for testing and calibration of underwater acoustic transducers and testing of acoustic system performance. The following activities are being carried out.

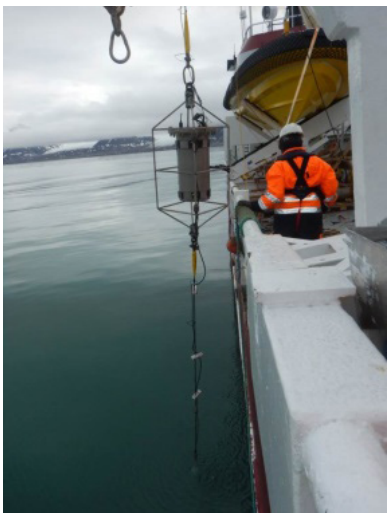
- Development of Ambient Noise System for Polar Region Measurements
- Development of Deep Water Ambient Noise System and Conducting Deep Water Measurements
- Vector Sensor Array Enhancements towards Coastal Surveillance Applications
- Up-gradation and Maintenance of Acoustic Test Facility (ATF)

Ambient Noise Measurement System (ANMS) for Polar Region Measurements

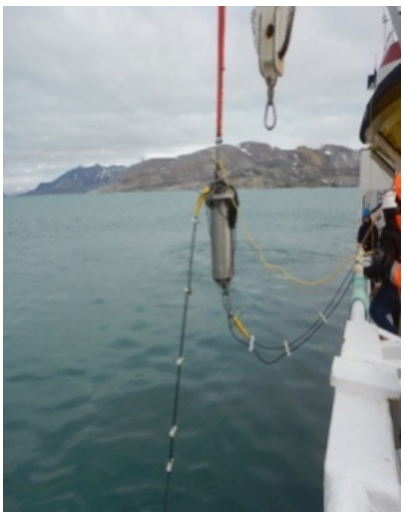
Ambient Noise is continuously measured since 2015 in the Kongsfjorden fjord, Svalbard Arctic. Indigenously developed Autonomous Noise Measurement System (ANMS) has been deployed for measurements at central Kongsfjorden fjord for studying ice dynamics, bioacoustics, meteorological and anthropogenic noise.

The independently moored ANMS deployed in July 2018 has been successfully retrieved on 14th July 2019. The ANMS incorporated with the IndARC mooring which was deployed in July 2017, also has been retrieved on 14th July 2019. A new system has been deployed along with IndArc mooring on 17th July 2019 and is now operational. It has 2 Bruel & Kjaer make hydrophones, integrated with data acquisition modules configured for 2 min acquisition every hour with a sampling frequency of 50 kHz.

Retrieval of ANMS deployed in 2017



Retrieval of independent ANMS deployed in 2018



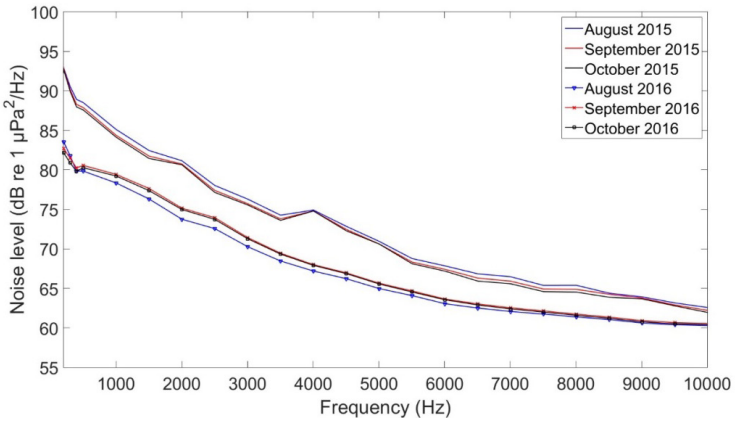
Deployment of ANMS in 2019

Kongsfjorden Data Analysis

Noise data sets have been obtained continuously for the last four years and the data have been analysed for noise due to different types of ice melting, biological, anthropogenic, intra annual and inter annual variations.

Ice melting noise in summer of 2015 & 2016

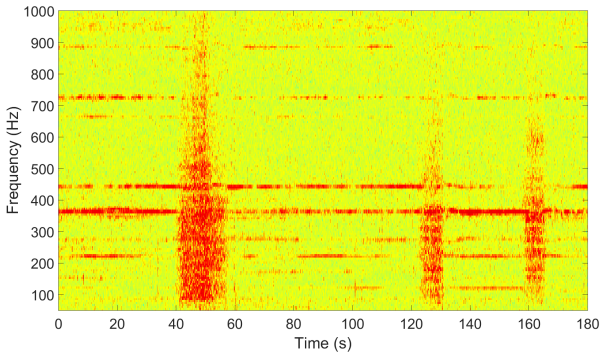
The ambient noise data for the summer period during the years 2015 and 2016 have been compared. Individual spectrograms for the months of August, September and October in 2015 and 2016 have been analysed. Maximum ambient noise is produced at frequencies less than 10 kHz, during summer 2015 and 2016. The spectrogram for the iceberg bubbling noise and iceberg calving noise have been identified. Variation in noise levels have been studied.



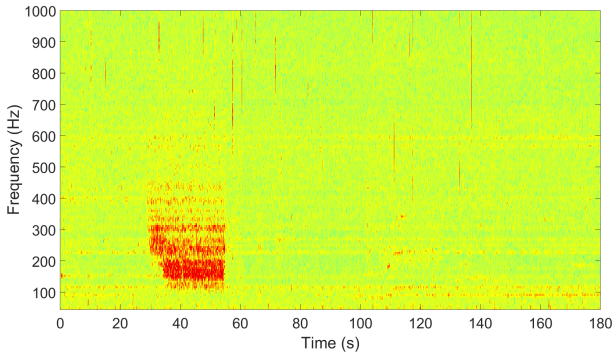
Variation in noise levels during summer of 2015 and 2016

Ice berg tremor and quake noise

Noise data sets have been acquired at a sampling duration of 180s at an interval of one hour. Iceberg tremor noise has been identified which falls in the band 100-1000 Hz and is shown in the figure. Iceberg quake noise also has been studied and the frequency falls in the band 100-400 Hz.



Spectrogram of iceberg tremor noise



Spectrogram of iceberg quake noise

Ocean Heat Content Studies:

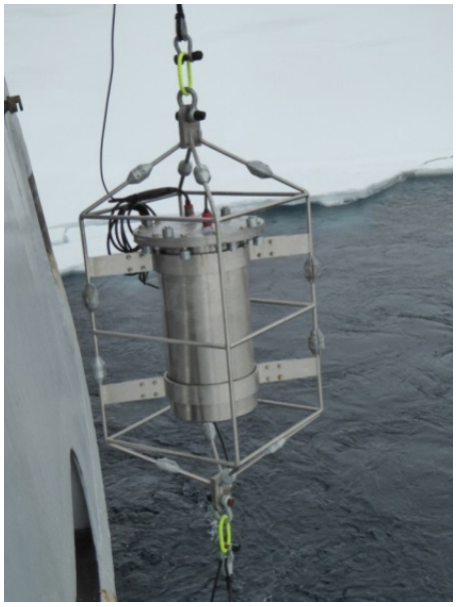
The Ocean Heat Content (OHC) in Arctic fjords, is one of the key indicator of global climate change which is derived from the record of hydrography profiles. OHC is estimated in the water column of Kongsfjorden near IndArc mooring based on CTD cast and its influence on ambient noise during midwinter period. The estimation of OHC near IndArc mooring is carried out owing to its location in innermost part of the fjord as well as the interaction of many tidewater glaciers.

Coordinated Arctic Acoustic Thermometry Experiment (CAATEX 2019)

NIOT has participated in the CAATEX 2019 experiment in the Central Arctic Ocean. The main aim of CAATEX experiment is to deploy acoustic sources and receivers in the Central Arctic Ocean in order to do basin scale acoustic thermometry to measure the heat content of Arctic Ocean and to benchmark climate models.

Ocean Acoustics team has successfully completed the assembly and integration of the acoustic receiver system at Longyearbyen, Norway during August 14, 2019 and handed over the system to CAATEX cruise team. The Acoustic receiver system with NERSC-4 (Nansen Environmental and Remote Sensing Centre Norway) mooring has been deployed successfully in the central Arctic Ocean at the location Lat.: 81°47'3.24"N, Long.: 22° 0'8.49"E on September 05, 2019. The system with 2 hydrophones is configured to record acoustic measurements for one year in synchronization with other acoustic receivers in the experiment (sampling frequency – 4 kHz; sampling duration – 1 hour; sampling interval-36 hours).

The national and international scientific partners include Norwegian Polar Institute, Scripps Institution of Oceanography, Woods Hole Oceanographic Institution, University of Texas-Austin, in USA, University of Bergen, Norwegian Meteorological Institute, Institute of Oceanology, in Norway and National Institute of Ocean Technology, Chennai and National Centre for Polar Ocean Research Goa in India.



Ocean Acoustic Team at Longyearbyen with CAATEX team and NIOT Acoustic Recorder deployment

Development of Deep Water Ambient Noise Measurement System (DANMS) and Conducting Deep Water Measurements

The objective is to record time series of ambient noise data in deep sea region particularly to gain knowledge on noise variability and noise properties in deep water, and to monitor the unexplored sound scape in the region.

A deep water noise system was deployed in November 2018 as part of OMNI buoy in south eastern Arabian Sea (8° 14´ N, 73° 18´ E) and was retrieved in November 2019. Time series measurements for 1 year have been retrieved successfully. The system acquired data with sampling frequency of 32 kHz for 12 minutes in every 30 minutes. The deployment location is off Maldives at water depths of 2100 m. This location is a noisy environment where wind, waves and various marine animals produce sound. Snapping shrimp is known to generate very high intensity sound, broad band signals (within 2 to 15 kHz), commonly seen in tropical coral reef environment.

A new Deep Water Ambient Noise Measurement System (DANMS) has been developed indigenously for long term sound monitoring in Indian Ocean. Glass instrumentation sphere for the DANMS was made ready after purging and filling of Nitrogen. The Data Acquisition modules and battery pack are encapsulated in glass sphere of 3000 m depth rating. Glass sphere with electronics was tested for satisfactory performance in lab and then integrated with hydrophones for noise measurement. Pressure testing of the system was also conducted for 300 bar. Field testing of the system has been completed in open sea and the system is now ready for deployment.

Glass Sphere housing electronics and battery pack

Development of algorithm for detection of submerged vessels and real time transmission of processed data is being taken up. The deep water moored buoys of NIOT are proposed to be used for detecting submerged vessels.

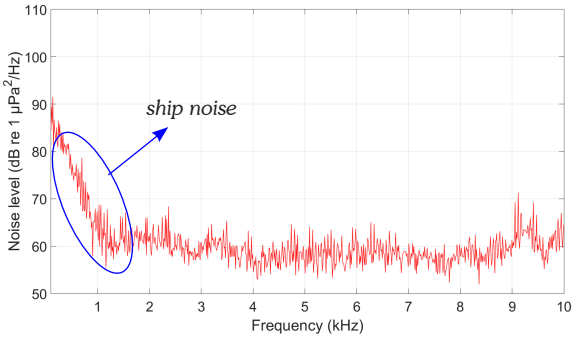
Vector Sensor Array (VSA) Enhancements towards Coastal Surveillance Applications

The objective is to enhance the VSA as a compact autonomous system and conduct more sea trials for surveillance applications.

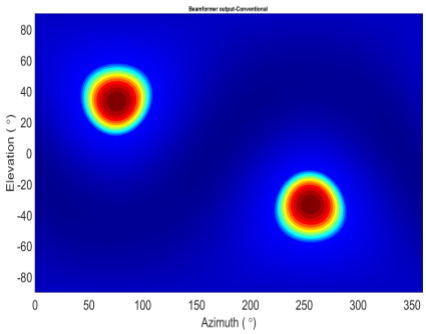
The enhanced Vector sensor array has been fabricated by Keltron, Kuttipuram and Ocean Acoustics team visited Keltron in June 2019 to check the performance of the VSA. Then the same has been delivered to NIOT and it was tested in the ATF. Direction of Arrival (DoA) estimation for the known source experiment in ATF is carried out and the results are satisfactory.

The VSA was enhanced as a compact and an autonomous system and sea trial was conducted for underwater source localization applications. Active measurements have been taken on 10th October 2019 in the fishing harbor off Chennai. Single tone frequencies of 1kHz to 6kHz were transmitted using two transducers sequentially. Later the system was deployed at 17m depth near harbour off Chennai for one month during October –November 2019 for autonomous observation. Ambient noise collected by the VSA in every hour for the duration of 90 sec with the sampling frequency of 25kHz. are analysed for anthropogenic source localization.

Deployment of VSA off Chennai



Noise spectrum



DOA estimation for ship noise

Direction of Arrival (DoA) estimation was carried out using Multiple SIgnal Classification (MUSIC) algorithm to improve the angle resolution. Marine traffic data has been obtained in this location and the occurrence of ship noise is being analysed. The ship noise data acquired by VSA on 20th October 2019 and the corresponding azimuth value is shown.

Upgradation and Maintenance of Acoustic Test Facility (ATF)

Recertification audit was conducted by NABL in the last week of April 2019 and accreditation obtained for Electro technical calibration and Electronics Testing for the period till 2021. Periodical calibration of equipment has been completed at Electronics Test and Development Centre (ETDC) Bangalore. ATF has been continuously utilized by internal as well as by external users for underwater acoustic transducer calibration and other system performance test. As part of external and industrial users the facility was utilized by NPOL, Kochi, Bharat Electronics, Bangalore and Tata Power SED, Bangalore.

MARINE SENSOR SYSTEMS

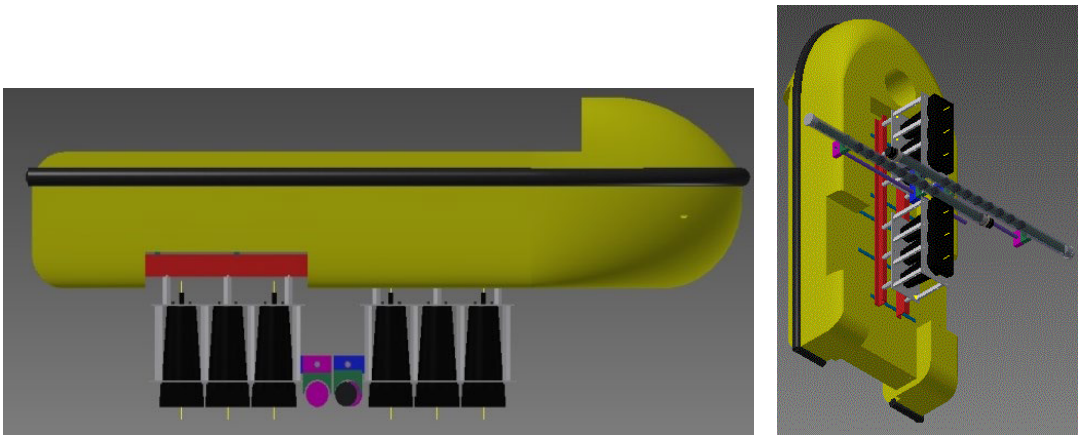
- To design and develop indigenous underwater acoustic imaging systems and allied technologies.
- To design and develop wide band underwater acoustic transducers and hydrophone arrays.
- To establish and maintain a test facility of excellence to provide support for various projects of NIOT.

Development of Indigenous 2D/3D Sub-Seabed Imaging SONAR

Acoustic Imaging technology is an efficient tool for seabed assessment. The objective of this project is to develop an Acoustic Imaging SONAR for 2D/3D imaging of sub seabed objects such as pipelines and other submerged objects with fine resolution. The system is designed with transducers in the Mill's Cross array configuration.

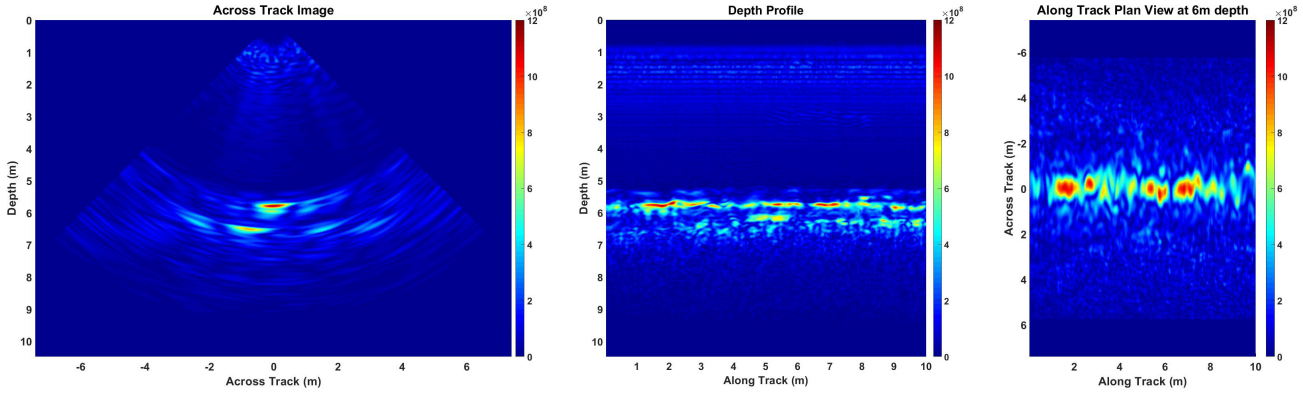
The preliminary experimental studies with the Mills Cross array transducer configuration were carried out in Acoustic Test Facility (ATF) of NIOT. The Mills Cross Array is formed with 6 elements transmitter array and 16 elements hydrophone array. The wideband beamforming algorithms are implemented in time domain and frequency domains. Sea trial has been carried out off-Chennai, Royapuram harbour and is shown in figures below along with Mills cross array arrangement.

Sea trial with the Mills Cross Array Configuration

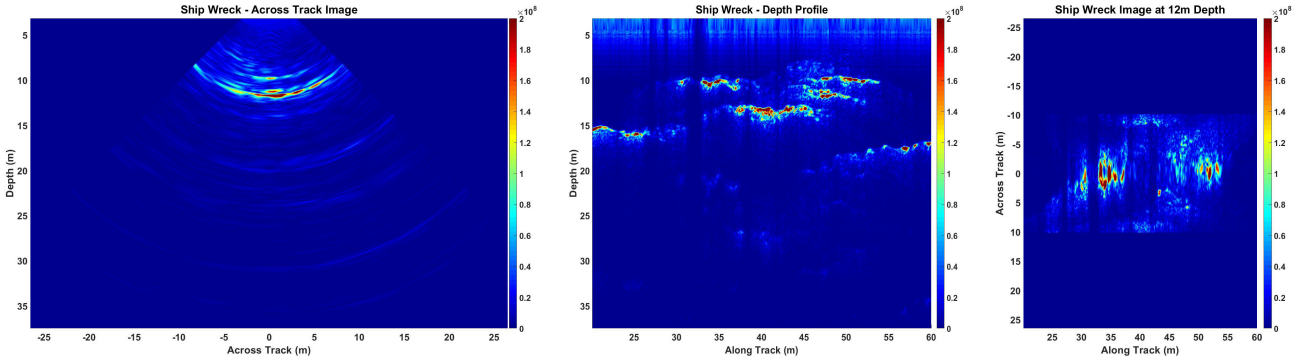


1x6 transmitter array and 1x16 hydrophone array – Mills Cross Array Arrangement

With the experimental data, 2D acoustic images of buried objects under sea bed and a partially sunken shipwreck near the harbour are obtained and are shown below.



2D Acoustic Images of Buried Objects Captured during Sea Trial

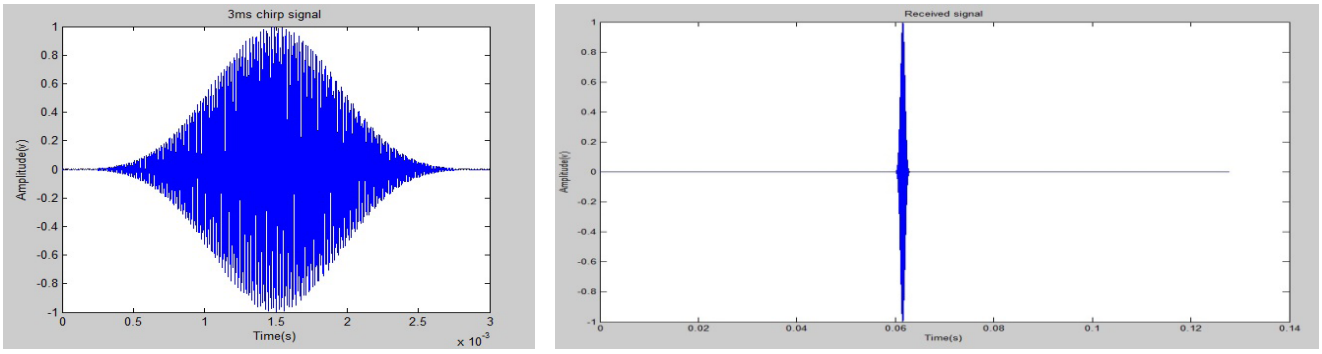


2D Acoustic Images of Shipwreck Captured during Sea Trial

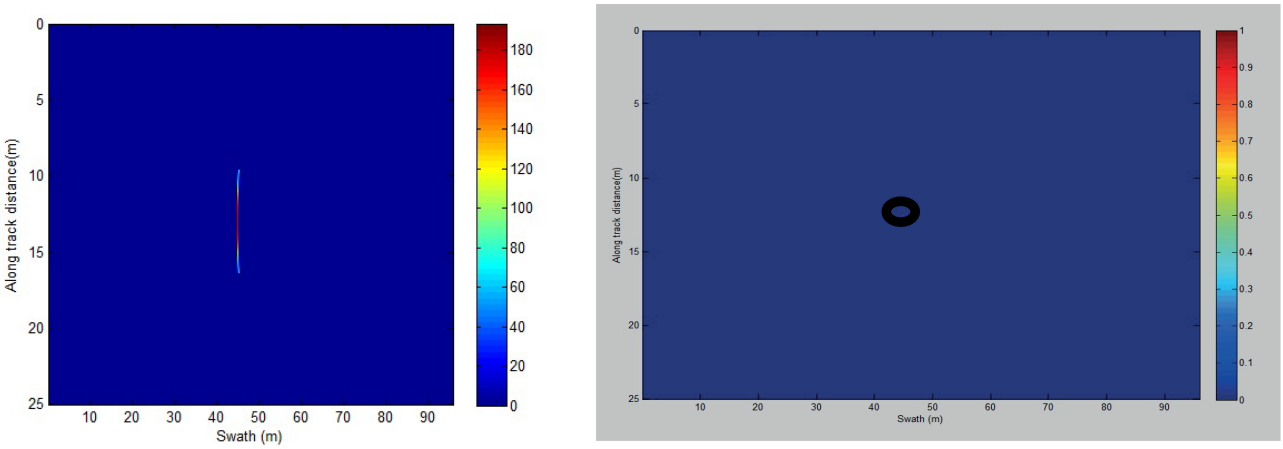
Development of Indigenous Synthetic Aperture Side Scan SONAR

The Synthetic Aperture Side Scan Sonar (SAS) is the state-of-the-art technology for high resolution underwater acoustic imaging. It is an enhancement of conventional side scan sonar incorporating synthetic aperture processing. The objective of this project is to design and realize synthetic aperture side scan sonar which can provide high resolution images (decimeter level) of the sea bed surface and objects with range independent resolution. The sonar is aimed for shallow water applications and is aimed to be integrated in platforms with a tow speed of around 4 knots.

The array design for the required resolution and tow speed is carried out. Off the shelf subsystems required to realize the sonar are identified and procurement is initiated. The side scan synthetic array processing with simulated data is being carried out due to non-availability of in-situ data. The simulation results of a point target are shown below.



Simulated tansmitted signal and corresponding received signal from point target at 45 m range



Received signal in the synthetic array and the generated pixel after synthetic array processing

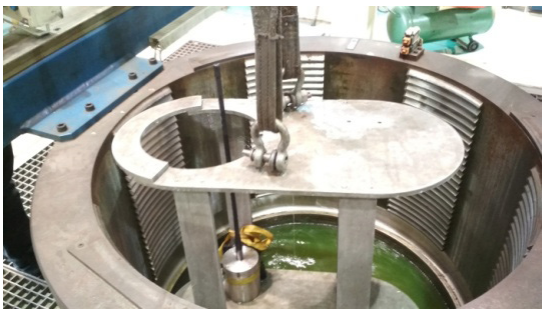
OCEAN ELECTRONICS

The major objective of Ocean Electronics group is to design, develop and demonstrate new autonomous ocean observation technologies and systems for oceanographic applications. Currently this group is involved in the development of Deep sea autonomous underwater profiling drifter (DAUPD), INSAT based Drifting buoys, Open sea submersible fish cage culture technologies, C Profiler system and development of sensors for measurement of temperature and conductivity etc.

Deep Sea Autonomous Underwater Profiling Drifter (D-AUPD)

First prototype unit of 500m depth rated DAUPD-1 was developed in-house using 1000CC variable buoyancy engine. Short duration deployment carried out at underwater acoustic research facility (UARF) of Naval Physical and Oceanographic Laboratory (NPOL) in Idukki dam, Kerala and performance observed for few cycles. System operated up to the depth of 110m and performance was satisfactory. Second unit DAUPD-2 was built and necessary functionality test has been carried out including mission cycle test and field testing as shown below, in Bay of Bengal to study the system performance in variable salinity conditions. Ballasting of DAUPD was carried out based on field test results.

Field Testing of DAUPD

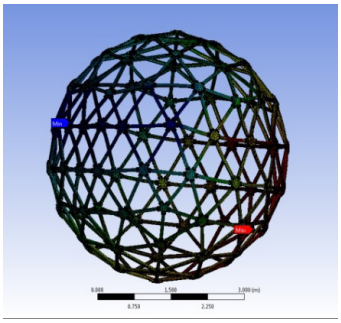


Pressure Test of RF Antenna at Hyperbaric Chamber

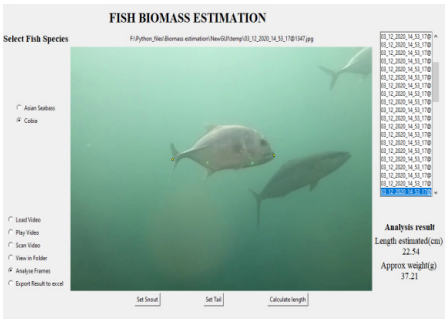
Development of underwater workable RF antenna for DAUPD telemetry was initiated and prototype modules tested at lab and hyperbaric pressure test facility to ensure its functionality at deeper depths.

Open Sea Fish Cage Culture Technologies

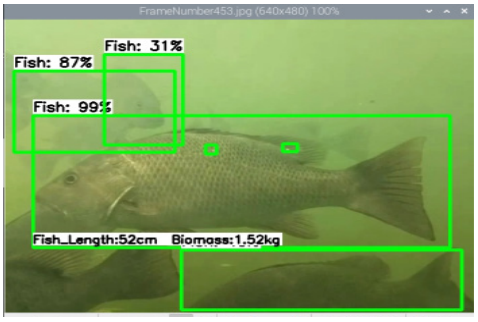
Development of open sea fish cage culture system is initiated to cater the requirement of Marine Biotechnology Group of NIOT. Bio-mass estimation of fish for open sea cages and Subsea feeder for the submerged cage are taken up. Design and analysis of 9m diameter rigid spherical type fish cage system using High Density Poly Ethylene (HDPE) struts was completed. Sea trial of 2m spherical cage was carried out in Andaman during Feb-March 2020. Also the sea trial for the performance of sub-sea feeder for the depth 6-7m was carried out at Andaman. The development of bio-mass estimation system was done and same was tested and validated at Central Institute of Brackishwater Aquaculture (CIBA), Chennai as well as NIOT's Andaman centre's site.



Spherical fish cage



Fish weight



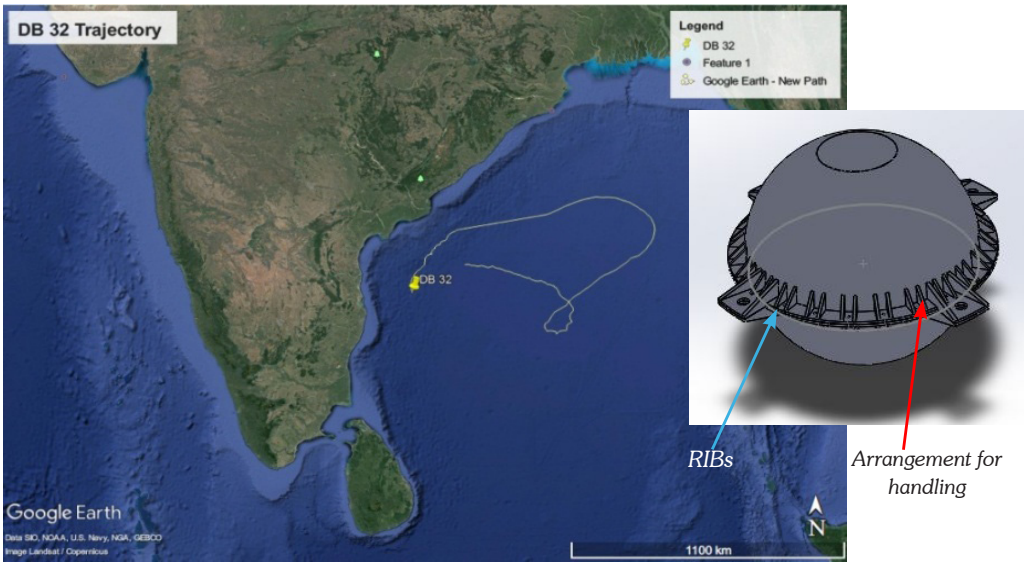
Fish's length computation using Machine Learning (ML)

Further Fish biomass estimation technique has been enhanced with machine learning based computer vision algorithm to calculate the fish mass while it is growing inside the cage at sea.

Indigenization of Drifting Buoy (DB) with INSAT Communication

Indigenization of INSAT based Drifting Buoy (DB) technology has been completed and the technology licensing agreement signed with two Indian industries under National Research Development Corporation (NRDC) commercialization purposes. Fifteen trial produced DB systems are deployed in Indian waters so far and results have been published in reputed National/International journals and conferences. Drifter's Sea Surface Temperature (SST) sensor calibrated at National Physical Laboratory (NPL), New Delhi to ascertain our claim of ± 0.05°C accuracy. Calibration results ensured better accuracy of ± 0.01°C than our claim.

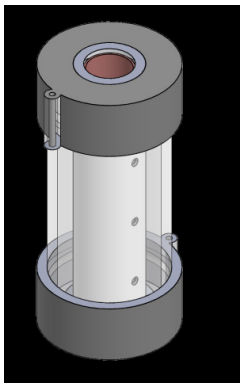
DB Surface float design was redesigned to increase its impact strength and durability. Implemented IRNSS (Indian Regional Navigation Satellite System) based NavIC (Navigation with Indian Constellation) satellite receiver module in DB and system was deployed in the field and tested during April 2019. The Mixed Layer Surface (MSL) current mapped in Bay of Bengal using DB is shown in the figure.



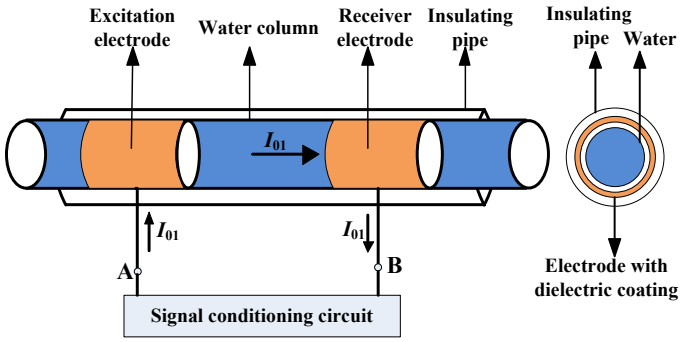
Mixed layer current map using NavIC interfaced DB32 DB Surface float with RIB design

Indigenization of CTD Sensor

Design and development of non-contact type conductivity (capacitive coupled) measurement system has been initiated with IIT Madras. Capacitive coupled measurement technique which ensures confined current path using regular RC electronic circuitry was designed. Auto balance signal conditioning circuit was developed to measure resistance of the water column, in-turn conductivity of liquid. The capacitive coupling overcomes the problems of electrode polarization and contamination associated with conventional methods. Laboratory model tested for its basic functionality at upper and lower value of conductivity. Interfacing and testing of Temperature & Depth sensor is in progress.



CTD Enclosure Design

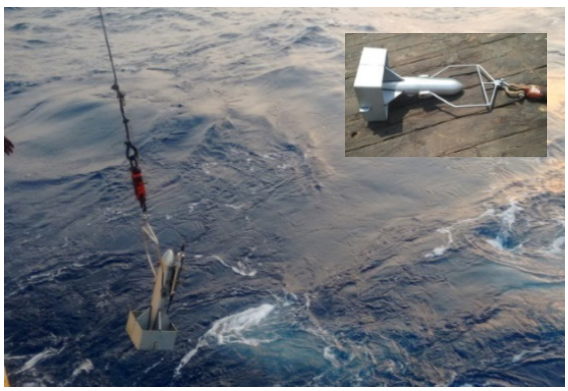


Schematic of the conductivity probe

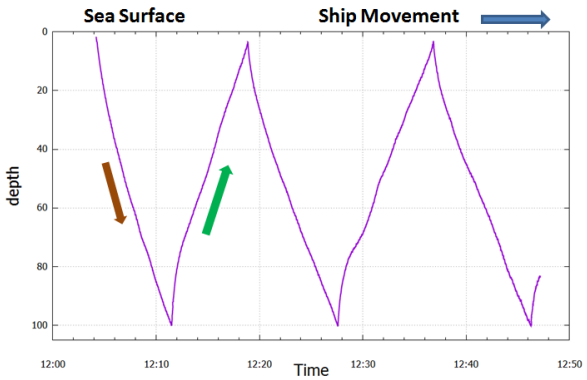
Enclosure design has been completed and fabrication of PCB - electronics is in progress for field workable model. The schematic of the proposed system is shown above.

C-Profiler

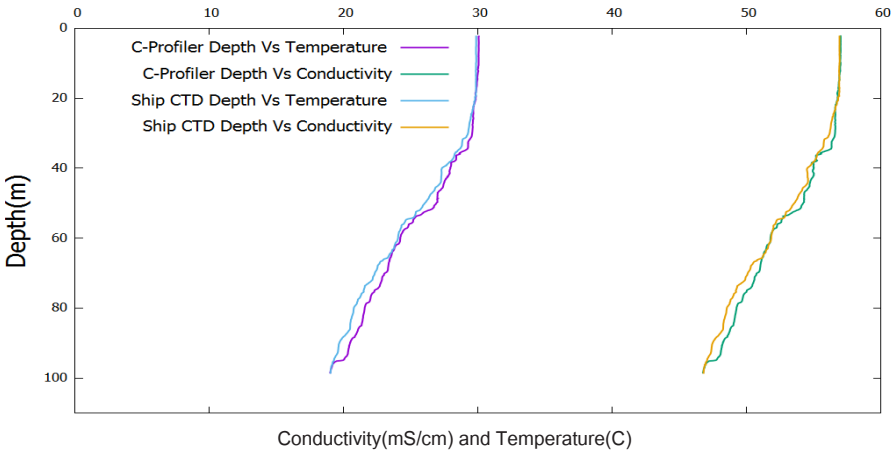
This developmental work supports in collecting near real-time in-situ CTD profile using a tow fish operated from a moving ship/boat in an economical way. Project is envisaged to have a tow fish with conductivity, temperature and depth (CTD) sensors as payload collecting shallow water data which is vital for ocean related predictions. The advantages of the profiler include possibility of real-time on-board data retrieval while the vessel on the move without lifting the probe to deck and swift change of sensor heads on deck enabling observation of various ocean parameters without extra profiler.



C Profiler field testing



Continuous profiles using C Profiler



Comparison of CTD plot for 100m depth

Firmware development for data acquisition from CTD sensor and real-time data plots were completed. Suitable winch was procured and a few field observations were carried out in Bay of Bengal during May 2019. CTD profile was recorded up to 100m depth and comparison plot with ship based CTD is shown in the plot above.

OCEAN SCIENCE AND TECHNOLOGY FOR ISLANDS

Ocean Science and Technology for Islands (OSTI) is primarily focusing on four 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 and characterization of novel secondary metabolites from 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.
- Establish Ballast Water Treatment Technologies – Test Facility for testing of ballast water treatment systems.

Marine Algal Biotechnology: Pilot scale mass culture of marine Chlorella vulgaris (NIOT-74) in 25 ton capacity paddle wheel operated raceway pond at Pamanji yielded a maximum biomass of 1.8 g/L. Standardized salt removal methods from the algal biomass harvested from raceways and maximum lutein content (11.56 mg/g) and total carotenoid content (60.18 mg/g) was obtained with 0.5% HCl wash. An efficient method for purification of lutein from marine microalgae *Chlorella sorokiniana* and C. *vulgaris was developed and maximum lutein was obtained by extraction with* ethanol: dichloromethane (2:1) biomass after saponification.

Chlorella culture in 25 T raceway - Pamanji

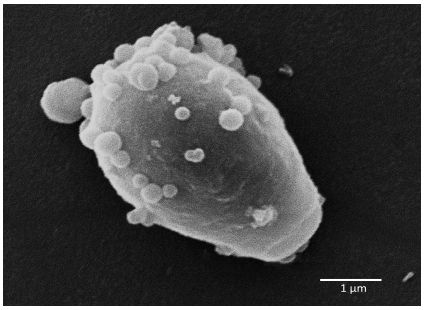
Harvested Chlorella biomass

Spirulina culture in 2 T raceway

Experimental scale mass culture of marine Spirulina in 2 ton raceway with F/2, NPK in modified organic medium with NPK and sodium bicarbonate yielded a maximum biomass 2.3g/L. Optimized Microwave-assisted extraction of c-phycocyanin from marine Spirulina and maximum yield of 164.04 ± 8.45 mg/g achieved against the conventional process of repeated freezing and thawing (87.67 ± 5.84 mg/g). Six chlorophycean microalgal strains screened for astaxanthin production in two salinities and a maximum biomass of 3.21g /L and 13.48 mg/L astaxanthin production was recorded in strain Po1 at 30 psu and 2.71 g/L biomass and 18.11 mg/L astaxanthin in strain Pi1 at 60 psu.

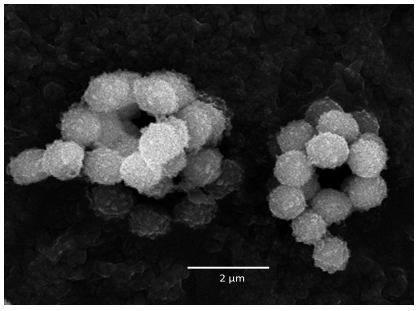
Microbial Biotechnology: The marine hydrocarbonoclastic bacterium *Alcanivoraxdieselole*i EB3 NIOT capable of degrading polyaromatic hydrocarbons (PAH) was isolated from water samples collected from a depth of 3000 m off equator (0°28.54'N; 87°52.303'E). The addition of nitrogen and phosphorus sources (0.1% w/v of CO $(NH_2)_2$ or K_2HPO_4) enhanced the hydrocarbon degradation percentage. The study revealed the effectiveness of *A. dieselolei* EB3 NIOT for PAH degradation a through phthalic acid pathway. Bioremediation package was developed for biodegradation of hydrocarbon within a short retention time of 30 days, using hydrocarbanoclastic piezotolerant deep-sea bacterial consortium. Biosurfactant production hydrocarbanoclastic deep-sea bacteria *Ruegeria*sp COD 27 was isolated and optimized growth conditions and biosurfactant production using customised media with 7.5 pH, 25°C, 5% NaCl, 10% glycerol and 1% yeast extract. The yield of biosurfactant with glycerol (3.1 g/L) and yeast extract (2.3 g/L) were significantly high compared to other carbon and nitrogen sources tested. Oleaginous deep-sea yeast strains capable of accumulating 40% lipids per g dry weight was isolated from the deep sea and lipid class were characterized and 65% of the total lipid was found to be monounsaturated and polyunsaturated fatty acids with high concentration of ω-7 unsaturated, Cis-Vaccenic acid (C18:1) and characterized for animal feed. Black pigmented melanin producing non-sporulating yeast *Hortaeawerneckii* N129A8 isolated from sediment samples collected from 3500 m depth was cultured in laboratory and a highest production 26 g/L of biomass with maximum concentration of melanin intracellular (355 mg/L) and extracellular (225 mg/L) were achieved.

The recombinant expression vector harboring the glycine betaine biosynthesis genes from *B. sporothermodurans* was transformed into E. coli M15 (pREP4). Maximum production of glycine betaine was recorded (8.13 mg/ml) at pH 8.0 and 8.2. When NaCl concentration increased the glycine betaine production also increased up to 2.5% concentration, above this concentration the glycine betaine production and the cell growth declined. A new strain of *Streptomycin olivaceus* NIOT-Ch-40 producing piericidin (monohydroxy pyridines) and *S.*fenghuangensis NIOT-Ch-34 producing thiostreptone (Cyclic peptide) was isolated from 2000 m sediment.



Budding Hortaeawerneckii SEM

Biodegradation of crude oil by A. dieselolei EB3



Streptomyces fenghuangensis

Open Sea Cage Culture: Two days hands-on training in open sea fish cage fabrication, deployment and culture management was organized during 11-12, December 2019 at Kollam, Kerala jointly with the State Fisheries Department, Kerala. Totally 49 participants (Fishermen and Kerala State Fisheries Department officials) participated in the training programme. Survey in back waters of Sangumal, Dhanuskodi, Kundhukkal, Mandapam and Vethalai village indicted availability of large number of milkfish seeds during the month October to November.

Training participants at Kollam

Mooring grid preparation training

Cobia stalked in cages at North Bay

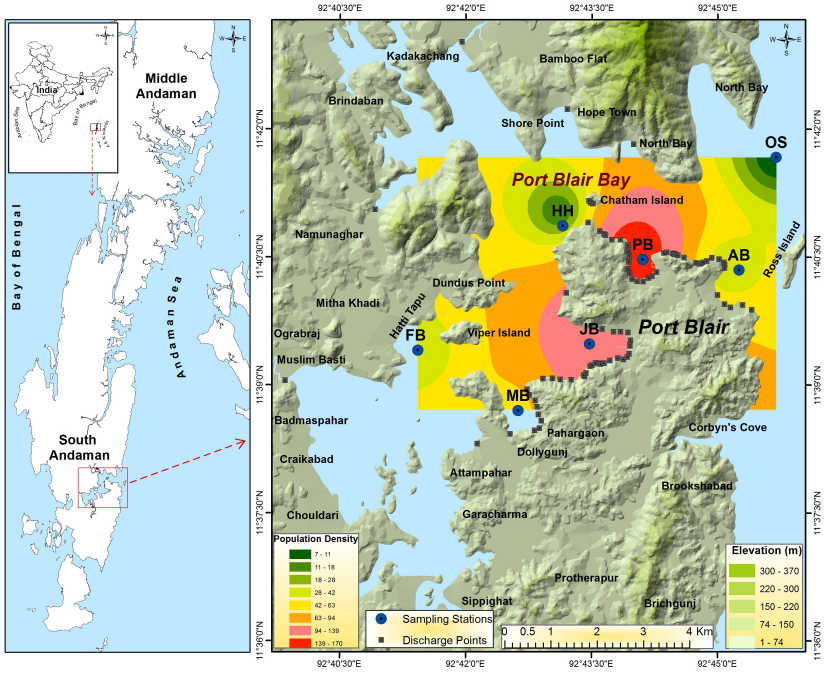
The floating and mooring components of cage systems of North Bay, Andaman were repaired and rectified. The open sea cages deployed at Olaikuda were removed and redeployed in new location to maintain the health of ecosystem. Completed environmental impact assessment studies in sea area in between Rutland and Chidiatappu for the expansion of open sea cage culture initiative of Andaman and Nicobar islands.

Establishment of Ballast Water Treatment Technologies – Test Facility:

Completed 4 years of continuous collection of base line data on the physico-chemical and biological characteristics of the coastal waters of Pamanji, Nellore. Technical specification and detailed drawing for trestle based seawater intake system and land based ballast water storage, test and control tanks were completed. EIA clearance for establishment of trestle based seawater intake system was obtained from Ministry of Environment and Forest and Climate Change. Completed standardization of viability assay for planktonic organisms (Phytoplankton & Zooplankton) under day and night condition. Short-listed surrogate organisms (Phytoplankton & Zooplankton) for mass culture in controlled environment. Live dead assay by neutral red stain uptake method standardized for zooplankton.

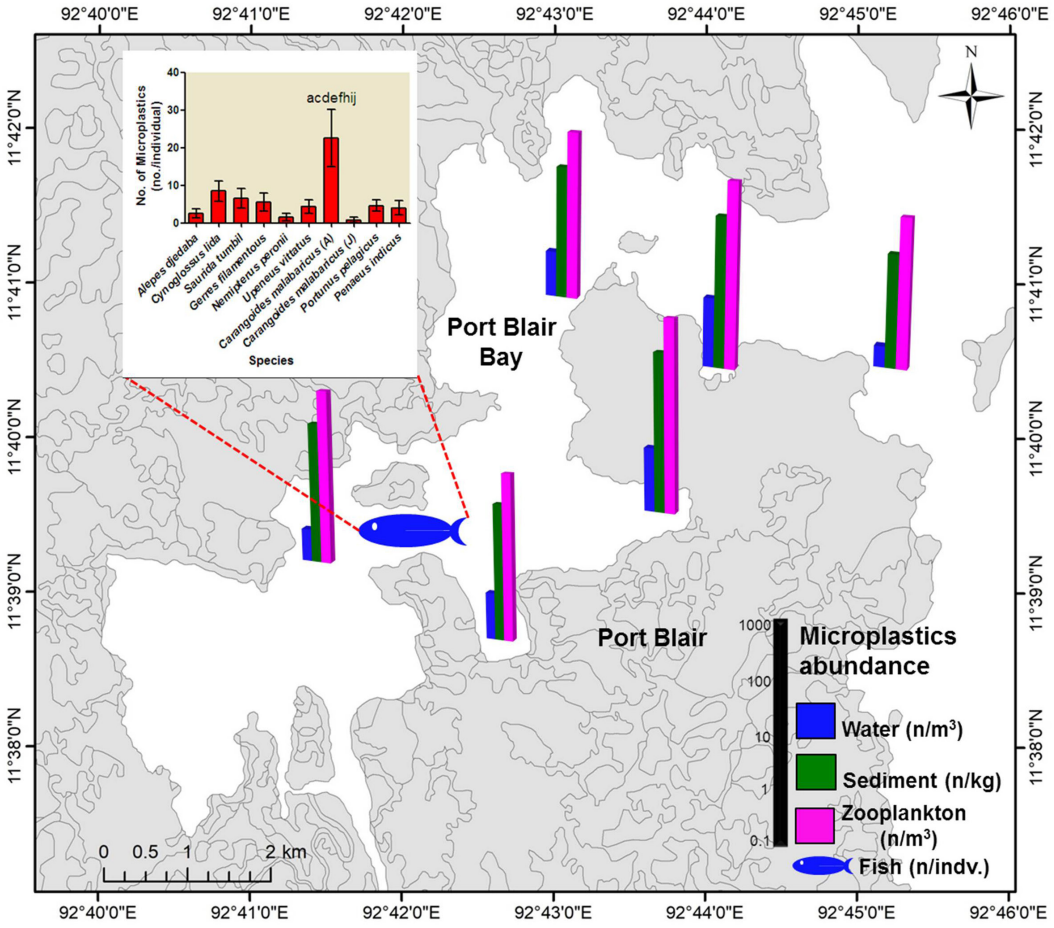
Seawater quality monitoring in Port Blair Bay

Sea water quality monitoring in the coastal waters in and around Port Blair was undertaken to detect changes in coastal water quality, predict pollution levels to facilitate actions that ensure protection and preservation of marine environment. Results of water quality revealed different physicochemical and biological parameters like nutrients (nitrate, nitrite, phosphate, silicate, ammonia, plankton density, dissolved and sediment associated trace metals) were comparatively higher at Junglighat Bay and Phoenix Bay. The Escherichia coli and Enterococcus faecalis etc. also were significantly higher in Phoenix Bay. Concentration of trace metals Cu, Ni and Zn were above permissible limits



Density of Vibrio *sp. along the Port Blair Bays*

for sediment samples at sites like Junglighat Bay, Phoenix Bay and Haddo harbor. Baseline survey was carried out on the distribution of microplastics in water, sediment and biota from the Port Blair Bay.



Distribution of microplastics in Port Blair bay

COASTAL AND ENVIRONMENTAL ENGINEERING

The group functions with a mandate to develop application-oriented technology in Coastal & Environmental related areas. Coastal and Environmental Engineering (CEE) group aims to bring the state-of-the-art technology in coastal infrastructure development through field observations, satellite imageries, numerical modeling studies and comprehensive detailed engineering designs. Presently involved in various MoES projects and Industry sponsored projects.

MoES Projects

Performance assessment along Indian coast to assist in design of environmentally friendly structures for coastal protection

The project aims at assessing the performance of structures installed with the primary objective of coastal protection. The response of shorelines along various coasts to these coastal protection structures is evaluated so as to aid in developing solutions for sustainable management of coastlines for new sites / remediation. These are carried out at sites with potential stakeholder interests like fishing hamlets, marine infrastructure (ports / harbors), tourism sites etc.

Using experience gained from analysis of coastal protection works and its long-term impacts, NIOT demonstrated an environmentally friendly beach restoration project consisting of an offshore submerged geosynthetic dyke in the fishing villages of Kadalur located south of Kalpakkam in Tamil Nadu.

Demonstration of Shore Protection measures at Kadalur Villages

NIOT has successfully demonstrated an offshore segmented submerged dyke for restoration of beach along the three fishing villages in Kadalur, south of Kalpakkam in Tamil Nadu, as part of plan project of Ministry of Earth Sciences. Comprehensive field monitoring comprising beach profiling studies, near shore bathymetry surveys, currents, wave and grain size distribution, fish catch, biological data collection etc, are being carried out to assess its functional performance. The satellite image study shows that the beach width has increased considerably after installation of dyke which is also evident from near shore bathymetry in which deposition of sediment is observed behind dyke. With the restoration of beach, the fishermen are able to park their boats safely on the beach and the villages remained protected against high energy waves during monsoon of 2019.

Comparison of beach before and after NIOT intervention at Kadalur

Boats beached along Kadalur coast

Changes in seabed profile after deployment of detached breakwater

i. Experiments for providing coastal erosion protection through bio-cementation process of calcareous sand stone formation

Coastal protection through bio-cementation process of calcareous sand stone formation has been tested at laboratory scale by mimicking the methodology of natural coastal calcareous stones formation. Stones synthesized at NIOT laboratory is tested for unconfined compressive strength and found comparable with naturally occurring stones along Tamil Nadu coast.

Variation in hardness of stones by compressive strength analysis

ii. Sea water quality testing along Chennai coast

The North Chennai coastal waters are receiving systems from several industrial outfalls. NIOT participated as a member of National Green Tribunal (NGT) for assessment of ecosystem response in the receiving coastal waters after sufficient dilution was achieved. NIOT was involved in planning of water / sediment quality and biological characteristics studies off Chennai coast.

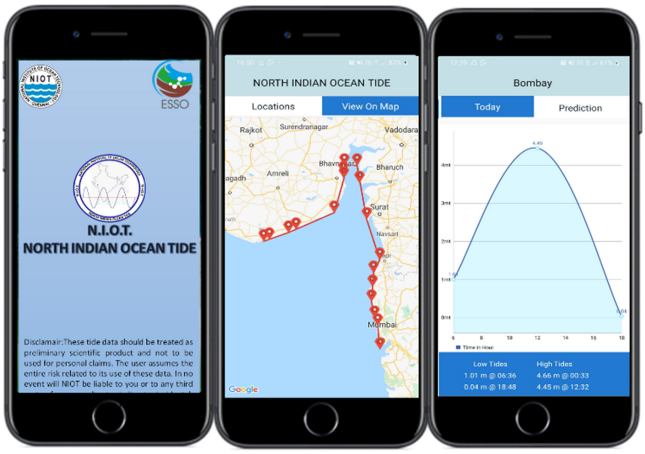
Development of design criteria for extreme environment by assessment of waves, currents and tide parameters.

i. Coastal Monitoring System

The coastal monitoring system has been established with network of 7 tide stations and 8 automatic weather stations, which provides tide and met ocean parameters along the Indian coast.

A tide prediction tool has been developed for the Gulf of Khambhat with the Coastal Observation System data base to predict time series of tide and tidal constituents at any location within the Gulf.

North Indian Ocean Tide (N.I.O.T) mobile application was developed with observed data along Indian Ocean and it was published on 31st October 2019.



Mobile Application for Tide

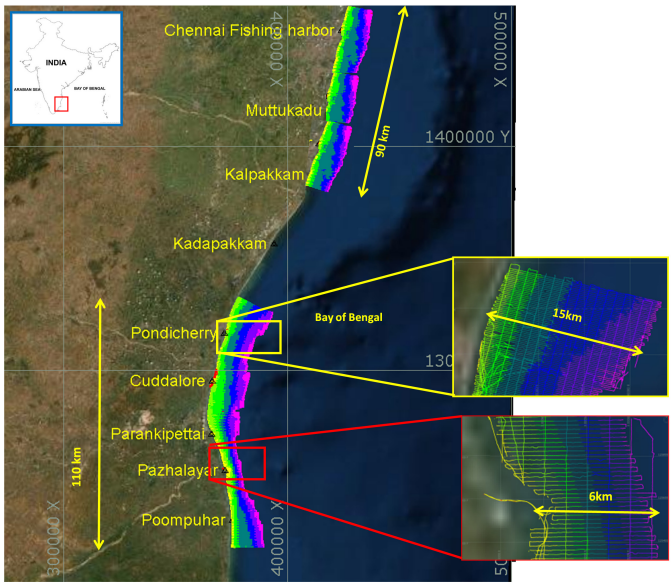
ii. Wave:

Wave model for North Indian Ocean established with high resolution bathymetry incorporating Lakshadweep and Andaman islands and validated with NIOT, INCOIS & NIO observed wave data.

Shallow water bathymetry survey for Exclusive Economic Zone (EEZ) along the East coast of India under Geoscientific studies for the EEZ

Ministry of Earth Sciences initiated systematic mapping of the Indian EEZ along East and West coast of India. As part of the programme, National Institute of Ocean Technology is mapping the shallow water bathymetry from 0 to 30m depth using single beam echo sounder along east coast of India. The coastal bathymetry in surf zone where wave breaks is measured using water scooter and post processing algorithms were developed in-house.

Mapping of Shallow water bathymetry initiated along Tamil Nadu coast and 20% of the coastal stretch has been mapped. Tenders were invited to carry out the bathymetry surveys along the 4 coastal states of East coast of India and were evaluated by the Technical and Financial Evaluation Committee constituted by the Director, NIOT.

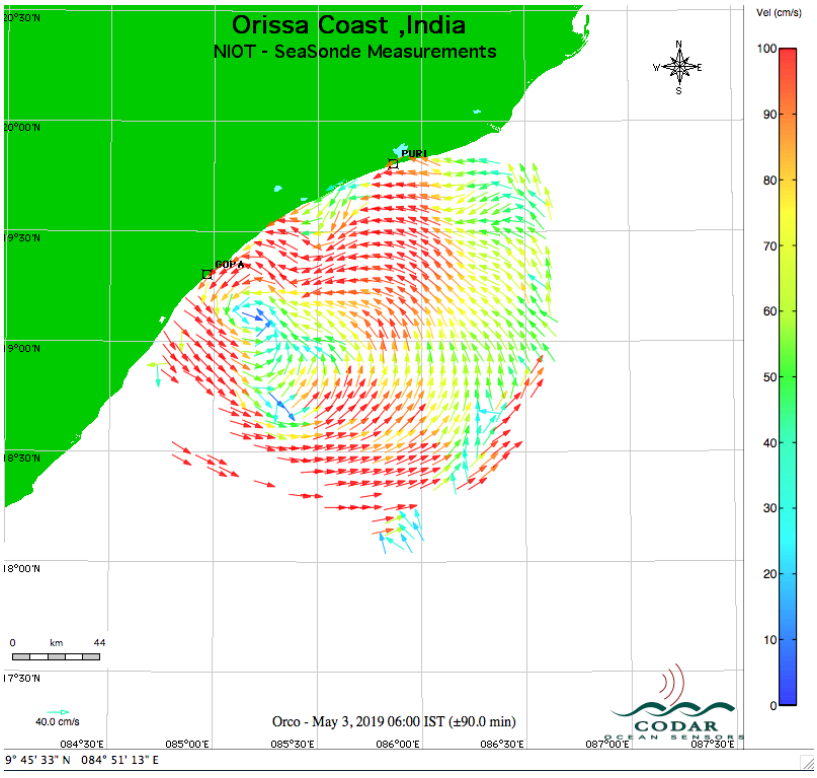


Bathymetry coverage in Tamil Nadu

NIOT- Ocean Observation Network High Frequency (HF) Radar

Under Ocean Observation Network (OON) Program of MoES, NIOT is operating Indian Coastal Ocean Radar Network (ICORN) with 10 HF Radar systems along Indian coast. The data from ten remote sites are transferred simultaneously to central servers at NIOT, Chennai as well as INCOIS, Hyderabad. The data is disseminated to various research organizations and academia through INCOIS. The expansion of ICORN network is initiated.

HF radar which is capable of measuring high wave during cyclones provided valuable information on the surface dynamics during major cyclonic storm "Fani" which originated over southwest and adjoining southeast of Bay of Bengal (BoB) and crossed into the



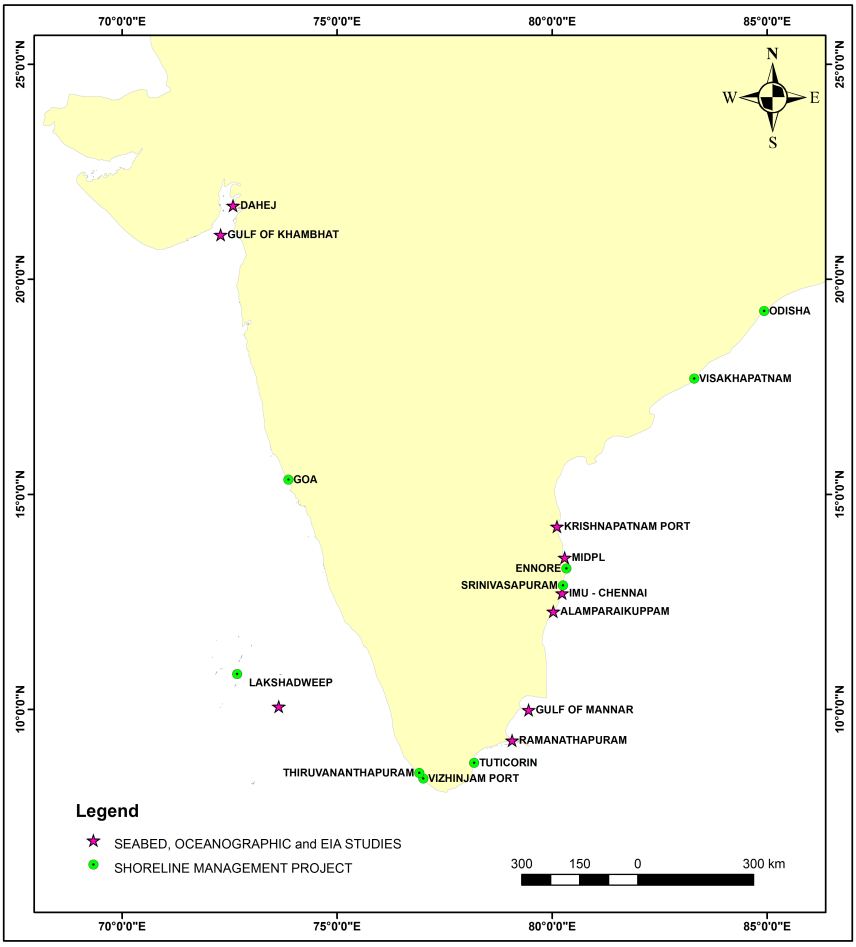
Surface currents along Odisha coast during Fani cyclone, May 3, 2019

Indian main land at Puri (Odisha) after passing through Andhra coast. The wave height and direction reported by the HFR is found to be closely matching with wave height reported by INCOIS wave radar buoy located at Gopalpur. Also the wave direction during the cyclone period matches very well with the measured buoy data.

The currents in the eastern part of Odisha between Gopalpur and Puri are measured by the HF Radars. Normally they have the magnitude of 30 – 60 cm/s during the normal weather season slightly varying up to 80 cm/s. A cross meridional flow between the two sites is observed daily which makes an out flow of water from the north-east part of the Andhra Pradesh to the south-west part. However, during the cyclonic event of Fani, on 2nd and 3rd May 2019, there was a major difference in the flow pattern of the region. The current velocity increased to 100 m/s during the cyclone period.

Industry Sponsored Projects

Various projects on beach restoration, shoreline management, sea bed investigation and Environmental Impact Assessment (EIA) are handled by the group. The following industry sponsored projects were carried out/in progress during 2019-20.



Ongoing project sites

I. Coastal Protection

1. Coastal Resilience: Developing New and Innovative Approaches in India and Bangladesh along the Bay of Bengal: The objective of the project is to review and analyse India's engagements and past investments in the coastal zone of India along the Bay of Bengal and to develop strategic investment plan for future risk reduction.

2. Preparation of DPR for coastal erosion mitigation and shore line management plan for Visakhapatnam: To arrive at a suitable coastal erosion mitigation scheme by numerical model studies and to formulate a shoreline management plan for Visakhapatnam coast.

3. Shoreline Management Plan for Lakshadweep Islands: Develop a shoreline management plan for Lakshadweep Islands based on the historical data, satellite imageries, field observations & analysis.

4. Shore Protection Studies at Poonthura, Valiyathura and Shanghumukham along Thiruvananthapuram: Suggest a suitable beach restoration scheme based on field investigations and numerical model studies for Thiruvananthapuram coast and to provide the technical support in the implementation of the suggested intervention scheme.

5. Fact finding and planning study on coastal issues in Goa under National Hydrology Project: Prepare Terms of Reference for the proposed integrated river basin and shoreline management plan for Goa coast based on the historical secondary data and analysis and stake holder consultations.

6. Scientific studies for shore protection (Srinivasapuram to Light House) along Chennai coast: Numerical modeling and erosion mitigation designs carried out for mitigating the seasonal erosion occurring between the Marina beach and Adayar River confluence.

7. Sustainable shoreline management for Ennore coast, Tamil Nadu: Long term field measurements, numerical modeling studies and detailed engineering studies for providing training works for the Ennore creek confluence for keeping the mouth sustainably open with minimum siltation and maintenance dredging.

8. Detailed Project Report for four Coastal Protection Sites in Odisha: Design of coastal protection structures at Pentha, Puri, Ramachnadi and Ramayaptanam and to prepare a detailed project report based on the site investigations and numerical model studies.

9. Shoreline change analysis of Vizhinjam coast using satellite images: To access the shoreline evolution using the satellite imageries and observed beach profiles and to compare shoreline changes for the pre and post Vizhinjam International Seaport Limited (VISL) port construction operations.

10. Shore Protection studies for eroding sites along Tuticorin District: Studies and suggestion for providing short term plans for erosion mitigation for sites located between Udangudi and Tiruchendur in Tuticorin district.

11. Study of sediment drift pattern near fire pump house at LPG jetty, Visakhapatnam to carry out the scientific studies on sediment drift pattern in the vicinity of fire pump house situated at LPG jetty and to suggest the suitable siltation preventive measures.

II. Seabed, Oceanographic and EIA Studies

1. Geophysical Investigations at Gulf of Khambhat and Gulf of Mannar: To carry out the Geophysical investigations and hydrographic surveys and met ocean measurements for the proposed offshore wind farms and to determine the borehole locations at Gulf of Khambhat and Gulf of Mannar for National Institute of Wind Energy, Ministry of New and Renewable Energy.

2. Development of eco-tourism projects in islands of Kadmat, Suheli and Minicoy islands of UT Lakshadweep: Assessment of impacts of proposed eco-tourism project on environment, ecology, shoreline and water quality in the small islands of Lakshadweep. Detailed mitigation / management plans and environmentally sustainable alternative processes proposed.

3. Physical oceanographic, bathymetry, topographic and geotechnical measurements for the MIDPL: Carryout physical oceanographic, bathymetry, topography and geotechnical investigations required for the numerical model studies for the revised master plan of Katuaplli Port expansion.

4. Scientific studies related to Environmental Impact Assessment for Phase-III expansion of Krishnapatnam Port Company Limited: Scientific studies were carried out for shoreline changes, dredge dump disposal, mapping of mangroves, impact of port development on mudflats to enable phase-III expansion of Krishnapatnam port.

5. Design and Oceanographic Measurements for Proposed Fishing Harbour at Azhagankuppam and Alamparaikuppam: Design of port infrastructure for the proposed fishing harbours in Tamil Nadu and to carry out the oceanographic measurements.

6. Topography Survey and Hydrologic studies for IMU Headquarters, Chennai.: Preparation of Survey report and hydrologic study using ARC/GIS to suggest rain water impounding drainage system.

7. Shoreline change study for Adani Petronet (Dahej) port Pvt Ltd. using satellite images: To assess the shoreline change over the 5 km coastline on either side Dahej site from 2011 to 2018 and to identify the spots of erosion and accretion along the site location.

8. Hydrographic surveys in and around damaged break water at eastern jetty, Kalpeni: Carry out bathymetry surveys as part of assessment of breakwater performance.

9. Site Identification and supervision of deployment of reef modules in the districts of Thanjavur, Pudukottai, Ramanathapuram, Thoothukudi and Tirunelveli – Assessment of potential sea grass and coral beds along 42 sites off Tamilnadu and design of artificial reef structures, their location in deep waters provided through detailed field investigations and analysis.

Details of a few industry sponsored projects and projects carried out for multilateral agencies are given in detail in the following section:

1. Coastal Resilience: Developing New and Innovative Approaches in India along the Bay of Bengal

NIOT is involved in developing evidence-based guidance on future investments for the coastal areas of India along the Bay of Bengal to further enhance the coastal resilience and reduce risk by evaluating past and ongoing interventions in a highly participatory process with the local stakeholders.

Future interventions required along the Indian coast have been identified by interacting with the stake holders of coastal states through the workshops held at Andhra Pradesh, Odisha, Tamil Nadu/Puducherry and West Bengal.

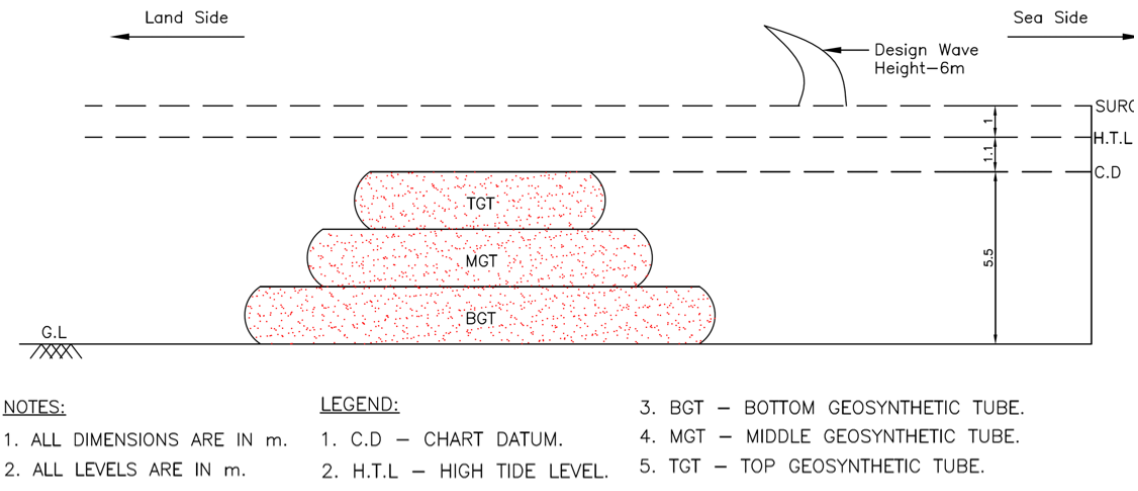
2. Shore protection studies for villages to the north of Adyar river mouth – Chennai coast

NIOT was requested by Tamil Nadu Public Works Department (TNPWD) to undertake detailed study of shoreline erosion and protection management plan for eroding areas to the north of Adyar inlet, from Srinivasapuram to Lighthouse, along the Chennai coast. Detailed scientific study involving field data collection, satellite image analysis and numerical modeling reveals that erosion may be attributed to sand bar formed at the inlet. Hence, it was recommended to remove the sand bar followed by nourishment towards north of Adyar inlet as solution to mitigate erosion. Recommendations for seasonal monitoring of the coast to assess the performance of beach between Srinivasapuram to Light house has been suggested for cost effective and sustainable shoreline management solution.

3. Shore Protection Studies for Poonthura Beach along Thiruvananthapuram

Kerala State Coastal Area Development Corporation (KSCADC), Department of Fisheries, Government of Kerala has entered into MoU with National Institute of Ocean Technology to carry out scientific studies at Poonthura, Valliyathura and Shangumugham beach and to suggest suitable shore protection schemes.

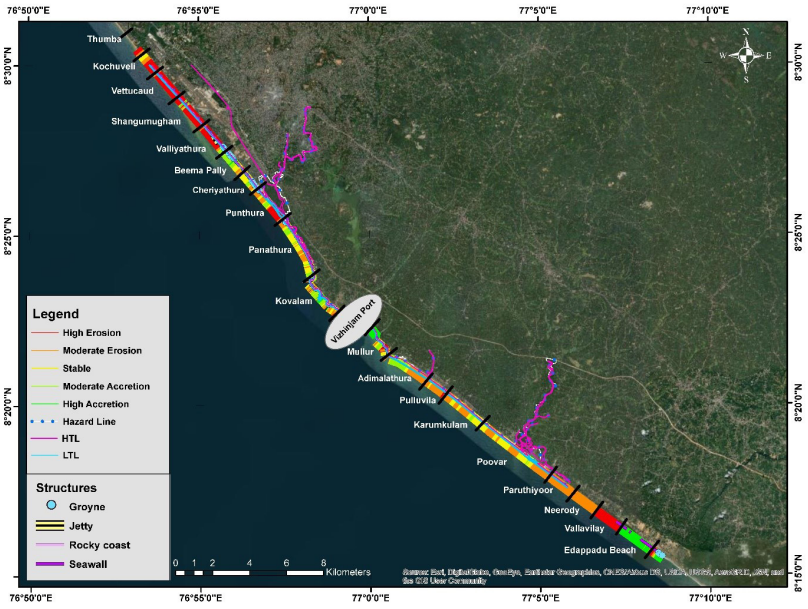
Coastal processes along the Poonthura coast is studied using field data collection, and littoral sediment transport studies. Based on the Numerical modelling, shoreline evolution assessed for possible interventions such as sediment nourishment, transition groynes and detached breakwaters and shore protection structure has been designed. In the first phase, construction of submerged breakwaters as shore protection measure for Poonthura coast is planned. Construction of the measure will be carried out by KSCADC with advice of NIOT.



Cross sectional view of the proposed structure at Poonthura

3. Shoreline change analysis of Vizhinjam coast using satellite images

Shoreline change assessment is carried out along the Vizhinjam coast based on high resolution Linear Imaging Self Scanner (LISS) IV-5m satellite images for the year 2019-20 and demarcated the high erosion and accretion hotspots for pre and post construction of port activities. Valliyathura, Poonthura and Edapadu have been identified as zones of erosion, whereas Kottakal, Poovar and Karumkulam regions are identified as zones of accretion.



Shoreline Change Map - January 2015 to September 2019

Beach profile analysis for a stretch of 40 km along the Vizhinjam coast has been analysed to assess the monthly, seasonal and annual changes in the beach volume. The zones of high erosion and accretion derived from the satellite images have been compared with the results from the beach volume change.

4. Sea survey, identification of 42 inshore waters for the deployment of artificial reefs, identification of suitable reef structures and supervision of deployment of reef modules in the districts of Thanjavur, Pudukottai, Ramanathapuram, Thoothukudi and Thirunelveli.

Scientific studies were carried out for designing suitable artificial reef modules to be deployed at 42 coastal villages of Tamil Nadu. The challenge was in identifying the suitable depths and appropriate location which could provide substrate for artificial reef formation. Deployment of artificial reef modules at the demarcated sites shall be carried out under the supervision of NIOT. Marine ecological studies for baseline assessment includes productivity, epibiota, planktonic & benthic biota diversity of the pre-deployment scenario and natural fishery resource availability along the proposed sites.

5. EIA studies for Proposed development of eco-tourism projects in islands of Kadmat, Suheli and Minicoy in Lakshadweep Islands

NIOT was involved in the endeavor of island development through ecotourism by carrying out environmental and ecological impact studies. Ecotourism related EIA is first of its kind and several mitigation / conservation measures integrated with island stakeholder interests such as encouraging/ participating tourist in seaweed plantation activity, artificial coral reef seeding & cleaning etc., were developed as part of the studies.

6. Scientific studies for Phase-III expansion of Krishnapatnam Port:

Krishnapatnam Port proposes to carry out expansion of the port for which scientific studies included

- Assessment of impact of dredging and dumping on shoreline and marine ecology, preparation of a management plan.
- Evaluation of long-term shoreline changes and development of shoreline management plan.
- Mapping of mangroves and present state of mangroves and mudflats from satellite imageries and assessment of impacts of rerouting of Kandaleru creek on mangroves.
- Assessment of impacts on marine ecology due to proposed expansion and preparation of a marine ecology management plan.
- Evaluation of impact of straightening of Kandaleru creek through hydrodynamic model studies.

NIOT was involved in the mapping and conservation studies of mangroves for the Krishnapatnam port development. It was facilitated through mapping techniques by integrating satellite imagery processing and field surveys to determine the developmental pressures on sensitive mangrove ecosystem.

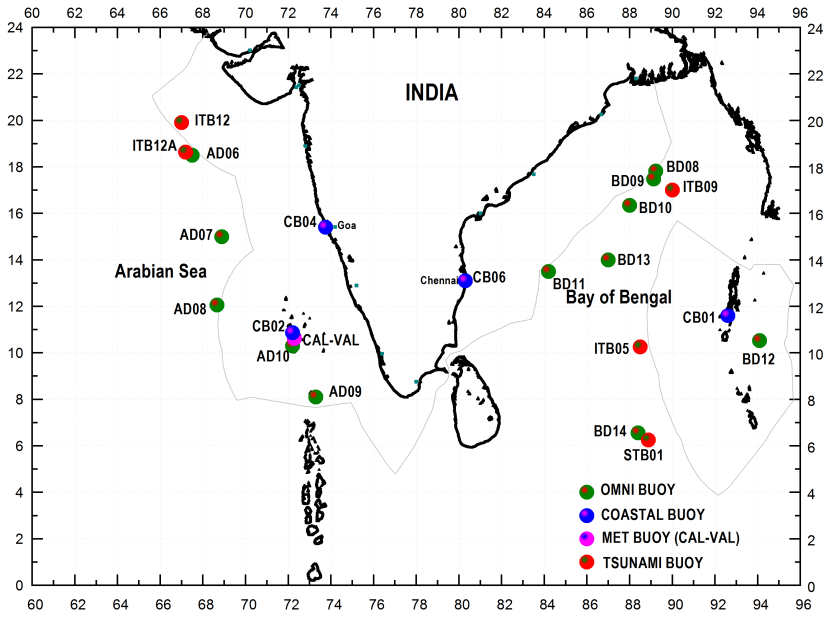
Mapping of mangroves in Krishnapatnam port

OCEAN OBSERVATION SYSTEMS

The main objectives of the program are the following:

- To maintain Moored Ocean Observation Network comprising of Met Ocean, Calibration Validation (CAL-VAL) and Tsunami buoy for data collection and to disseminate data to INCOIS and to support Research Moored Array for African–Asian–Australian Monsoon Analysis and Prediction (RAMA) programme under the INDO-US collaboration transferred from INCOIS.
- Ocean observational tools prototype technology development.
- To conduct collaborative R&D projects, capacity building with National and International Institutes / Organizations.

During this period, Ocean Observation Systems (OOS) has serviced 20 buoys by undertaking 13 cruises/field trips, 229 days of sailing covering a distance approximately 20781 nautical miles, 838 man-days for the completion of 58 operations (30 deployments & 28 retrievals) in the Bay of Bengal (BoB) and the Arabian Sea (AS). In addition, OOS is also supporting the advanced satellite based programs of ISRO, India, for its validation (CAL-VAL) of satellite data with in situ buoy data off Lakshadweep islands. OOS has been systematically carrying out preparations for executing these tasks in spite of the several challenges faced such as ship time availability, adverse weather conditions, harsh marine environment, inaccessibility to the site in case of any eventualities and vandalism.



Moored Buoy Network in the Northern Indian Ocean

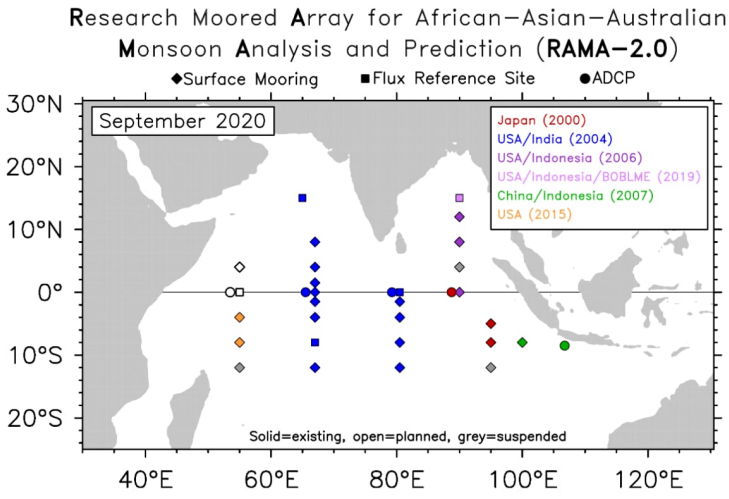
Indian Arctic Mooring (IndARC)

IndARC IV mooring which was deployed in July 2017 at 198m depth in the Kongsfjorden, Svalbard, Arctic was continuously operational for two years and was successfully retrieved on 14th July, 2019 by OOS team jointly with NCPOR and subsequently IndARC V mooring was successfully deployed on 17th July 2019. Apart from oceanographic sensors suit, the underwater self-recording camera system was incorporated in mooring at 32 m water depth. This camera system is equipped with two low power cameras and indigenously developed electronics control circuitry for automatic recording of underwater video footage at scheduled time intervals.

Growth of biofouling on ADCP, Glass floats and Tandem Acoustic release and biofouling on IndArc mooring

Deployment of IndARC V mooring onboard the vessel MV STALBAS

RAMA Buoy support: During this reporting period, to augment and maintain the RAMA array, two cruises were undertaken one from Chennai-Chennai on-board ORV Sagar Nidhi between 25th July 2019 to 20th August 2019 (27 days, 3323 nm). During this cruise 26 buoy operations were carried out. One more cruise on-board ORV Sagar Nidhi was undertaken to service RAMA buoy systems during 15th October 2019 to 13th November 2019 (30 days, 4027 nm). In this cruise period 18 buoy operations were carried out. The operations include recovery and deployment of deep ocean Autonomous Temperature Line Acquisition System (ATLAS) /Tropical Flex (T-Flex) moorings and subsurface moorings. Atlantic Oceanographic and Meteorological Laboratory (AOML) drifters of National Oceanic and Atmospheric Administration (NOAA) were also deployed during this cruise.



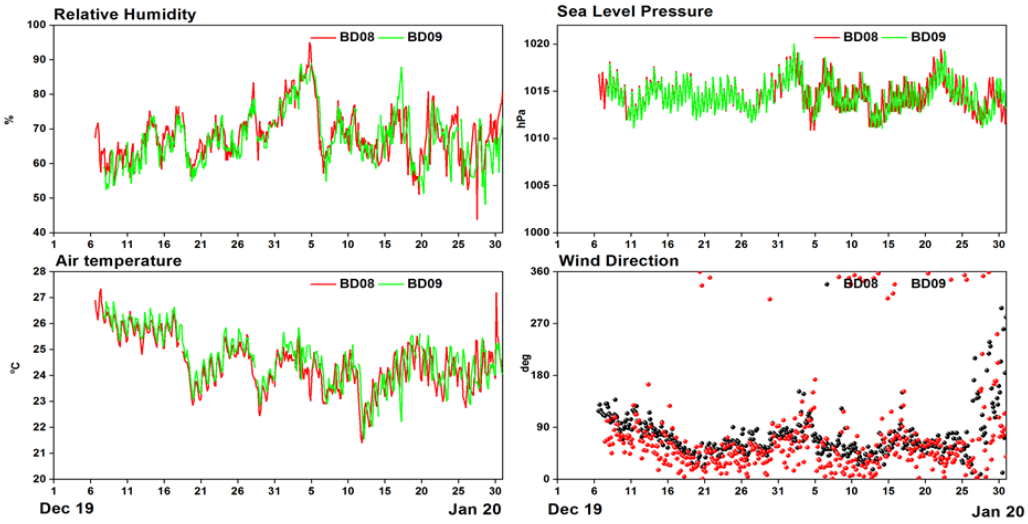
Technological developments:

Successful Indigenous developments and field testing of products listed below were accomplished during this period

- Indian Ocean Moored Buoy Network in the Northern Indian Ocean (OMNI) buoy system Prakruti.
- Low power Indigenous Tsunami surface buoy system with Deep-ocean Assessment and Reporting of Tsunamis (DART) format.
- Development of state of art Indigenous Buoy Data Logger Hrudaya 8G.
- Calibration facility for Air pressure sensor is established successfully during this period.

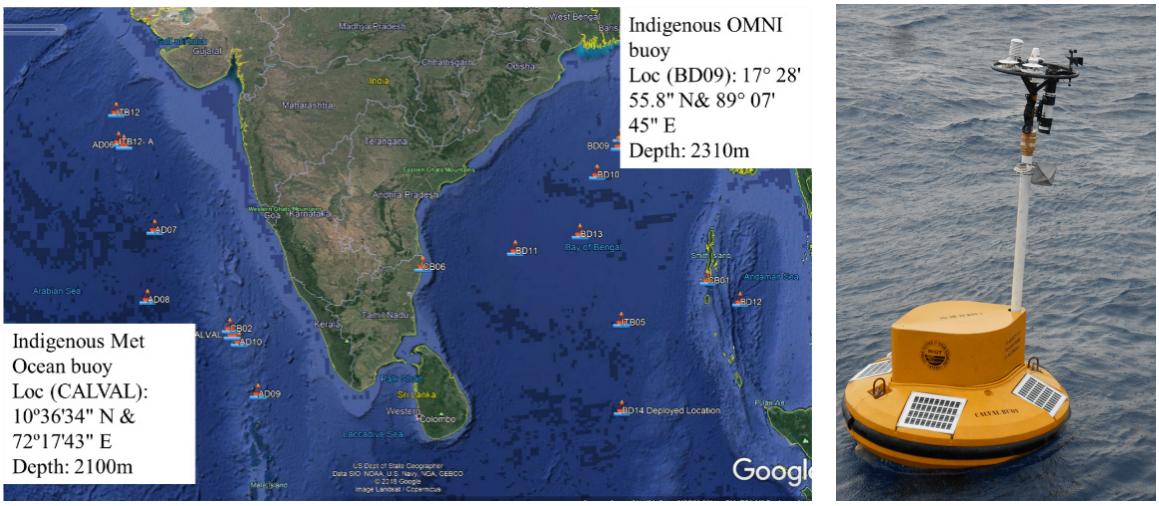
Performance validation of Indigenous Buoy

Indigenized Data Acquisition System (IDAS) CPU Hrudaya is installed and deployed in two buoys. The first one is an indigenous OMNI buoy and the second is an indigenous met ocean buoy. The buoy was deployed on 7th December 2019 at location of 17°28'55.8"N & 89°07'45"E (BD09) in the BoB. This buoy performance was validated with another OMNI buoy location BD08 at 17°49'7.2"N & 89°13'58.8"E, of separation around 20 nm. The data acquired by both BD08 and BD09 are in good agreement as shown in the graphs below.



A comparison of indigenous buoy (BD09) with a nearby imported buoy system (BD08)

Indigenous Met ocean buoy was deployed in Lakshadweep at the location of 10°36'34" N & 72°17''43" E (CALVAL) on 29th November 2019 at a depth of 2100m. The buoy was equipped with Met sensors such as solar radiation, relative humidity, precipitation, wind, air pressure and subsurface sensors Doppler Volume Sampler (DVS) and three Conductivity Temperature (CT) sensors at the depth of 1m, 10m and 500m. Data transmitted by CALVAL with indigenous CPU is found to be of good quality.

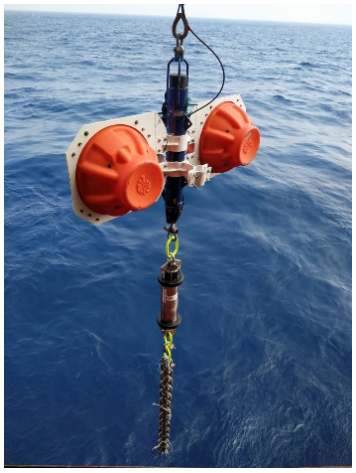


Deployment of Indigenous buoy- PRAKRUTI with I-DAS

Indian Tsunami Buoy System – SAGAR BHOOMI Version-2 BPR

In the development of Version – 2 BPR, the underwater enclosure was made. The new frame was designed and fabricated. The overall system was assembled and deployed at Arabian Sea during Sagar Kanya cruise in December 2019 at station depth of 2200 m. The long-term deployment of the surface buoy with BPR system is proposed in the forthcoming cruises.

Indian Tsunami Buoy Sagar Bhoomi-II surface buoy system was deployed in three locations TB12, TB05 and TB09 and is configured with DART Message format, configurable transmission interval and low power processor. The data collected in real time and is being shared with NDBC through INCOIS.



Schematic of Sagar bhoomi version-II BPR and the field testing of the same

Development of Indigenous Induction cable

At present the buoy mooring inductive cables are imported and lead time to deliver the item takes nearly 8 months. To overcome this delay and to reduce cost, the indigenous development of inductive cable was initiated. The cable end termination was designed by NIOT engineers. The load test of the designed cable was conducted successfully. The wire rope dimensions, jacket material and cable end terminations details were shared to Indian industries and some of the firms came forward to manufacture and supply the cable. Through tender process, one of the Chennai based industry developed & delivered one number of induction cable on December 2019 and the subsurface CT sensors were connected to the cable & bench testing done successfully. This will also encourage the Indian industries to develop product under "***Make in India***" program.

(a)

(b)

(c)

Induction cable a) End termination b) Integrated with CT sensors c) Cable in spool

Syntactic Floats for Deep Sea Mooring

Implosion is the main issue in using the subsurface glass floats in deep sea mooring. Due to the implosion of the glass floats, the expensive subsurface sensors cannot be retrieved from the deep sea. Syntactic foam is the best alternate for the subsurface glass floats. The syntactic floats are also widely used for oceanographic applications. For maximum durability, a thick-walled polyethylene exterior shell provides superior resistance to impact and bio-fouling. The syntactic floats as replacement of glass floats are used in mooring at 4

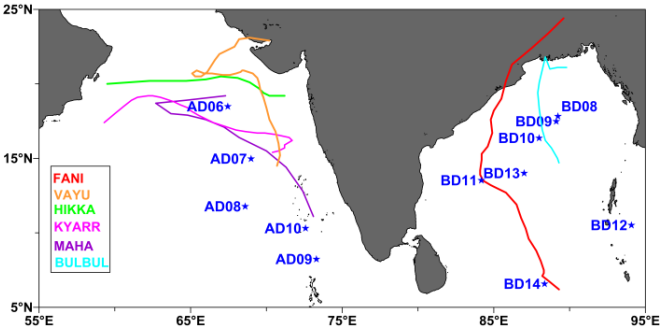
different locations AD09, AD10, BD13 and BD09 during November / December 2019 Sagar Nidhi & Sagar Kanya cruise.

Transfer of technologies: Four Technologies developed at NIOT, namely, Indigenous Deep Ocean & Coastal buoy system, surface and submerged tsunami buoy system were transferred to industry through National Research Development Corporation (NRDC).

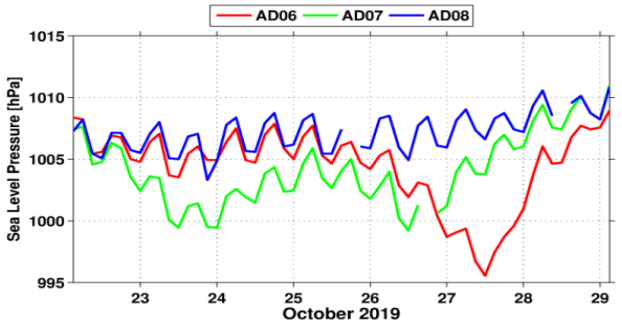
Deployment of Syntactic floats in deep sea mooring

Tropical cyclones in the Northern Indian Ocean during April 2019 –March 2020

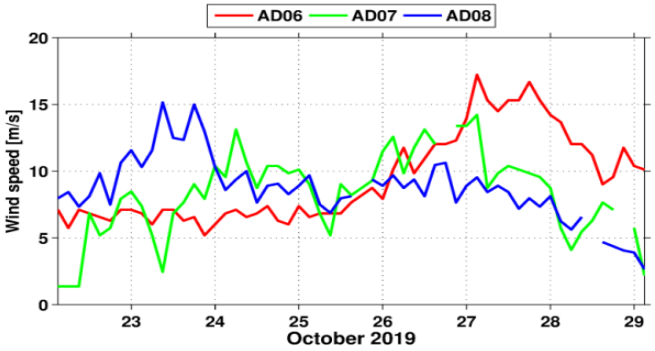
The year 2019 was one of the most active years with six cyclones affecting the North Indian Ocean with Extremely Severe Cyclonic Storm Fani (26 April – 4 May 2019), Very Severe Cyclonic Storm Vayu (10 – 17 June 2019), Very Severe Cyclonic Storm Hikaa (22 –25 September 2019), Super Cyclonic Storm Kyarr (24 October– 1 November 2019), Extremely Severe Cyclonic Storm Maha (30 October –7 November 2019) and Very Severe Cyclonic Storm Bulbul (6 –11 November 2019). The moored buoy deployed by NIOT BD11 (13.5N, 84E), close to the cyclone track (~12 km), observed a maximum Sea Level Pressure (SLP) drop (from 1008 to 980 hPa) and increase in wind speed (from 4 to 28 m/s) was observed at BD11 location on 30th April 2019 during Extremely Severe Cyclonic Storm Fani. A drop in Air temperature 4°C and significant wave height of 6.8 m was recorded by BD11 buoy. Significant moored buoy observations as well as derived parameters such as Tropical Cyclone Heat Potential (TCHP) and depth of 26°C isotherm (D26) evaluated from OMNI buoy measurements were regularly updated to IMD during the cyclones.



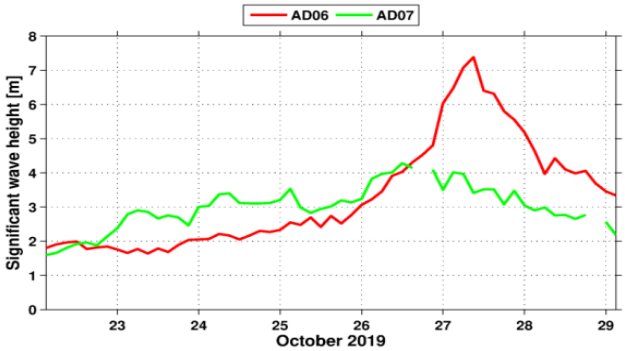
Cyclone track and moored buoy locations in the Arabian Sea and Bay of Bengal



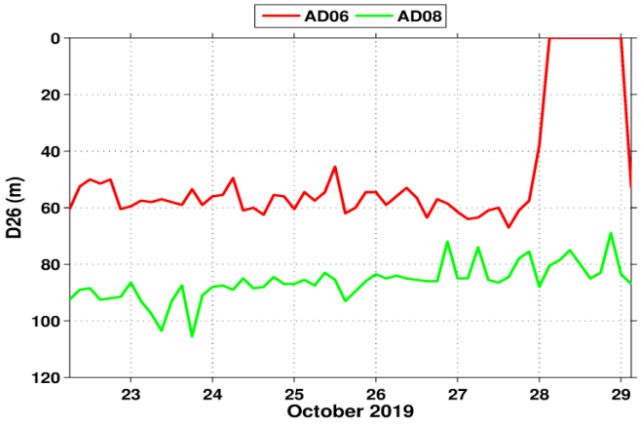
Sea Level Pressure measured by the OMNI buoys during Kyarr (23 – 29 Oct 2019)



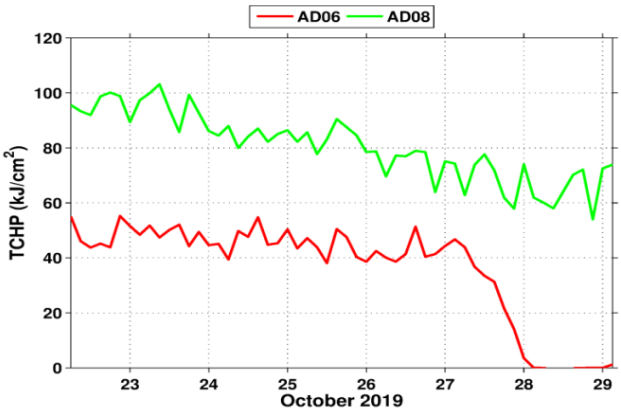
Wind speed measured by the OMNI buoys during Kyarr (23 – 29 Oct 2019)



Significant wave height measured by the OMNI buoys during Kyarr (23 – 29 Oct 2019)



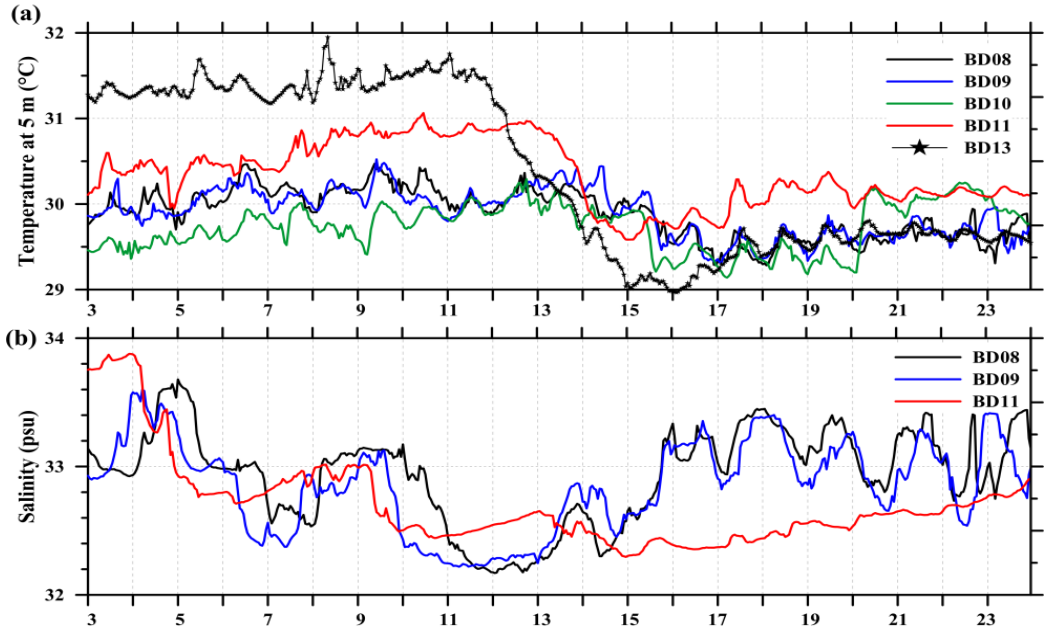
Depth of 26° C isotherm (D26) from OMNI buoys during Kyarr (23 – 29 Oct 2019)



TCHP estimated from OMNI buoys during Kyarr (23 – 29 Oct 2019).

Differential upper ocean response depicted in moored buoy observations during the pre-monsoon cyclone Viyaru

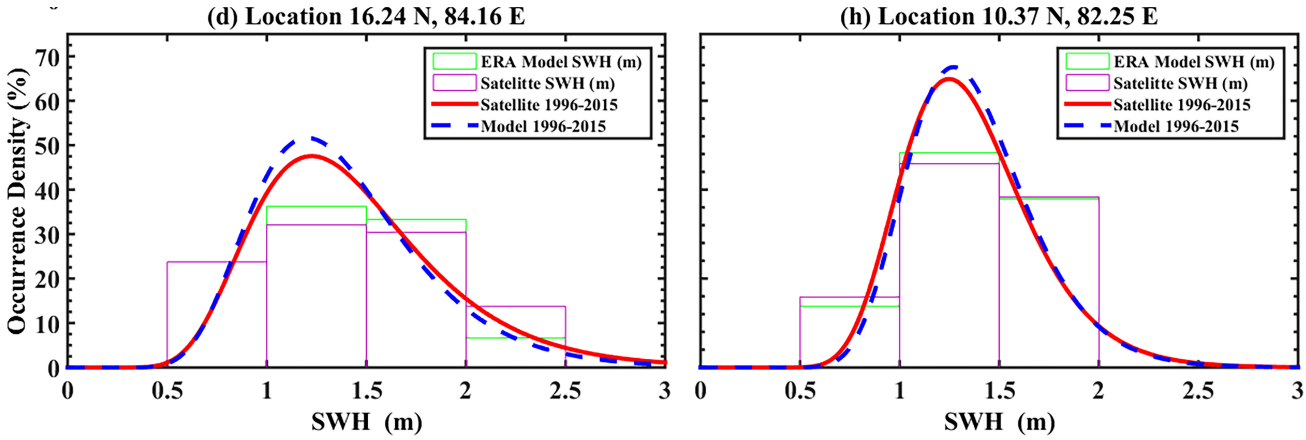
The pre-monsoon cyclone Viyaru in the BoB during 10-17 May 2013 traversed a long track from 5°N to 22°N over 7 days with basin-wide response, which was well captured by the time series observations of OMNI buoy network (BD08, BD09, BD10, BD11 and BD13) along with satellite data. The time series observations of temperature, salinity, surface current, mixed layer depth, tropical cyclone heat potential and barrier layer thickness depicted the upper ocean response during the cyclone passage. The differential upper ocean characteristics and its variable response reveal that vertical mixing override horizontal advection during cyclone passage. This study provides insight into the differential response on either side of the track and presence of cold core eddy combined with a thick barrier layer in modulating the upper ocean response.



Time series measurements of SST and sea surface salinity during Cyclone Viyaru

Long-term Estimation of Wave Climate Variability in the Western Bay of Bengal

The comprehensive analysis of long-term wave climate is carried out at selected locations in the western Bay of Bengal (BoB), by observing the distribution of significant wave height (SWH) using monthly averaged satellite and Wave model (WAM) model for 20 years (1996–2015). The data used in this study were compared with two in-situ buoy observations obtained from NIOT. The satellite and wave model (WAM) data show a good correlation with both in-situ buoy observations. The probability distribution functions indicated a significant increase in the higher range of SWH during the recent decade. The analysis of 20-year SWH indicates a positive trend with significant annual and semi-annual periodicities. The northwestern bay depicts higher energy in the annual cycle, whereas the southwestern bay exhibits equal contributions from annual and semi-annual cycles. The study also reveals that the increasing trends in local SWH in the western BoB are modified due to the number of tropical cyclones as well as the migrating swells generated in the southern Indian Ocean.



Decadal probability distribution of satellite derived significant wave height (m) at 16 N, 84 E and 10 N, 82 E

Joint Data Audit

Data verification audit was carried out between INCOIS and NIOT on 3-4 June 2019 at INCOIS, Hyderabad and concluded that all the data shared are in order.

Influence of environmental factors on macrofoulant assemblages on moored buoys in the eastern Arabian Sea

Factors governing the distribution of organisms in the pelagic ocean are studied, with environmental parameters and macrofouling assemblages on 11 buoys deployed in the Arabian Sea for an average duration of 322 days. Macrofoulants on all the mooring components extending from the sea-surface to a depth of 1800–4300 m were documented. Role of temperature, salinity, dissolved oxygen, biological productivity and zooplankton community in governing the macrofoulant distribution are studied. Species composition, vertical zonation and wet biomass exhibited significant spatial variations. Lepas anatifera (L.anatifera)

constituted more than 90% of foulant wet biomass on all moorings. Assemblages in the southeastern (SEAS), east-central (ECAS) and northeast (NEAS) regions were distinct. Density of L.anatifera on surface buoys were low in SEAS (0.2±0.09 no./cm^2), high in ECAS (0.32±0.11 no./cm^2) and moderate in NEAS (0.23±0.04no./cm^2). Macrofoulants were observed up to a depth of 75 m in SEAS, 130 m in ECAS and 120 m in NEAS. The depth profile of macrofoulant assemblages on moorings could be related to the prevalent hypoxic condition. Vertical profiles of wet biomass on all moorings exhibited subsurface maximum at depth ranging from 10 to 20 m, consequent to the abundance of L. anatifera in a thermally stable depth of water column, wherein diurnal and semidiurnal temperature variability was minimal.

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 NIOT is responsible for operational management and maintenance of research ships and scientific equipments on board. Currently there are five vessels under NIOT viz., Sagar Nidhi, Sagar Manjusha, Sagar Purvi, Sagar Tara and Sagar Anveshika.

As the existing Coastal Research Vessel (CRV) Sagar Purvi which is more than 23 years old will not be sufficient to cope up with the future demands and due to aging of this ship, the cost of maintenance has considerably gone up. To overcome this slightly larger capacity vessels were required & hence NIOT/MoES had successfully acquired two new Coastal Research Vessels which are sophisticated than the available similar category of vessel. These ships will augment the observational and sampling capabilities of our scientific community in Indian coastal waters to a great extent.

VMC team provides support to the research ships on a day to day basis, to ensure that the cruises are carried out as per schedule. They also collect scientific data and compile the data collected during the expedition.

Progress achieved

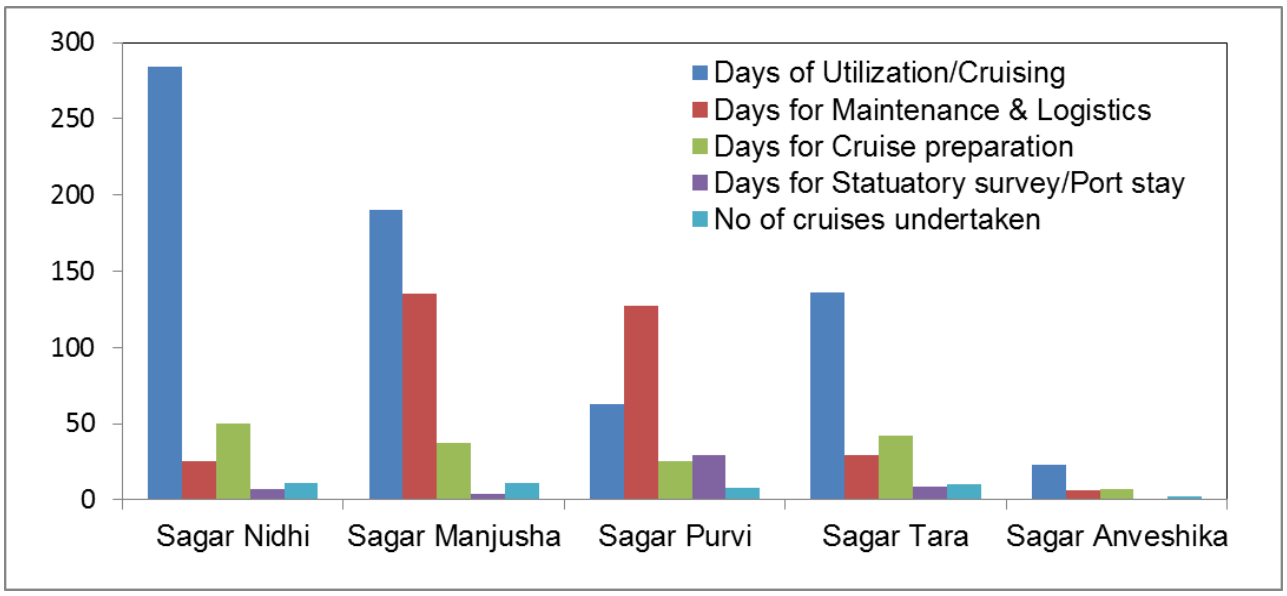
Vessel Utilization Report during 1st April 2019 to 31st March 2020

Vessel	Days of Utilization / Cruising	Days for Maintenance & Logistics	No. of Cruises Undertaken
Sagar Nidhi	**284**	**25** *[Azimuth Thruster Repair, Deep sea, CTD, Hydro graphic winch Intervention]*	**11**
Sagar Manjusha	**190**	**135** *[Dry-dock and afloat repairs, Overhauling of Main & Auxiliary Engine, New Anchor windlass base fabrication and fitment, Design, Fabrication Fitment and Testing of Idler gear for Windlass, Stern Tube repair, Installation of new CTD winch system]*	**11**
Sagar Tara* *(Total no. of days: 216)*	**136**	**29** *[Rectification of Guarantee Defects]*	**10**
Sagar Anveshika# *(Total no. of days: 36)*	**23**	**6** *[Rectification of Guarantee Defect]*	**2**
Sagar Purvi$ *(Total no. of days: 244)*	**63**	**127** *[Tail Shaft Extension Survey, Engine routine maintenance, new AC condenser fitment, Underwater Hull cleaning]*	**8**

**Sagar Tara started her maiden voyage on 29th August 2019.*

#Sagar Anveshika started her maiden voyage on 25th February 2020.

$Sagar Purvi utilization is considered till 30th November 2019, since Governing Council (GC), NIOT has approved vide GC minutes dt.8th March, 2019 to transfer Sagar Purvi to Kerala University of Fisheries and Ocean Studies (KUFOS), Cochin for academic training as 'Vessel in the Campus' on land.



Successful completion of major cruises onboard Sagar Nidhi:

- Seabed Locomotion Trials of Deep Sea Mining Systems at PMN Test Mining Site, CIOB by DST-NIOT.
- Deployment & Retrieval of RAMA moorings (NIOT-PMEL-NOAA) & microbial study by MBT-NIOT in Equatorial Indian Ocean.
- Successful completion of ACS trials in Bay of Bengal.
- Sagar Nidhi participated in a coastal security exercise **'Sagar Kavach'** with Indian Navy/Indian Coast Guard/ Marine Police & received appreciation.

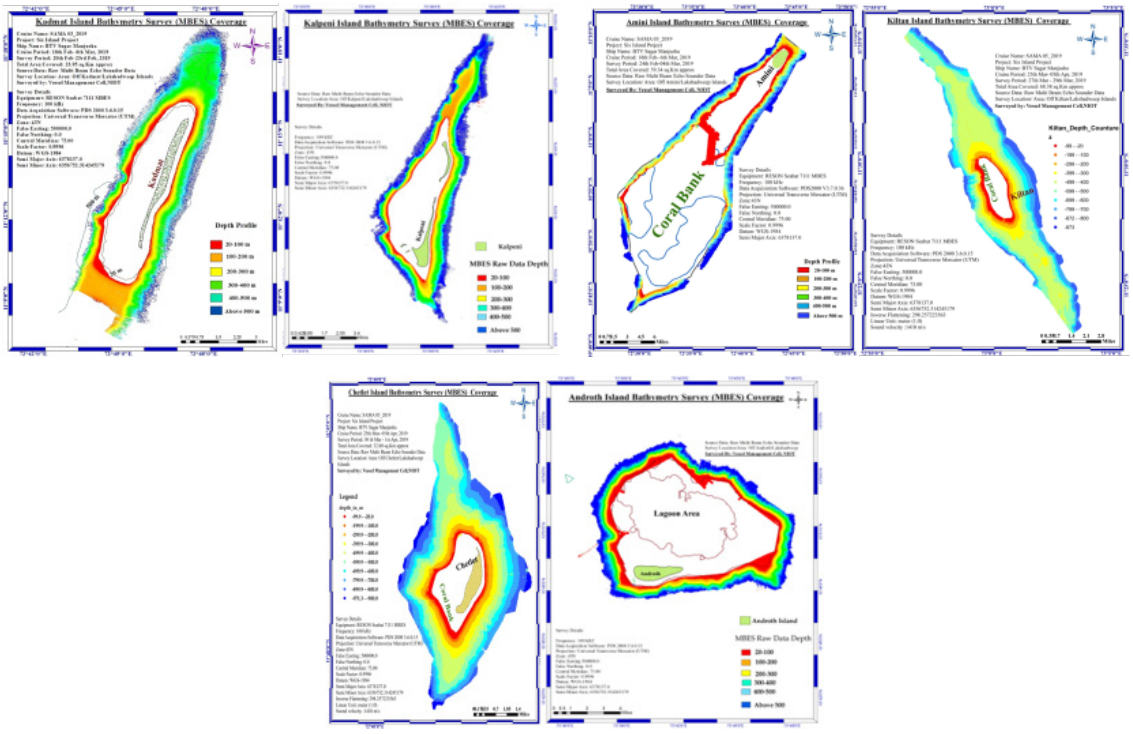
Sagar Nidhi during Sagar Kavach Exercise

- Successful completion of Survey and Sampling in Bay of Bengal by NIO-Visakhapatnam and MBT-NIOT team onboard Sagar Nidhi.

CTD & Corer operations

Successful completion of major cruises onboard Sagar Manjusha:

- Successful installation and testing/trials of new tow fish winch system installed onboard Sagar Manjusha for OE-NIOT team. A new winch base for installation of winch has been prepared after inspection and study conducted by VMC team on the winch footprint, loads acting; deck mounting arrangements prior finalizing the drawing.
- Scientific operations onboard Sagar Manjusha- National Centre for Coastal Research (NCCR) / National Centre for Sustainable Coastal Management (NCSCM).
- VMC team completed Multibeam Bathymetry survey, sampling & data processing for selection of suitable locations for construction of desalination plants in Six Islands of Lakshadweep archipelago by OSS-NIOT using Sagar Manjusha.



Bathymetry Survey & Sampling for Six Island Desalination Project

- Sagar Manjusha participated in a five-day event **'Sahyog Kaijin'** Indo-Japanese Coast Guard Exercise which was witnessed by Director General of the Indian Coast Guard. Efforts of VMC/ Ship staff & overall maintenance of Sagar Manjusha were well appreciated by the Indian & Japanese Coast Guards.

Sagar Manjusha with Indo-Japanese Coast Guard Ships

Acquisition of two new CRVs

CRV Sagar Tara

- **Sagar Tara joined MoES fleet after successful and satisfactory harbour & sea trials on 16th August, 2019.** Ship's machinery and scientific equipment were tested & tried out at sea satisfactorily.

- Harbor acceptance trials were carried out as per IRS class requirements and in-line with contractual specifications. All the machinery and equipment were checked and found to be performing satisfactorily.

Operational trial of Bow Thruster

Static and dynamic load test of Deck Crane

- Sea acceptance trials (Class) were carried out as per Indian Register of Shipping (IRS) class requirements and test / trials of Main Engine endurance trial, Crash Stop, Astern Trial, Turning Circle, Main & Emergency Steering, Anchor Windlass Trial, Fuel Consumption Record were witnessed in presence of IRS class surveyor.
- Builder's full power trial was carried out and found to be in line with contractual specification. Sea keeping of the ship at Sea-state 3 & Sea-state 4, Beaufort scale 3 & Beaufort scale 4 at different decks & compartments had been verified & behaviour of the ship is found to be comfortable.
- All Scientific equipment have been installed and commissioned onboard Sagar Tara and are performing satisfactorily. Complete training, trouble shooting and periodic maintenance are briefed by OEM/ TWL shipyard representative.
- Vibration and noise level were checked in various locations and compartments and found to be well within acceptable limit.

Successful completion of major cruises onboard Sagar Tara after successful delivery on 16th Aug, 2019:

- Sagar Tara has undertaken more than ten scientific cruises since delivery and the performance of ship & scientific equipments has been found to be satisfactory as acknowledged by the scientific users (NIO Goa, IMU Vizag, NCCR, NCSCM, CEE, Ocean Structures, OOS group of NIOT & others).
- Maiden voyage was undertaken by NIO-Visakhapatnam team for Sea Water Quality Monitoring (SWQM) Project (NCCR Project) and they conducted Scientific Survey in Bay of Bengal.
- IMU-Visakhapatnam team has conducted a study on Ambient and Underwater radiated Noise levels measurements for Sagar Tara during Sept, 2019 and the parameters are well within the standard limits prescribed by DNV Class/IMO and Ship is meeting Silent Class-A notation.

CTD castings *Water Sampling* *Grab sampling* *Zooplankton*

CRV Sagar Anveshika

- Sagar Anveshika was successfully launched on 31st August, 2019 at M/s TWL Shipyard and was taken over by NIOT/MoES at M/s TWL shipyard, Kolkata on 14th February 2020. Ship's machinery and Scientific equipments were tested & tried out at sea satisfactorily. Ship performed well at different sea states. Both the Ships have been constructed & delivered within contractual cost and time.

- All machinery / equipment such as Main engine, Gear box, Diesel generators, Oily water separator, bow thruster, Scientific winches and handling system, etc have been commissioned onboard by OEM or OEM authorized representatives. Harbor acceptance trials were carried out as per IRS class requirements & in-line with contractual specifications and found to be satisfactory.

CTD Winch, Oceanographic Winch, General Purpose Winch (Left to right)
Load Test of Scientific Winches and Handling System

- Sea acceptance trials (Class) were carried out as per IRS class requirements and test / trials of Main Engine endurance trial, Crash Stop, Astern Trial, Turning Circle, Main & Emergency Steering, Anchor Windlass Trial, Fuel Consumption Record were inspected in presence of IRS class surveyor.

- Builder's full power trial and Sea Acceptance Trials for Scientific Equipment was carried out for verifying performance of various scientific equipment as per protocols defined in technical specification and found satisfactory. Vibration and noise level were also checked in various locations and compartments and found to be well within acceptable limit. Sea keeping of the ship at various sea states at different locations and compartments have been verified and behaviour of the ship is found to be comfortable.

- All Scientific equipment of TWL and owner Supply have been installed and commissioned onboard Sagar Anveshika and performing satisfactorily. Complete training, trouble shooting and periodic maintenance were briefed by the OEM/ TWL Shipyard representative.

Successful completion of major cruises onboard Sagar Anveshika after delivery on 14th Feb, 2020:

- Sagar Anveshika has undertaken about two scientific cruises since delivery and the performance of ship & scientific equipments has been found to be satisfactory as acknowledged by the scientific users.

- Maiden voyage was undertaken by NIO-Visakhapatnam team for SWQM Project (NCCR Project) and they conducted Scientific Survey in Bay of Bengal.

Verification of Quality standards on every stage of construction:

i. The progress was monitored closely and quality standards were verified on a regular basis on every stage of the construction of CRVs through IRS (Class), NIOT overseeing team, Expert Committees & IRS (Overseeing team).

   - Total Management Contractor [M/s ABS Marine team] officially reported at M/s TWL Shipyard to join the vessel Sagar Tara and Sagar Anveshika on 29th July, 2019 and 23rd January, 2020 respectively. Onboard familiarization and training were imparted to Officers and Crew from time to time simultaneously.

- The committee members appreciated the efforts of VMC team, NIOT Overseeing team & TWL shipyard team for maintaining the momentum throughout the project to ensure timely delivery of the vessels.

Sagar Nidhi-Trouble Shooting of Deep Sea Winch system

VMC team carried out trouble shooting of deep sea winch system onboard Sagar Nidhi and made it ready in a short time that resulted in ship's sailing for Autonomous Coring System (ACS) trials and ensured successful deployment/recovery/operations of ACS upto 1070m depth & drilling upto 56 m below seabed in KG Basin. A standard operating procedure [SOP] was also prepared & suitable action to be taken during technical emergencies were formulated & placed onboard as a ready reckoner.

New CRVs-Engineering techniques to improvise Shipbuilding capability

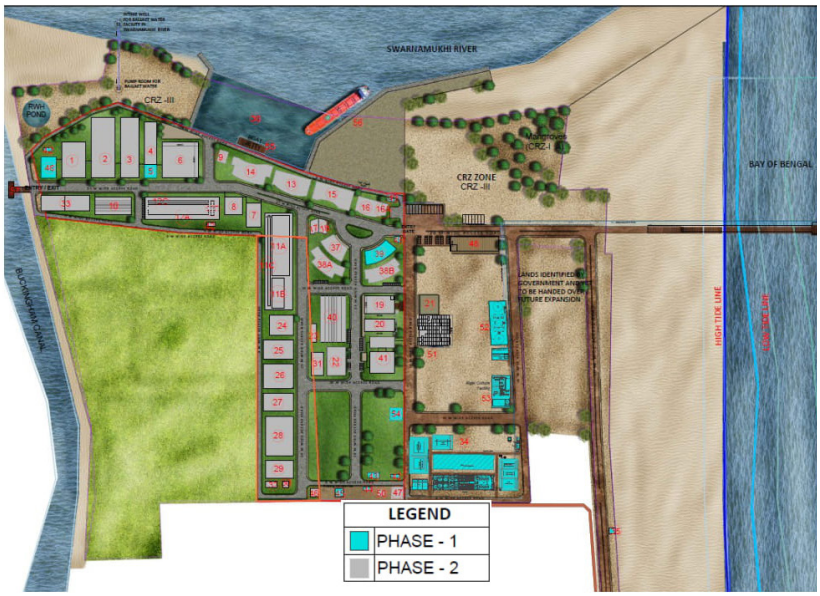
VMC team have provided technical inputs to Shipyard for superstructure marine grade Aluminium welding and back strip welding of steel structure, bi-metallic strip welding & welding procedure for joining of steel and aluminium, which was also approved by Class. This has enabled saving of time towards ship building & better quality control.

SEAFRONT FACILITY

The aim is to establish a state of the art Seafront Facility with all the necessary infrastructure, laboratories and platforms for carrying out open sea trials at close proximity. A coastal stretch of land has been acquired along Nellore Coast towards this.

Progress

- Revised Master plan has been finalized for Seafront Research Facility (SRF) at Pamanji as approved by Project Review Coordination Committee with an option to refer the Master plan on long term development of the campus.
- The infrastructures for pre investment and testing facility for conducting the algal culture, consisting of raceway ponds, store room and pump room are completed and these facilities are being maintained and utilized.



FACILTY NO	NAME OF FACILITIES
1	Buoy Test Facility
2	Buoy Assembly Facility
3	Deep Ocean Mining Test Facility
4	Submersibles Integration Facility
5	Hyperbaric Test Facility
6	Coastal Process Testing Facility (Wave Basin)
7	Seabed Simulation Tank
8	Hydraulic Research Facility-Part 1
9	Acoustic Lab (G+1)
10	Integration Facility for Hydraulics Testing
11 A	Deep Ocean Testing Bay
11 B	Sonar Test Facility
11 C	Ocean Electronics Test Tank
12 A	Buoy Test Tank
12 B	Wave Flume For Sonar Testing
12 C	Hydraulic Research Facility – Part 2
13	Deep Ocean Mining Lab (G+1)
14	Buoy Calibration Lab
15	Biological Instrumentation and Analytical Lab (G+1)
16	Shore Maintenance Facility with customs & CISF facility.
16 A	VMC Tower
17	Oceanographic Instrumentation and Calibration Lab (G+1)
18	Under water Precision Engineering Lab (G+1)
19	OTEC Desalination Lab (G+4)
20	Closed Yard for OTEC Desalination
21	Open Yard for OTEC Desalination (Non Built-up Area)
22	Material Storage and Cage Fabrication Yard
23	Submersible Equipment and Component Storage Bay
24	Storage for Deep Sea System
25	Mining Material Storage Yard
26	Scrap Yard for Mining Accessories
27	Poly Metallic Nodule Storage Yard
28	Buoy Accessories Storage
29	Shore Maintenance Material Store
30	Open Storage for Shore Maintenance
31	Storage for Coastal Testing Accessories
32	Acoustic Material and Component Storage
33	Fish Feed Formulation Facility
34	Fin Fish Hatchery (Non Built up Area)
35	HF Radar Facility
36	Open Ocean Test Facility (Non Built up Area)
37	Computational Facility (Stilt + 2)
38 A	Centralized Office (Stilt + 4)
38 B	Centralized Office (Stilt + 4)
39	Admin (Stilt + 4)
40	Common Storage
41	Canteen and Guest House (G + 2)
42	Pump Room
43	Labour Shed
44	Panel Room
45	Fire Station
46	STP
47	Building Transformer Yard
48	Desalination, RO Plant, UG Sump
49	Security
50	Existing Security
51	Solar Farm
52	Ballast Water Treatment Facility
53	Algal cultural facility
54	New Transformer
55	Boat Jetty
56	VMC Dock
57	Boat Jetty

PLOT COVERAGE	
TOTAL BUA	103080 SQ.M
PLOT AREA	399829.40 SQ.M
FSI	0.25

Revised Master plan for SRF at Pamanji

COMPUTER MAINTENANCE CELL

Computer Maintenance Cell (CMC) administers, manages and caters to the needs of different projects, departments within the institute apart from inhouse software development and maintenance.

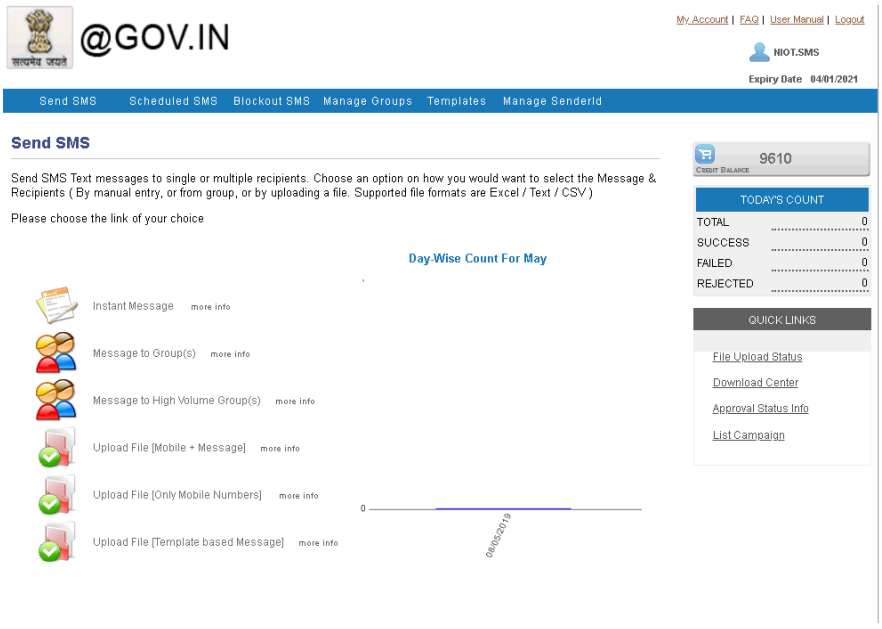
CMC services the campus-wide LAN which caters close to 500 users. LAN has been designed with single mode fibre Optical Fiber Cable (OFC) backbone offering aggregate bandwidth of 1 Gbps.

NIOT has dedicated leased lines of 1 Gbps and 30 Mbps capacity from NIC and Vodafone respectively to ensure uninterrupted service to the user community.

CMC maintains all the core network, Web, email and application servers along with tele-presence facilities of the campus, and extends support for 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.

CMC has developed Integrated Office Automation System (IOAS) with which Stores & Purchase, General administration modules and Finance applications are made online, enabling NIOT to move towards paperless office implementation as per Government of India guidelines. The online recruitment module was used for regular posts recruitment from online application submission to call letter generation. CMC is providing support for major software's that are being used by various departments.

CMC has been successful in piloting PFMS usage and now NIOT uses PFMS for regular employee payroll processing. NIOT has successfully implemented NIC email, SMS services, and GeM as a part of Ministry's initiative for transparent communication and transactions. E-Office implementation is in progress and is slated to for completion in few more weeks. Conferences using Microsoft Teams and Webex are carried out on trial basis to avoid physical meetings as COVID-19 measures.



NIC SMS Services

CAMPUS DEVELOPMENT AND MAINTENANCE

Infrastructure facilities

To cater the requirement of research activities of different groups at NIOT campus, following civil & interior works have been completed as part of the campus development work. Consent with approval has been obtained from Greater Chennai Corporation to construct the various buildings as part of the campus development activity such as vertical expansion of buildings at Hyperbaric Test Facility and Ecotoxic laboratory, Guest House, Endurance Test Facility, Security room, UPS room for OOS, Amudhasurabi facility and labour shed.

Interior work at Accounts section

NIOT board –Silver Jubilee

Cuddapa slab and MS frame work at additional dining hall

ACP Alco bond composite panel roofing sheet work at entrance of Auditorium

Metal dustbin for collecting the waste degradable materials

LIBRARY

NIOT library has been providing support for the research activities since its inception in 1994. Apart from the scientists and technical staff, the library also provides its support to students.

The library has a collection of more than 5550 books and 5000 archival periodicals. The library subscribes 24 reputed scientific journals in electronic version. Additionally, through the consortium agreement by Ministry of Earth Sciences, accesses to about 148 journals are also provided to the scientific staff. It is also equipped with a data base for providing the information on its resources. Library has a good collection of Hindi literature including novels, short stories, biographies, dramas, general knowledge, technical glossary and dictionaries. A collection of audio-visual materials augments to the overall resources. About 5 Hindi magazines, 2 English magazines and 5 daily newspapers in different languages are subscribed to provide the current news to the users.

A view of the Library Collection

A View of the Subscribed Journals

Being a research library, majority of its resources are online journals and database which is accessible within the campus through Intranet. NIOT also has Inter institutional membership of the libraries of IIT (Madras) and British Council Division. To enrich the library resources, new books and journals are also being procured with the approval of the competent authority.

Services offered by the library include Facility for reading within Library, Document lending service, Reference of select materials, Online Public Access Catalogue to browse the library collection through web, computers to browse and access electronic journals, databases, archives, etc.

A Digital Repository with archives of Scientific/ Technical papers published by the Institute staff is also maintained that can be accessed through Institute's website and shared on MoES Digital Collection. The library shares its resources with all important academic/ research institutions in India through Digital Repository Services. As a member of Knowledge Resource Center (KRC) network, NIOT library also shares information in the common platform with libraries of other institutes under Ministry of Earth Sciences.

IMPLEMENTATION OF OFFICIAL LANGUAGE

NIOT being a technical institute, while dealing with the developing of reliable indigenous Technology for sustainable utilization of Ocean Resources and development, it has always endeavored in making use of the Official Language hand in hand. NIOT is constantly striving towards exploring new avenues for the effective conjunction of the scientific work with the official language.

Hindi training

In compliance with the rules of Official Language, the imparting of training in Hindi to all the staff members in a systematic manner is mandatorily followed in NIOT. As per the roster maintained, among the existing 191 staff members, 131 (i.e.68.50%) staff members have affirmed of being trained as on 31-03-2020. It is also made sure that they are being given the incentives of personal pay and cash award as per the examination prescribed as their final course of study.

During the year, 2 staff members who were enrolled in the regular training program for the course of Praveen have completed the same successfully. Currently a total of 27 staff members i.e. 20 staff members for the course of Prabodh and 7 staff members for the course of Praveen are enrolled for the 2020 session of Hindi training. All the efforts are being made to complete the training of all the staff members at the earliest.

Hindi typewriting course

Staff members eligible for typewriting course are also being enrolled for the same from time to time. In the current year, a staff member who was nominated for the course of Hindi typewriting through regular training program has been declared as passed. The cash award and personal pay for period of 1 year as admissible is also granted to the respective staff member.

Hindi Fortnight Celebrations

In accordance with the progressive use of Hindi among the staff members, NIOT celebrates Hindi fortnight every year. During the year 2019-20, it was celebrated with utmost enthusiasm on the Hindi day i.e.14.09.2019 and between 16th to 27th September, 2019. Various competitions like Debate, essay writing, extempore were conducted for encouraging staff members towards Hindi. All the officials actively took part in all the competitions and in the co-ordination activities as well. It was necessary to ensure that all the Officials are equally given the chance, with the view of reassuring the participation of staff members belonging to non-Hindi speaking states, prizes were distributed among both the categories separately. Hence, there was an healthy competition among all the staff members and staff members belonging to non-Hindi speaking states took participation in all the competitions with a great zeal.

Hindi Fortnight Celebration

The closing day of the fortnight was on 27th September, 2019, with all the staff members of NIOT. The prizes for the winners of competitions held during the fortnight were also distributed among them. The Valedictory function was held under the Chairmanship of Dr..M.A. Atmanand, Director, NIOT with Dr.D.N.Singh, DGM-O.L, Southern Railway & Member Secretary, Town Official Language Implementation Committee, Chennai as the Chief Guest.

Hindi Workshops

Further, Workshops are being organized to strengthen the knowledge in Hindi among the staff members and to motivate them to do more work in Hindi. Officials like Dr.Jayasankar Babu, HoD-Hindi Department, Pondicherry University, Dr.S.Vijaya, Rajbhasha Adhikari, State bank of India and Dr.D.D.Ozha, Senior Scientist were invited as Chief Guests and it is also noted that there was active involvement by all the staff members inspite of their busy schedule. The officials of Hindi Section are also engaged in encouraging the staff members with the typing workshops and basics.

Hindi Workshop

During this period a Kavi Sammelan was also organized which was indeed a platform for our staff members to express their talent in literature. Staff members were given the opportunity to flaunt their ability in creativity both in Hindi and Tamil. The regional language-Tamil was also given equal importance in the function.

Virat Kavi Sammelan

Official Language Implementation Committee meetings

The meetings of Official Language Implementation Committee (OLIC) to evaluate the progress of work being done by the staff members in Hindi is also organized at regular intervals. The members of the committee put forward their suggestions for the effective implementation of Official Language and steps are taken to implement the same accordingly. Four meetings of the Official Language Implementation Committee were conducted during the year.

Quarterly and half yearly reports for progressive use of Hindi

Quarterly reports (online) regarding the use of Hindi for the respective quarter endings are prepared and sent to Regional Implementation Office, Cochin and MoES, New Delhi within the stipulated period of time. The half yearly report to the Town Official Language Implementation Committee is also being submitted in the prescribed format regularly.

Invited presentations in Hindi

The scientific officials of NIOT have also maintained a welcoming approach towards the progressive of Hindi. NIOT represented in the All India Hindi Scientific Seminar held at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam. Besides, the achievements of NIOT were also presented during the meeting of Town Official Language Implementation Committee held at NIOT.

Official language inspection

An inspection with regard to the implementation of Official Language in NIOT was carried out by the Ministry of Earth Sciences, Delhi.

Parliamentary Committee on Official Language

The implementation of Official Language in NIOT was inspected by the Second Sub-Committee of Parliament on Official Language on 14th January, 2020. It was an honour that the Convenor of the subcommittee launched NIOT's first Hindi edition of the Samudrika e-magazine. The Convenor released the e-magazine in the presence of all the members of the committee.

Participation in All India Official Language Conference

The efforts of NIOT towards the progressive use of Official language are also applauded while NIOT represented in the following Conferences:

- All India Official Language Conference organized by Parivartan Jan Kalyan Samiti, New Delhi held during 30-01 May, 2019 at Kovalam, Thiruvananthapuram and 25-27 November, 2019 at Kodaikanal, Tamil Nadu. NIOT was awarded the Rajbhasha Shield.
- Residential workshop on Official Language held at Goa during 09-11 December, 2019.

Participation in TOLIC meetings and competitions

It is always made sure that the half yearly meetings of Town Official Language Implementation Committee (TOLIC) are attended by the Head of the Institute. The meeting held on 17.05.2019 was attended by the Director-in-Charge along with the Hindi officials. The meeting held on 22.10.2019 was hosted by NIOT itself. An exhibition on the major projects of NIOT was also set up during the programme. NIOT was awarded the shield for having secured Motivation position among Big-II offices category for the best performance in the progressive use of Official Language during the year 2018-19, which was indeed a piece of appreciation in all the aspects.

Besides, NIOT represented in various programs and competitions held from time to time.

MEETINGS

- **Parliamentary Standing Committee**

  Study visit of the Department-related Parliamentary Standing Committee on Science and Technology, Environment, Forest & Climate Change took place on December 28, 2019 at NIOT, Chennai. NIOT presented the technological activities and achievements. The committee reviewed the activities and appreciated the achievements made by NIOT team.

Parliamentary Standing Committee

- Ministry of Earth Sciences, Government of India organised a side event during the 25th Session of the International Seabed Authority Council meeting. Secretary General HE Michael Lodge, Indian High Commissioner, HE Sevala Naik and other dignitaries graced the occasion. Highlights of India's four decades of Deep Sea Resource programme were presented.

- NIOT & NCCR jointly organised the Curtain Raiser Programme at NIOT in view of the India International Science Festival – 2019 (IISF-2019) held on 5-7, November 2019 at Kolkata. Senior Scientists from CSIR-SERC, CSIR-CLRI and officials from Doordharshan, Press Information Bureau (PIB) have participated in the programme.

CONFERENCES / WORKSHOPS

- Dr.M.A.Atmanand Director, NIOT, as Chair of IOCINDIO, conducted the Scientific, Technical and Institutional Innovations Workshop for National and Regional Framework on Coastal Vulnerability Assessment and Monitoring for Sea-Level Rise and Storm Surges in the Indian Ocean Region from 27-30 May, 2019 at ITOocean, INCOIS, Hyderabad, India. He Chaired the IOCINDIO-VII meeting on 31st May and 1st June 2019 at INCOIS Hyderabad.

- The Central Indian Ocean (IOCINDIO) Leadership Workshop for Developing the "Regional Framework for Coastal Vulnerability towards the Safety, Security & Sustainable Development of Member States in the Indian Ocean" was conducted at NIOT during 06-07 Jan 2020.

- Towards the UN decade of Ocean Science for sustainable development (2021-2030), a "Regional Planning Workshop for Northern/Central Indian Ocean Countries & Regional Organisation for Protection of the Marine Environment (ROPME) Sea Area", was conducted during 8-10 January 2020 at NIOT, Chennai. The workshop attracted a great number of accomplished senior scientists, professionals & students from more than 15 countries from the IOCINDIO region & outside.

UN Decade of Ocean Science

Participation in Decade of Ocean Science

SPREAD 2019

A round table discussion on **"Shore Protection and Remediation using Eco friendly Alternative Designs" (SPREAD 2019)** was organized at NIOT on 16th December 2019 to disseminate the experience and knowledge gained through the design, implementation and performance monitoring of the shore protection measures at the two sites impacted by natural (Kadalur villages) and manmade (Puducherry) causes.

Participants of SPREAD 2019

Workshop on Coastal Resilience

NIOT in collaboration with Deltares & CDR Netherlands and World Bank conducted 8 state level workshops on Coastal Resilience: Developing New and Innovative Approaches in India and Bangladesh along the Bay of Bengal held at Chennai, Pondicherry, Visakhapatnam, Bhubaneshwar and Kolkata.

Workshop on Coastal Resilience

Indo-US workshop on Moored buoy data analysis

Ocean Observation systems successfully conducted an Indo-US Science Workshop on analysis of moored buoy data from 2nd to 4th July 2019 to commemorate 25 years of existence and services of NIOT. The workshop was envisaged with a unique approach of mentoring the students on a specific theme under a dedicated mentor similar to the ancient GURUKUL system of education. The workshop was held with the objective of popularizing utilization of Indian moored buoy data by the research community. The theme of the workshop was selected as the "Upper ocean response to cyclones in the Northern Indian Ocean" considering its significant impact on the life and property of the densely populated coastal states of Indian sub-continent.

Science workshop lectures and discussions

STAFF RECREATION CLUB

Staff Recreation Club (SRC) has conducted various events for children and family members of NIOT and NCCR staff.

- A Dental camp on 18th July 2019 by Sree Balaji Dental College and Hospital, Chennai
- An Eye camp on 29th August 2019 by Lawerence & Mayo's (Optical), Chennai
- An Ortho camp on 15th October 2019 by Parvathy Ortho Hospital, Chennai
- A Medical camp on 15th November 2019 by Chennai National Hospital, Chennai.

Important Days Observed at NIOT

73rd Independence Day Celebration

The 73rd Independence day was celebrated at NIOT on August 15, 2019. Dr.M.A.Atmanand, Director NIOT and Dr.M.V.Ramanamurthy, Director NCCR hoisted the national flag and addressed the gathering.

71st Republic Day Celebration

NIOT celebrated 71st Republic Day on 26th January 2020. Dr.M.A.Atmanand Director NIOT and Dr.M.V.Ramanamurthy Director NCCR hoisted the national flag and delivered the speech on achievements in the last six months.

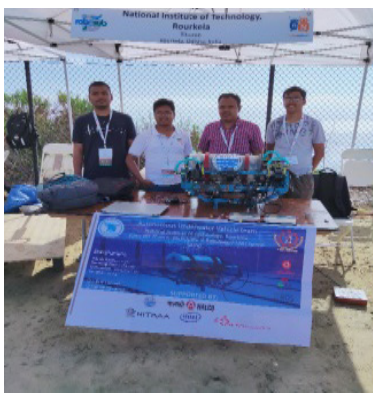
- 'Anti-terrorism Day' on 21st May 2019.
- Mass Yoga Performance on account of 5th International Day of Yoga was organized by NIOT in association with Shiv Darshan Yoga Vidyalaya on 21st June 2019.
- 'Sadbhavana Diwas' on 20th August 2019.
- NIOT observed Vigilance Awareness Week from 28th October to 2nd November 2019 under the theme 'Integrity – A way of life' and many events and special lectures were arranged for the staff members. Integrity Pledge taken by students of DAV, Velachery & St.John's Public School, Jalladianpet on 29th October 2019, in view of Vigilance Awareness Week - 2019.
- 'National unity day' on 31st October 2019.
- 'Constitution day of India' on 26th November 2019.
- 'National Voters day' on 24th January 2020
- 'Martyrs Day' on 30th January 2020.

International Women's day Celebration

International Women's Day was celebrated on March 10, 2020 at NIOT. Mrs.Anitha Atmanand was invited as the Chief Guest. Various competitions were organized and prizes were given.

Student Autonomous Underwater Vehicle (SAVe)

SAVe: NIOT-MoES has sponsored the **Students Autonomous underwater Vehicle** national winning team of IIT Bombay (right) and NIT Rourkela (left) to participate in the International ROBOSUB competition held at San Diego, USA during 29th July 2019 to 4th August 2019. The teams were qualified up to the semi-finals.



ISO Certification

The ISO 9001:2015 surveillance audit for the administrative processes of NIOT was conducted by the external auditors from the accrediting body TÜV SÜD South Asia Pvt Ltd., Chennai and was successfully completed during September 30, 2019. The certification for NIOT as per the ISO 9001:2015 standard is valid till 2021. The change over to the new standard and implementation of the same has been completed.

Visit of Dignitaries

- The French Consul General Ms Catherine Suard visited NIOT on 7th November 2019 and had discussions about Joint Collaborative Program based on the Knowledge Summit-2 that was held in France.
- H.E. Mr. Hans Jacob Frydenlund, Norwegian Ambassador, Mrs. Gina Lund, Special Advisor, Ministry of Education & Research, Dr.Maan Singh Sidhu, Counsellor, Science & Technology visited NIOT on 18th November 2019 and discussed on Oceans, Climate, Energy & Mutual interest of Indo-Norwegian program for future R & D.

- French Maritime Delegation visited NIOT on 28th November 2019 and areas of mutual interest was discussed.
- Seventeen members of European Delegation team lead by Ms. Tania Friederichs visited NIOT on 6th December 2019 and interacted with Director and Senior scientists for bilateral cooperation under Horizon 2020 program.

- Smt. J. Mercykutty Amma, Hon'ble Minister for Fisheries, Harbour Engineering and Cashew Industry, Government of Kerala along with state fisheries departmental officials visited NIOT on 22nd January 2020 and discussed about the possibility of societal projects in Kerala.
- Dr. Sidney Thurston Chair of the WMO/IOC Data Buoy Cooperation Panel (DBCP) Task Team for Capacity Building & member of the DBCP Executive Committee, NOAA's representative to the Indian Ocean Global Ocean Observing System (IOGOOS) visited NIOT on 10th Jan 2020.
- Mr.Serge Segura, First Ocean Ambassador, France visited NIOT along with his team of experts on 6th February 2020, interacted with NIOT scientists and visited facilities.
- Ms Inger Midtkandal, Mr.Niklas Hallgren & Mr.Pankaj Patil from Royal Norwegian Embassy visited NIOT facilities on 24th April, 2019.
- Ms. Thaysa Portela de Carvalho, Project coordinator from University of Turku, Finland visited NIOT facilities on 19th July 2019.
- Twelve German Scientists visited NIOT in connection with the workshop on "Urban Resilience-2: Coastal and River Management, Vulnerability and Sustainability", organized by the Indo-German Center for Sustainability held at IIT Madras, Chennai during 20-22, October 2019.

Silver Jubilee Celebration

NIOT celebrated its Silver Jubilee on 3rd November 2019 at NIOT, Chennai. Hon'ble Vice President of India Shri.M.Venkaiah Naidu, graced the occasion as the Chief Guest and addressed the gathering. He released Coastal Flood Warning System and a special postal cover.

Hon'ble Governor of Tamilnadu Shri Banwarilal Purohit, Hon'ble Union Minister for Science and Technology, Earth Sciences and Health & Family welfare Dr.Harsh Vardhan and Hon'ble Deputy Chief Minister of Tamilnadu, Shri.O.Panneerselvam were the Guests of Honour. Minister for Fisheries, Personnel and Administrative Reforms, Tamilnadu Shri.D.Jayakumar and Minister for Revenue and Disaster Management and Information Technology, Shri.R.B.Udayakumar, also graced the occasion. HMoES Dr.Harsh Vardhan delivered a speech highlighting the achievements of NIOT such as beach restoration, underwater vehicles and tsunami buoys. Secretary MoES Dr.M.Rajeevan welcomed the gathering and conveyed the ocean technological developments along with future missions planned. Students from various schools received prizes from Honorable Vice President of India Shri.Venkaiah Naidu. Prior to the programme, NIOT achievements, projects of societal importance, awards and technology developments have been exhibited to the distinguished invitees by Dr.M.A.Atmanand, Director, NIOT.

As part of Silver Jubilee celebrations an invited conference was held during August 19-20, 2019. Dr.M.Rajeevan, Secretary MoES delivered the presidential address and launched the new website of NIOT. Prof.M.Ravindran Founder Director NIOT shared his memories down the lane from the inception of NIOT and Dr.M.A.Atmanand Director presented the 'Growth of NIOT' highlighting achievements. A coffee table book on NIOT was released. The Former Secretaries Dr.Harsh K. Gupta, Dr.P.S.Goel and Dr.Shailesh Nayak graced the occasion and participated in the panel discussion of 'Future of NIOT'. Distinguished delegates from USA, UK, Japan, France and Singapore presented state of the art work on Ocean technology. Directors from other institutes and many distinguished scientists from various organizations attended the function. Senior scientists/staff were honoured with a memento. All the regular staff of NIOT were presented a memento.

SWACHHATA PAKHWADA

- Swachhata Pakhwada was held during July 1-15, 2019 at NIOT and cleanliness campaign inside and outside the campus were conducted. Awareness and Cleanliness campaign including waste segregation were conducted in Government schools in the neighborhood of NIOT. NIOT staff helped the schools in fixing leaking taps, electrical motors and replacement of defunct taps as part of the campaign. Underwater and coastal cleaning were carried out in Olaikuda (Rameswaram) and Port Blair. Also various competitions were held at NIOT. The valedictory function was held on 17th July 2019 at NIOT and prizes were distributed to the winners.

Swachh Bharat activities at NIOT campus

- Swachhata Hi Seva campaign was observed in NIOT during 11th September - to 2nd October 2019. NIOT team conducted a rally on awareness program by involving college students. Shramdaan was observed by involving all the staff of NIOT in the zone-wise cleaning process in the NIOT premises. Also in order to bring awareness to avoid Single Use Plastic, staff were requested to bring old sarees and cloth bags were stitched and distributed to Self help group women.

- MoES NIOT won first place for Swachhata among all the MoES institutes.

AWARDS

- Dr. Purnima Jalihal, Scientist-G & Group Head, Energy and Freshwater, was awarded **Uehara Prize for the year 2019** by **International OTEC community** for contribution to the development of Ocean Thermal Energy Conversion.
- Dr.R.Venkatesan, Scientist-G & Group Head, Ocean Observation Systems, received the **MTS Fellow Award for 2019 from the President, Marine Technology Society, USA** during the OCEANS 2019 Conference held at Seattle, Washington, USA.
- Mr.D.Narendra Kumar, Project Scientist-II received **"Young Engineers Award"** from **The Institution of Engineers (India)**, during 33rd National Convention of Marine Engineers held on 30th August, 2019 at Cochin, for his contribution and accomplishments in the area of Marine Engineering.
- NIOT received the **Certificate of Award** from **Jan Parivartan Kalyan Samiti Trivandrum** for the contributions of Hindi cell of NIOT towards Glossary of Technical terms and implementation of Hindi.

MoES Award

- The following staff of NIOT received the MoES awards for the year 2018-19 during the Foundation Day of Ministry of Earth Sciences (MoES), held on July 27, 2019 at New Delhi.
- Dr.A.A.Gnanaraj, Scientist-D - **Certificate of Merit** in the field of Ocean Science and Technology
- Shri Y.V.Narasimha Rao, Scientific Officer, Gr.II
- Shri K.Ramasundaram, Scientific Officer, Gr.II
- Smt. N.N.Lavanya, Junior Assistant

} **Best Employee Award**

Patents Granted

Sl. No.	Inventors	Title	Awarded reference	Country
1	Muthuvel.P Sasikala.T Gnanaraj.A.A Deepak.C.R Atmanand.M.A	Portable In-Situ Soil Testing Device	319005 26.08.2019	India
2	Venkatesan R Atmanand M.A Ramasundaram S Arul Muthiah M Vengatesan G Sundar Jesuraj S	An Apparatus and the Functioning of Integrated Marine Surveillance System	322886 16.10.2019	India

Sl. No.	Inventors	Title	Awarded reference	Country
3	Kirubagaran R Josephine A Kumar T.S Vijaya Raghavan R Dharani G Vinithkumar N.V Mary Leema Thilagam J Magesh Peter D	Pharmacoactive nutrient and a process of production thereof from Marine Algae.	EP3403 662 29.01.2020	Europe
4	Mary Leema Thilakam J Magesh Peter D Kumar T.S Thirupathi K Dharani G Kirubagaran R Atmanand M.A	Process for the production of lutein thereof from marine algae.	EP 17172060.0 03.02.2020	Europe

Patents filed

Sl. No.	Inventors	Title	Filed Application no.	Country
1	Harikrishnan G Subramanian A.N Ramadass G.A Atmanand M.A	An electrical power system for a remotely operated vehicle driven underwater	201941020301 22.05.2019	India
2	Muthukrishna Babu S Gnanaraj A.A Muthuvel P Ramesh N.R Amudha K Umapathy A Vishwanath B.O Chandran V Ramadass G.A Atmanand M.A	Deep sea in-situ soil tester	201941039233 27.09.2019	India

PUBLICATIONS

International Journals

1. Aditya Chaudhary, Neeraj Agarwal, Rashmi Sharma, B. K. Jena, Raj Kumar, *"Coastal currents from Jason-2 and SARAL/AltiKa in the Indian region"*, **International Journal of Remote Sensing,** Taylor and Francis, Vol.40 (20) pp. 7767-7783, April 2019.

2. K.N. Navaneeth, M.V. Martin, K.Jossia Joseph, R. Venkatesan, *"Contrasting the upper ocean response to two intense cyclones in the Bay of Bengal"*, **Deep Sea Research Part I: Oceanographic Research Papers,** Vol.147, pp. 65-78, May 2019.

3. Levin Lisa A., Bett Brian J., Gates Andrew R., Heimbach Patrick, Howe Bruce M., Janssen Felix, McCurdy Andrea, Ruhl Henry A., Snelgrove Paul, Stocks Karen I., Bailey David, Baumann-Pickering Simone, Beaverson Chris, Benfield Mark C., Booth David J., Carreiro-Silva Marina, Colaço Ana, Eblé Marie C., Fowler Ashley M., Gjerde Kristina M., Jones Daniel O. B., Katsumata K., Kelley Deborah, Le Bris Nadine, Leonardi Alan P., Lejzerowicz Franck, Macreadie Peter I., McLean Dianne, Meitz Fred, Morato Telmo, Netburn Amanda, Pawlowski Jan, Smith Craig R., Sun Song, Uchida Hiroshi, Vardaro Michael F., Venkatesan R., Weller Robert A. (2019) *"Global Observing Needs in the Deep Ocean"*, ***Frontiers in Marine Science***, Vol. 6, pp.241–250, May 2019.

4. Sarah K. Dailey, Peter D. Clift, Denise K. Kulhanek, Jerzy Blusztajn, Claire M. Routledge, Gérôme Calvès, Paul O'Sullivan, Tara N. Jonell, Dhananjai K. Pandey, Sergio Andò, Giovanni Coletti, Peng Zhou, Yuting Li, Nikki E. Neubeck, James A.P. Bendle, Sophia Aharonovich, Elizabeth M. Griffith, Gundiga P. Gurumurthy, Annette Hahn, Masao Iwai, Boo-KeunKhim, Anil Kumar, A. Ganesh Kumar, Hannah M. Liddy, Huayu Lu, Mitchell W. Lyle, Ravi Mishra, Tallavajhala Radhakrishna, Rajeev Saraswat, Rakesh Saxena, Giancarlo Scardia, Girish K. Sharma, Arun D. Singh, Stephan Steinke, Kenta Suzuki, Lisa Tauxe, Manish Tiwari, ZhaokaiXu, Zhaojie Yu, *"Large-scale mass wasting on the Miocene continental margin of western India"*, **Geological Society of America Bulletin**, Vol.132(1-2),pp.85–112, May 2019.

5. Dipanjan Chaudhuri; Debasis Sengupta; Eric D Asaro, R. Venkatesan, M. Ravichandran., *"Response of the salinity-stratified Bay of Bengal to cyclone Phailin"*, **The Journal of Physical Oceanography**, Vol. 49(5), pp.1121-1140, May 2019.

6. Dilip Kumar Jha, Krupa Ratnam, S. Rajaguru, G. Dharani, M. Prashanthi Devi, R. Kirubagaran, *"Evaluation of trace metals quality in seawater and sediments of Nellore, southeast coast of India, by using multivariate and ecological tool"*, **Marine Pollution Bulletin**, Vol.146, pp.1-10, June 2019.

7. Hermes J. C., Masumoto Y., Beal L. M., Roxy M. K., Vialard J., Andres M., Annamalai H., Behera S., D'Adamo N., Doi T., Feng M., Han W., Hardman-Mountford N., Hendon H., Hood R., Kido S., Lee C., Lee T., Lengaigne M., Li J., Lumpkin R., Navaneeth K. N., Milligan B., McPhaden M. J., Ravichandran M., Shinoda T., Singh A., Sloyan B., Strutton P. G., Subramanian A. C., Thurston S., Tozuka T., Ummenhofer C. C., Unnikrishnan A. S., Venkatesan R., Wang D., Wiggert J., Yu L., Yu W.,*"A Sustained Ocean Observing System in the Indian Ocean for Climate Related Scientific Knowledge and Societal Needs"*, **Frontiers in Marine Science,** Vol. 6, pp.355, June 2019.

8. Chatragadda Ramesh, Nambali Valsalan Vinithkumar, Ramalingam Kirubagaran, Chidambaram Kulandaisamy Venil, Laurent Dufossé, *"Multifaceted Applications of Microbial Pigments: Current Knowledge, Challenges and Future Directions for Public Health Implications"*, **Microorganisms,** Vol.7(7), 186, June2019.

9. Chatragadda Ramesh, Nambali Valsalan Vinithkumar, Ramlingam Kirubagaran, *"Marine Pigmented Bacteria: A prospective source of Antibacterial Compounds"*, **Journal of Natural Science, Biology and Medicine,** Vol.10(2), pp.104-113, July 2019.

10. Meena, B., Anburajan, L., Sathish, T., Apurba Kumar Das, Vinithkumar, N. V., Kirubagaran, R, Dharani, G, *"Studies on diversity of Vibrio sp. and prevalence of hapA, tcpI, st, rtxA&C, acfB, hlyA, ctxA, ompU and toxR genes in environmental strains of Vibrio cholerae from Port Blair bays of South Andaman, India"*, **Marine Pollution Bulletin**, Vol.144,pp.105-116, July2019.

11. T. Muhammed Naseef, V. Sanil Kumar, Jossia Joseph, B. K. Jena, *"Uncertainties of the 50 year wave height estimation using generalized extreme value and generalized Pareto distributions in the Indian Shelf seas"*, **Natural Hazards, Springer Nature B.V. 2019,** Vol. 97 (3), pp.1231-1251, July 2019.

12. Meena, B., Anburajan, L., Vinithkumar, N. V., Kirubagaran, R.,Dharani, G, *"Biodiversity and antibacterial potential of cultivable halophilicactino bacteria from the deep sea sediments of active volcanic Barren Island",* **Microbial Pathogenesis,** Vol.132, pp.129-136, July2019.

13. Priyanka S, Kirubagaran. R., Mary Leema J.T, *"Statistical Optimization of BG-11 Medium For Enhanced Zeaxanthin Productivity In Synechococcus marinus (NIOT-208)",* **International Journal of Pharma and Bio Sciences**, Vol.10(3) pp.58-70, July-September 2019.

14. S.Shanmugapriya, S.Ramesh, G.A.Ramadass, *"Retrieval of water quality parameters of South Andaman coral Islands using remotely operated Underwater vehicle"*, **Water Science,** Vol.33 (1), pp.105-117, September 2019.

15. Venkatesan R, M Arul Muthiah, G Vengatesan, B Kesavakumar, N Vedachalam, *"Best Practices for Increasing Data Return: Case Study From Indian Ocean Observation Network"*, **Marine Technology Society,** Vol.53 (5), pp.30-42, September 2019.

16. Ganesh Kumar, Nivedha Rajan, .Kirubagaran, G. Dharani, *"Biodegradation of crude oil using self-immobilized hydrocarbonoclastic deep sea bacterial consortium",* **Marine Pollution Bulletein,** Vol.146, pp.741-750, September 2019.

17. Anburajan, L., Meena, B., N.V. Vinithkumar, R. Kirubagaran, G. Dharani, *"Functional characterization of a major compatible solute in Deep Sea halophilic eubacteria of active volcanic Barren Island, Andaman and Nicobar Islands, India"*, **Infection, Genetics, and Evolution**, Vol.73, pp.261-265, September 2019.

18. Jayappriyan Kothilmozhian Ranishree, Sathish Tadikamalla, Baskar Balakrishnan, Dheenan Palaiya Sukumaran, Vinithkumar Nambali Valsalan, Dharani Gopal, Kirubagaran Ramalingam, *"Occurrence of euryhaline Dunaliellasalina in Andaman & Nicobar Islands: Assessment and Optimization of its Total Carotenoid by Orthogonal Array Design",* **Journal of Pure and Applied Microbiology,** Vol.13(3), pp.1363-1374, September 2019.

19. Srinivasan R, Rajendran V, Shijo Zacharia, Tata Sudhakar, 2019, *"A study of Ocean parameters in Bay of Bengal (BoB) using Indigenized drifting buoys"*, **International Journal of Earth System Science,**Vol.128, pp.196, October 2019.

20. Jebarathanam Prince PrakashJeba Kumar, Bose Rajan Babua, Ganesan Nandhagopal, Shunmugavel Ragumaran, Chokalingam Muthiah Ramakritinan, Vijaya Ravichandran, *"In vitro synthesis of bio-brick using locally isolated marine ureolytic bacteria, a comparison with natural calcareous rock"*, **Ecological Engineering,**Vol.138, pp.97-105, November 2019.

21. Venkatesan R, N Vedachalam, K Jossia Joseph, G Vengatesan, *"Data returns and reliability metrics from the Indian deep-ocean wave measurement buoys"*, **Marine Technology Society,** Vol.53(6), pp. 6-20, November/December 2019.

22. Satheeswaran, T, Yuvaraj, P., Damotharan, P., Karthikeyan,V., Dilip Kumar Jha, Dharani, G., Balasubramanian, T., Kirubagaran, R., *"Assessment of trace metal contamination in the marine sediment, seawater, and bivalves of Parangipettai, southeast coast of India"*, **Marine Pollution Bulletin**, Vol.149, 110499, December 2019.

23. Anburajan, L., Meena, B., Sreelatha, T., Vinithkumar, N. V., Kirubagaran, R.,Dharani, G, *"Ectoine biosynthesis genes from the deep sea halophilic eubacteria, Bacillus clausii NIOT-DSB04: Its molecular and biochemical characterization"*, **Microbial Pathogenesis,** Vol.136, 103693, November 2019.

24. Samiran Mandal, SouravSil, Saikat Pramanik, KS Arunraj, Basanta Kumar Jena, *"Characteristics and evolution of a coastal mesoscale eddy in the Western Bay of Bengal monitored by high-frequency radars"*, **Dynamics of Atmospheres and Oceans,** Vol. 88, pp.101107, December 2019.

25. Sankara Subramanian SH, Balachandran KRS, Rangamaran VR, Gopal D. *"RemeDB: Tool for Rapid Prediction of Enzymes Involved in Bioremediation from High-Throughput Metagenome Data Sets"*, **Journal of Computational Biology**, Vol. 27 (7), December 2019.

26. Nandhagopal G, Prince Prakash Jebakumar J, Rajan Babu B, Ragumaran S, Ramakritinan C.M, Sivaleela G, Rajkumar Rajan R, *"Artificial Coastal Defence Structure as a survival tool for the shallow water Sponges"*, **Continental Shelf Research**, Vol.193, 104032, ISSN 0278-4343, January,2020.

27. Samiran Mandal, SouravSil, Avijit Gangopadhyay, Basanta Kumar Jena, Ramasamy Venkatesan, *"On the nature of tidal asymmetry in the Gulf of Khambhat, Arabian Sea using HF radar surface currents"*, **Estuarine, Coastal and Shelf Science**, Vol.232(5), pp.106481, January 2020.

28. Martin M V, Venkatesan R, Beyline M, Limna Mol V.P, Divya L *"Influence of environmental factors on macrofoulant assemblages on moored buoys in the eastern Arabian Sea"*, **PLoS ONE**, Vol.15(1), January 2020.

29. Simi Mathew, Latha G and R. Venkatesan, *"Latent heat flux variation during the warming phase of intraseasonal oscillations over northern Bay of Bengal"*, **Journal of Earth System Science,** 129, 70, February 2020.

30. Kranthikumar Chanda, Shubham Shet, Bishwajit Chakraborty, Arvind K Saran, William Fernandes, G.Latha, *"Fish Sound Characterization Using Multifractal Detrended Fluctuation Analysis"*, **Fluctuation and noise letters,** Vol 19(1), February 2020.

31. Narayanaswamy Vedachalam, Raju Ramesh, Vandavasi Bala Naga Jyothi, Vittal Doss Prakash, Gidugu Ananda Ramadass, Malayath Aravindakshan Atmanand *"Design considerations for strategic autonomous underwater swarm robotic systems"*, **Marine Technology Society Journal**, Vol.54(2), pp:25-34, March 2020.

National Journals

1. Padmanaban, V.P., Verma, P., Gopal, D., Sekar, A.K., Kirubagaran R., *"Phylogenetic identification and metabolic potential of bacteria isolated from deep sea sediments of Bay of Bengal and Andaman Sea"*, **Indian Journal of Experimental Biology,** Vol.57(8), pp. 561-572, August 2019.

2. M.A.Atmanand, S.Ramesh, *"Institutional Report, National Institute of Ocean Technology"*, **Indian National Science Academy,** Vol. 86 (1), pp. 689-696, March 2020

The Cumulative Impact Factor for the year 2019-20 is 92.2

The NIOT H-Index for the year 2019-20 is 5.

Book Chapter

1. Purnima Jalihal, R. Venkatesan (formerly in NCAER), *"Advanced desalination technologies"*, Book Chapter - **Sustainable Water and Waste water processing, Elsevier**, pp.91-131,2019.

2. Purnima Jalihal, *"Emerging Technologies for sustainable Desalination Handbook- VG Gude"*, Book review **Current Science**, Vol.117(11), December 2019.

3. M. Kamalakannan, M. Kalyani, V. Prabhakar, Basanta Kumar Jena and R. Venkatesan, *"Assessment of Nonlinear Quadruplet Interactions for Measured Spectra in Deep Waters on the East Coast of India through Gauss–Legendre Quadrature Method"*, Book Chapter in **Lecture Notes in Civil Engineering**", Vol.1, pp.795-812, 2019.

PAPERS PRESENTED IN CONFERENCES

International Conferences

1. Janarthanan C, V.Chandran, V.Sundaramoorthi, B.O.Vishwanath, S.Rajesh, P.Muthuvel, N.R.Ramesh, Gopakumar K, G.A.Ramadass, M.A.Atmanand, *"System Preparations for Deep Water Locomotion Trials of Deep Sea Mining Crawler"*, **The 29th International Society of Offshore and Polar Engineering Conference,** Honolulu, Hawaii, USA, June 16-21, 2019.

2. D Rajasekhar, D Narendrakumar, P S Deepak Sankar, Anantha Krishna, *"Innovative Engineering Solution for Reducing NOx/SOx Emission from Ships - Non Thermal Plasma Technique"*, **Global Maritime Seminar GLOMARS-2019**, pp. 104-109, August 16-17, 2019.

3. D Rajasekhar, D Narendrakumar, P S Deepak Sankar, Anantha Krishna, *"Design of Polar Research Vessel – Challenges"*, **Global Maritime Seminar GLOMARS-2019**, pp. 76-80, August 16-17, 2019.

4. Santhi Sree B, Gowri Sankar S., Srinivasan R, Raghavender N, Chandrasekaran D, Vinod M botahle, *"A case study of space borne thermal data validation using natural targets and artificial targets"* is presented and published in the proceedings of 2019 IEEE Recent Advances in Geoscience and Remote Sensing **Technologies Standards and Applications Conference (TENGARSS 19'),** held at Cochin, Kerala, October 17-20, 2019.

5. Uma Kumari, Dhanalakshmi Samiappan, R.Kumar, Tata Sudhakar, *"Development of a highly accurate and fast responsive salinity sensor based on Nuttallapodized Fiber Bragg Grating coated with hygroscopic polymer for ocean observation"* is presented in **International conference in Optical Fiber Technology,** October 2019.

6. Uma Kumari, Dhanalakshmi Samiappan, R.Kumar, Tata Sudhakar, *"Optical Sensor based on Acrylate Coated Apodized Fiber Bragg Grating for Sea Surface Temperature Monitoring"* **International Conference on optics-electro optics,** October 2019.

7. Shanmuga Priyaa S, Basanta Kumar Jena, Rajkumar J, *"Bathymetry retrieval from Sentinel-2 Multispectral images for south Kerala coast"*, **MARINCO International Conference 2019** held at IMU Chennai, November 4-5, 2019.

8. Shanmuga Priyaa S, Basanta Kumar Jena, *"Seasonal pattern of suspended sediments along Karaikal coast using satellite images"*, **MARINCO International Conference 2019** held at IMU Chennai, November 4-5, 2019.

9. Ashwani Vishwanath, Purnima Jalihal, Abhijeet Sajjan, *"Studies on Spar configurations for offshore desalination"*, **First Maritime International Conference (MARINCO-2019)**, IMU Chennai, November 4-5, 2019.

10. M.P. Sudhakar, *"Extraction of polymers and optimization of bioplastic film development from red seaweeds"*, **International Conference on Recent Trends in Bioplastics (RTB -2019)** at Alagappa University, Karaikudi, December 9-12, 2019.

11. Karthikeyan A, Anand Mani, Narasimha Rao Y V, Ajai Babu, Biren Pattanaik, Prasad Dudhgaonkar, Purnima Jalihal, *"Experiment Study on Laboratory scale Open Cycle OTEC power module'',* **International Conference on Advances in Energy Research (ICAER 2019)**, IIT Bombay, December 10-12, 2019.

12. Gautam Maurya, Tapas Das, Prasad Dudhgaonkar, Abdus Samad, *"Effect of Guide Vane Fillets on Wave Energy Harvesting Impulse Turbine"*, **ASME 2019 Gas Turbine India, GT India 2019,** Chennai, India, December 5-6, 2019.

13. R. Kokila, K. Chithra, R. Dhilsha, *"Wideband Beamforming Using Modified Farrow Structure FIR Filtering Method for Sonar Applications"*, **SYMPOL 2019,** CUSAT, Cochin, December 11 – 13, 2019.

14. Nitin Singh Rajput, S.B. Pranesh, D. Sathia Narayanan, G.A.Ramadass, *"Acrylic Spherical Pressure Hull for Manned Submersible"*, **International Mechanical Engineering Congress (IMEC) 2019,** NIT Trichy, November 29 – December 1, 2019.

15. Nitin Singh Rajput, S.B. Pranesh, D. Sathia Narayanan, G.A.Ramadass, *"Plastic General Instability Analysis of Deep Sea Water Pressure Casing"*, **SYMPOL 2019,** CUSAT, Cochin, December 11-13, 2019.

16. Srinivasan R, Sathyanarayanan S, Tata Sudhakar, Atmanand. M. A. *"First attempt in implementing the IRNSS based navigational satellite receivers in ocean observation platforms",* **The International Symposium on Ocean Technology (SYMPOL 2019)** held at CUSAT, Cochin, December 11-13, 2019.

17. Ashwani Vishwanath, Purnima Jalihal, *"Nonlinear analysis of mooring system for an offshore desalination platform"*. **7th International Congress on Computational Mechanics and Simulation (ICCMS 2019),** IIT Mandi, December 11-13, 2019.

18. D Rajasekhar, D Narendrakumar, P S Deepak Sankar, Anantha Krishna, *"Study of Efficiency, Performance and Reliability of ORV Sagar Nidhi using Genetic Algorithm"*, **International Conference on Coastal and Inland Water Systems, CIS 2019,** pp. 44, December 16-17, 2019.

19. D Rajasekhar, D Narendrakumar, P S Deepak Sankar, Anantha Krishna Rao, *"Nano fuel additives: An innovative Technology for Ship Emission Reduction"'*, **International Conference on Coastal and Inland Water Systems, CIS 2019,** pp. 43, December 16-17, 2019.

20. D Sathish Kumar, B K Jena, Usha Natesan, *"Response of Beach to Pre and Post Storm Conditions along North East Coast of Tamil Nadu",* Proceedings of **AdCoRe IP 2019** NCCR, NIOT Chennai, December 17-19, 2019.

21. Lokesh T, Sankar S, Kiran A S, Abhishek Tavva, Vijaya Ravichandran, Ramanamurthy M V, *"Beach sediment volume estimation using RTK GPS survey and its application"*, Proceedings of **AdCoRe IP 2019,** NCCR, NIOT Chennai, December 17-19, 2019.

22. M G Muni Reddy, D Hari Prasad, A Arun Kumar, Basanta Kumar Jena, *"Coastal Processes along the Visakhapatnam Coast",* Proceedings of **AdCoRe IP 2019** NCCR, NIOT Chennai, December 17-19, 2019.

23. Sankar S, Lokesh T, Kiran A S, Abhishek Tavva, Vijaya Ravichandran, Ramanamurthy M V. *"Coastal morphological evolution of Kadalur Periyakuppam, Tamilnadu using Satellite Remote sensing studies",* Proceedings of **AdCoRe IP 2019,** NCCR, NIOT Chennai, December 17-19, 2019. **Received Best Poster Award.**

24. Shanmuga Priyaa S, Basanta Kumar Jena, *"The impact of total suspended sediments concentration on shoreline along south Kerala coast using satellite images",* Proceedings of **AdCoRe IP 2019,** NCCR, NIOT Chennai, December 17-19, 2019.

25. Kalyani M, K Jossia Joseph, R Venkatesan, B K Jena, *"How far sea and swell separation conforms to constant frequeny? Verification through measure mixed spectra in coastal waters off Chennai"*, **AdCoRe IP-2019**, NCCR, NIOT Chennai, December 17- 19, 2019.

26. Reddy Janakiram, R Janani, R Keerthivasan, K Jossia Joseph, R Venkatesan, *"Inter-Comparison and validation of numerical model results of WW3 and WAM with coastal buoy data off Chennai"*, **AdCoRe IP-2019,** NCCR, NIOT Chennai, December 17- 19, 2019.

27. Keerthivasan R, Reddy Janakiram, R Janani, K Jossia Joseph, R Venkatesan, *"Seasonal Variability of Sedimentation along the East Coast of India Using Numerical Model and Moored Buoy Observations"*, **AdCoRe IP-2019,** NCCR, NIOT Chennai, December 17- 19, 2019.

28. Janani R, R Keerthivasan, Reddy Janakiram, K Jossia Joseph, R Venkatesan, *"Analysis of Wave Characteristics off Chennai Using Moored Buoy Data"*, **AdCoRe IP-2019**, NCCR, NIOT Chennai, December 17- 19, 2019.

29. Nasiha J, Sanjana M.C, Latha G, *"Low frequency ocean sound level increase in long-term monitoring of south west Bay of Bengal,"* **AdCore IP -2019,** NCCR, NIOT Chennai, December 17-19, 2019.

30. J. Santhanakumar, C. Sureshkumar, Dilip Kumar Jha, G. Rajaprabhu, P. Venkateswaran, R. Sendhil Kumar, G. Dharani, R. Kirubagaran. *"Study on fish aggregation around open sea cages deployed near Olaikuda off Rameshwaram, Pamban Island, India"***, AdCoRe IP-2019,** NCCR, NIOT Chennai, December 17-19, 2019.

31. K. Sujitha, A. Ganesh kumar, G. Dharani,*"Isolation and characterization of polyaromatic hydrocarbon degrading marine yeast Candida spencer martinsiae isolated from the Bay of Bengal"*,**AdCoRe IP-2019**, NCCR, NIOT Chennai, December 17-19, 2019.

32. D. Manisha, A. Ganesh kumar and G. Dharani, *"Degradation of phenanthrene by marine-derived Aspergillus versicolor NIOT"*,**AdCoRe IP-2019,** NCCR, NIOT Chennai, December 17-19, 2019.

33. Sivakumar K., Verma P., Gopal D, *"Bioproduction and Characterization of Melanin from Deep Sea Yeast Associated with Arabian Sea Sediment"*, **AdCoRe IP-2019**, NCCR , NIOT Chennai, December 17-19, 2019.

34. Jaiswal R., Sivakumar K., Verma P., Gopal D, *"Potent antimicrobial activity by new Streptomyces sp. N129A28 associated with deep Arabian Sea sediment"*, **AdCoRe IP-2019,** NCCR , NIOT Chennai, December 17-19, 2019.

35. Singh M., Metri A.M., Verma P, Gopal D, *"A search for Quorum sensing Inhibitors from Indian Ocean and Arabian Sea"*, **AdCoRe IP-2019**, NCCR, NIOT Chennai, December 17-19, 2019.

36. Teppala Vikranth, Rama Krishna. SSVS, Srinivasan. R and Tata Sudhakar, *"A study on RIP currents behavior in coastal Andhra Pradesh with real time surface drifter"*, poster is presented **AdCoRe IP-2019,** NIOT Chennai, December 17-19, 2019, NCCR, NIOT Chennai, December 17-19, 2019.

37. K. Jossia Joseph, Amit Tandon, R. Venkatesan, Thomas J. Farrar, Robert A. Weller, *"Long Wave Measurement Corrections for the OMNI Buoy Network"*, **Ocean Science Meeting** at San Diego, USA, February 16 – 21, 2020.

38. Biren Pattanaik, *"Wave Powered Navigational Buoy Electrical Power Assessment during Open sea trial"*, **International Conference on Power Electronics and IoT application in Renewable Energy and Its Control at GLA University**, Mathura, UP, February 28-29. 2020.

39. K. Jossia Joseph, R. Venkatesan, G. Latha, *"Analysis of Wave Climate in Northern Bay of Bengal using Deep Ocean Wave Measurements"*, **International Indian Ocean Science Conference (IIOSC),** NIO Goa, March 16-20, 2020.

40. M. Kalyani, K. Jossia Joseph, K. N. Navneeth, G. Latha, R. Venkatesan, P. G. Remya, T. M. Balakrishna Nair, *"Role of OMNI Buoys in Improving the Indian Ocean State Forecast-A Case Study in Bay of Bengal during Northeast Monsoon"*, **International Indian Ocean Science Conference (IIOSC),** NIO Goa, March 16-20, 2020.

41. Anoopa Prasad C, Martin V Mathew, K N Navaneeth, K Jossia Joseph, R Venkatesan, *"Intense upwelling in the southeastern Arabian Sea during monsoon transition",* **International Indian Ocean Science Conference (IIOSC),** NIO Goa, March 16-20, 2020.

National Conferences

1. G. Dharani, *"Open Sea Cage Culture Prospects And Challenges - Indian Scenario"*, **Conference on Asian Pacific Aquaculture conference at Chennai Trade Centre,** during June19-21, 2019.

2. N. V. VinithKumar, *"Challenges and prospects of seaweed farming in Andaman Islands"*, **Conference on Asian Pacific Aquaculture conference at Chennai Trade Centre,** during June19-21, 2019.

3. Biren Pattanaik, *"Research activities on Ocean Energy and Fresh Water Technology"*, **Odisha Young Scientists Award 2018 to give presentation at Bhubaneswar,** August 12, 2019.

4. Nasiha J, Sanjana M C, Latha G, *"Clustering Analysis of Polar Ocean Acoustic data*", poster presented at **National Conference on Ocean Sciences NCPS 2019,** NCPOR, Goa, August 21–22, 2019.

5. Bolem Srinivas, *"Encrypted transmission of Oceanographic data: challenges and opportunities",* **OSICON - 19 Indian Ocean processes and resource - A Key to Blue Economy at CMLRE,** Cochin, December 12-14, 2019.

6. Shanmuga Priyaa S, Basanta Kumar Jena, Sundararajan S, M V Ramana Murthy, *"Estimation of Suspended Sediments and Turbidity along south Kerala coast using Satellite Images",* **OSICON 2019** held at CMLRE, Cochin, December 12-14, 2019.

7. Subhashree Sahu, J Rajkumar, Vishal Jain, B. K. Jena, *"Surface currents and wave measurement during cyclone Titli"*, **OSICON 2019** at CMLRE, Cochin, December 12-14, 2019.

8. Sundararajan S, Basanta Kumara Jena, Khadanga M.K, Karthikeyan R, Kamalakannan B, Asim Amitav Pattanayak, *"Seasonal and Spatial Variation of Physicochemical Parameters of a Tropical Estuary, Tapi, west coast of India"*, **OSICON 2019** at CMLRE, Cochin, December 12-14, 2019.

9. Kalyani M , Winfred Marshall, K Jossia Joseph, R Venkatesan, *"Seasonal and cyclonic wind- wave relationship in northern Bay of Bengal from measured OMNI buoy data",* **OSICON 2019**, at CMLRE, Cochin, December 12-14, 2019.

10. Anoopa Prasad C, P V Hareesh Kumar, K Jossia Joseph, R Venkatesan, *"Long-term response of salinity in the upper layers of Bay of Bengal to climatic events",* **OSICON 2019,** at CMLRE, Cochin, December 12-14, 2019.

11. Martin V.M, K.N.Navaneeth, C.Anoopa Prasad, K.Jossia Joseph, R.Venkatesan, *"Interannual variability of thermocline depth in the eastern Bay of Bengal and its implications to winter chlorophyll-a bloom"*, **OSICON 2019,** CMLRE, Cochin, December 12-14, 2019.

12. Navaneeth K N, Martin V Mathew, C Anoopa Prasad, K Jossia Joseph, R Venkatesan *"Observations of Cyclone Driven Intensification of Mesoscale Eddy in the Bay of Bengal"*, **OSICON 2019**, CMLRE, Cochin, December 12-14, 2019.

13. Noufal K.K, Latha G, Ramesh R, *"Acoustic signal spread due to internal wave sound speed fluctuation in the shallow waters of North West Bay of Bengal,"* **Proceedings in Sixth Biennial Conference of Ocean Society of India, OSICON-2019,** Indian Ocean Processes and Resources-A Key to Blue Economy, pp: 309-310, CMLRE, Cochin. December 12-14, 2019.

14. Bolem Srinivas, *"Design and Uncertainty analysis of operational flood inundation modeling and probabilistic forecast for urban regions and cities"*, **National Conference on Challenges in Earth System Science for Global Sustainability (CESS -GS)** at IIT, Kharagpur, January 15-17, 2020.

15. N. V. Vinith Kumar, *"Seaweed Biodiversity and Culture Prospects in Andaman Islands"*, **Conference on Third India International Seaweed Expo & Summit** at NIOT, January 30-31, 2020.

16. Basanta Kumar Jena, Rajkumar J, *"Operational Strategy to Monitor Coastal Erosion along Indian Coast"*, **National Conference on Coastal Ocean – Atmosphere Science & Technology (COAST 2020)**, Marine Science Department, Berhampur University, 28 February to 1 March 2020.

17. Subhashree Sahu, Rajkumar J, Basanta Kumar Jena, *"Wave and Surface current measured during cyclone Titli"*, Poster Presentation in the **National Conference on Coastal Ocean – Atmosphere Science & Technology (COAST 2020)**, conducted by Marine Science Department, Berhampur University, February 28 - March 1, 2020.

18. Madan M M, Sanjana M C, Latha G, *"Estimating wind speed using passive acoustic measurements during cyclonic events in shallow waters of BoB"*, presented at **National Conference on Coastal Ocean-Atmosphere Science & Technology (COAST 2020),** conducted by Marine Science Department, Berhampur University, Odisha, February 28 - March 1, 2020.

19. A.Thirunavukkarasu, *"Fiber metal Laminates for the subsea housing applications"*, **6th Asian Conference on Heat Treatment Surface Engineering at Chennai Trade centre,** Chennai, March 5-7, 2020.

INVITED TALKS

Dr. M.A.Atmanand

- "Blue Economy – India's strides" in the OSICON 2019 conference at Cochin on 12th December 2019.
- "Technologies for Blue Economy" in the SYMPOL 2019 conference at Cochin University on 12th December 2019.
- "India's initiatives to tackle plastics pollution" in the "INDO-UK Workshop on Marine Litter" organized by UK Science & Innovation Network and National Centre for Coastal Research, Chennai on 14th October 2019.
- "Experiences with shore protection at Kadalur Periyakuppam and Pondicherry beach restoration" in the "Urban Resilience-2: Coastal and River Management, Vulnerability and Sustainability" conference organized by Indo-German Centre for Sustainability (IGCS) at IIT Madras, 21st October 2019.

Dr. Purnima Jalihal

- "Ocean Thermal Desalination - Challenges and way forward", Technology Day lecture, CSIR-CSMCRI - Bhavnagar, 27th May 2019.
- "Desalination- Technical challenges and road ahead", IISc, Interdisciplinary Centre for Water Research (ICWAR), Seminar Series, 29th May 2019.
- "Sustainable Technologies for Harnessing Energy and Water from the Oceans", National Institute of Advanced Studies (NIAS), 27th August 2019.
- "Sustainable Technologies for Harnessing Energy from the Ocean", IORA Blue Economy Conference, 4th September 2019.
- "समुद्र से ऊर्जा एवं शुद्ध जल की प्राप्ति हेतु नवीकरणीय प्रोद्योगिकी", SERC- CSIR, Hindi fortnight Valedictory Function, Chief Guest speech, 23rd September 2019.
- "Ocean Energy and Water for Blue Economy", Indo-Portugal Workshop, NCPOR, 26th September 2019.
- "Energy and Water from the Oceans- Environmentally Friendly Technologies", IIT-Tirupati, 14thNovember 2019.
- "Future of Indian Desalination Industry and Role of HDPE Pipes", SPE Conference, Mumbai, 22nd November 2019.
- "Water stress- Can the Oceans Provide a Solution", CIS – 2019, Bhubaneswar, 16th December 2019.

Dr.R.Venkatesan

- "Air-sea interactions in Bay of Bengal" in the Indo-US workshop, Space Application Centre, Ahmedabad during January 26 -28, 2020.
- "GOOS Regional Alliances" as a Chair of GRA at the Regional Planning Workshop for the Northern/ Central Indian Ocean countries towards the UN Decade of Ocean Science for Sustainable Development (2021-2030) at NIOT during 08 -10 January 2020.

- "Data Interoperability on ocean best practices", in the Regional Framework for Coastal Vulnerability towards the Safety, Security & Sustainable Development of Member States in the Indian Ocean at NIOT on 06 - 07 Janaury 2020.
- "Recent Advancements in Ocean Technology in India - Societal Benefits", University of Massachusetts, Amherst, USA, 15th November 2019.
- "Two Decades of Ocean Observations in India-Ocean Science reaching Society", University of Massachusetts, Dartmouth, USA on 22nd November 2019.

Dr.Dhilsha Rajapan

- "Underwater sensors and Ocean Instrumentation" during an International Conference, ECE Department at Loyola College, Chennai on 22nd January 2020.

Shri. D.Rajasekhar

- "Evolving Era of Green Ship Technology for Ocean Exploration" conducted by IME(I), at Andhra University, Visakhapatnam, 4th March, 2020.
- "Design, Construction & Operation of Marine Vehicles, platforms, systems & technologies for sustainable development" in the Second International Symposium on Marine Design & Construction [SMDC 2019], at IMU, Vishakhapatnam, 5th December, 2019.

Dr.G.Latha

- "Underwater acoustic transducer calibration-An Indian facility with International standards", JAMSTEC, Yokohama, Japan on 19th November 2019.
- "Soundscape monitoring in Indian and polar waters", at the 6th Annual meeting of the Society of Bioacoustics, held at Tsukuba Japan on 21st November 2019.
- "Acoustical oceanography – Indian scenario and future endeavors", in the 6th Biennial Conference OSICON-19 on 'Indian ocean processes and resources- a key to blue economy during 12-14, December 2019, Cochin.
- Panelist in the session "Practical examples of ocean and polar research cooperation" in Indo-Norwegian seminar on cooperation in Ocean, Climate and Polar research, education and technology held at IIT Madras, February 5-6, 2020.

Dr. Basanta Kumar Jena

- "Hydrographic survey and methodology" at IIT Mumbai, 3rd April 2019.
- "Coastal Resilience: Developing New and Innovative Approaches in India and Bangladesh along the Bay of Bengal Component 1: Improving empirical evidence and analytical support to future investments", Kick-off Workshop India 17th July 2019 at NIOT Chennai.
- "Engineering investigation for design of coastal reservoir - a case study at the gulf of Khambhat" in the International Workshop Coastal reservoirs: a sustainable solution to water scarcity, at Andhra University, 27-28, August 2019.

INTERNATIONAL COLLABORATION

- A Memorandum of Understanding has been signed by Dr. M.A.Atmanand, Director - NIOT and Mr. Rostislav Atkov, Deputy Director General, Krylov State Research Center, Russia in the presence of Dr. M. Rajeevan, Secretary, MoES and Mr. Oleg Ryazantsev, Deputy Minister of Industry and Trade, Russian Federation in the areas of Deep Sea Technologies at MoES, New Delhi on 26th July 2019.

- Under the Indo-US collaboration, a joint meeting spearheaded by Dr.M.A.Atmanand Director NIOT and Dr.M.V.Ramanamurthy Director NCCR, to discuss Science Plan on Arabian Sea studies, was organized and conducted at NIOT Chennai on 30th January 2020. The experts from the USA Dr. Scott Harper NOAA, Prof. Lou St. Laurent, ONR, Prof Amit Tandon UMAS, and Dr. Craig Lee participated in the meeting apart from experts from Indian institutes.

- Ms. Anne Line Wold Director General, Ministry of Research and Higher education Norway visited NIOT along Norwegian delegates on 6th Feb 2020 and signed a tripartite MoU between NTNU Norway, NIOT and NCPOR.

- International collaborative research works were undertaken with NOAA/PMEL-USA, WHOI-USA, and University of Massachusetts-USA. Discussions on topics such as air-sea fluxes, validation of ECMWF numerical model data sets, long term variability in thermohaline characteristics, inter-comparison of sensors/systems etc. are carried out with respective collaborators. These eminent scientists also delivered invited talks at NIOT during their visits.

- As part of co-operation with OceanSITES, the global ocean observational network, which aims to collect multidisciplinary data worldwide from the full depth water column, two moored buoys, one in Arabian Sea and the other in Bay of Bengal are identified as OceanSITES. The moored buoy in Arabian sea AD07 mooring (15N,69E) was successfully augmented with additional sensors up to 4000m water depth.

- Under Indo-UK collaborative work, NIOT is one of the consortium partners in the collaborative project (Flow Turb) on Ocean tidal turbines, with University of Edinburgh.

- NIOT signed an MoU with DNV GL for the certification & classification of manned submersibles rated for 6000m water depth on February 5, 2020.

NATIONAL COLLABORATION

- An existing MoU with Bharat Electronics Ltd, Jalahalli, Bangalore (BEL), Public Sector Unit was extended till 28th February 2023 for collaborative programs of mutual interest.
- A MoU was signed between ISRO-VSSC and NIOT on 8th May 2019 for the development of 6000m depth rated titanium alloy personnel sphere for manned submersible.
- An MoU has been signed between NIOT and Indian Maritime University (IMU) on 18th March 2020 for Academic and Research Collaboration.
- A MoU was signed between NIOT and Bhabha Atomic Research Centre (BARC), Mumbai for research in lipid hyperaccumulation in microalgae employing radiation and induced mutation selection for biodiesel production.

- A MoU was signed with CIBA, Chennai for development of Open Fish cage technologies.

DEPUTATION ABROAD

Sl. No	Name	Place of visit	Period	Purpose
1	Dr. Martin V. Mathew	USA	1.4.2019 - 19.4.2019	To participate in the International Visitor Leadership Program (IVLP) organized by U. S. Department of State.
2	Shri M.Arul Muthiah	Southampton, UK	9.4.2019- 11.4.2019	To attend Ocean Business 2019 at National Oceanography Centre (NOC)
3	Dr Dhilsha Rajapan Shri Tata Sudhakar Dr Shijo Zacharia	Plymouth, UK	30.4.2019- 1.5.2019	To visit research faculties, identify collaboration areas and finalization of NDA
4	Dr R Venkatesan	Kiel, Germany	1.5.2019- 3.5.2019	To attend Global Ocean Observing System Steering Committee (GOOS SC-8)
5	Shri N R Ramesh	Pretoria, South Africa	13.5.2019- 15.5.2019	To attend workshop on the development of standards and guidelines for activities in the area under International Seabed Authority
6	Dr M.A.Atmanand	Copenhagen Denmark	13.5.2019- 15.5.2019	To attend the first Global planning meeting hosted by National Museum of Denmark
7	Shri C Janarthanan	Honolulu, Hawaii, USA	16.6.2019- 21.6.2019	To attend and present a paper in International Society of Offshore and Polar Engineering Conference at Honolulu, Hawaii, USA
8	Dr G Dharani	Republic of Maldives	18.6.2019- 20.6.2019	To participate in the IMO/South Asia Co-operative Environment Programme (SACEP) Regional Workshop on International Convention for the Control and Management of Ships Ballast Water and Sediments
9	Shri D Rajasekhar	San Diego USA	24.6.2019- 28.6.2019	To witness Factory Acceptance Test of Acoustic Doppler Current Profiler w.r.t. acquisition of Two New Coastal Research Vessels.
10	Dr.M.A.Atmanand	Paris, France	26.6.2019 - 4.7.2019	To attend the 30th Session of the IOC Assembly from 26th June to 4th July 2019 and 52nd Session of the IOC Executive Council, 25th June 2019 at UNESCO Headquarters, Paris France.
11	Shri B Kesava Kumar Shri Thirumurugan Shri G Raguraman Shri A Thirunavukkarasu Shri C Muthukumar	Norway	8.7.2019- 23.7.2019	To participate in Indian Scientific Expedition to Arctic
12	Dr G.A.Ramadass	Kingston, Jamaica	15.7.2019- 26.7.2019	To attend 2nd part of 25th session of International Seabed Authority (ISBA)
13	Shri R.Sundar	San Diego, USA	29.7.2019- 4.8.2019	To attend the International AUVSI Robosub

Sl. No	Name	Place of visit	Period	Purpose
14	Shri V Pandurangan	UK	27.8.2019-30.8.2019	To witness Factory Acceptance Test of Scientific Equipment w.r.t. Two New Coastal Research Vessels at M/s.Kongsberg Geoacoustics Ltd., Great Yarmouth, United kingdom
15	Shri. G.Raguraman Shri. A.Thirunavukkarasu	Svalbard, Norway	8.8.2019-16.8.2019	To undertake scientific activities to Caatex cruise Svalbard
16	Dr. Purnima Jalihal	Dhaka, Bangladesh	4.9.2019-5.9.2019	To participate in the 3rd Ministerial conference of the Indian Ocean Rim Association (IORA) on Blue Economy.
17	Dr M AAtmanand	USA	9.9.2019-13.9.2019	To undertake collaborative programmes and new scientific initiatives in Earth System Sciences
18	Dr G.A.Ramadass	Oslo, Norway	10.9.2019-14.9.2019	To study the ocean management model and certain aspects of sustainable coastal development and techniques adopted by Norway
19	Dr.N.Vedachalam	Bangkok, Thailand	12.9.2019	To attend the 3rd ASEAN-India Workshop on Blue Economy as a back-to-back meeting with the Informal ASEAN-India Maritime Dialogue
20	Shri. S.Ramasundaram	Honolulu, USA	16.9.2019-20.9.2019	To attend Ocean Observation - 2019 Conference
21	Shri. Gopkumar Kuttikrishnan	China	22.9.2019-28.9.2019	To attend the Underwater Mining Conference and visit Institute of Deep-Sea Science and Engineering of Chinese Academy of Sciences
22	Dr.K.Jossia Joseph	Seattle, USA	23.9.2019-27.9.2019	To undergo training on Data Quality Control and Processing at Pacific Marine Environmental Lab (PMEL), National Oceanic and Atmospheric Administration (NOAA) at Seattle.
23	Dr. Purnima Jalihal	Busan, South Korea	26.9.2019-28.9.2019	To attend Seventh International OTEC Symposium
24	Dr R.Venkatesan	North Dartmouth, MA USA	1.10.2019-31.12.2019	On Fullbright Nehru Academic and Professional Excellence Fellowships (2019-20) at the University of Massachusetts
25	Shri.Ashwani Vishwanath	Dun Laoghaire, Dublin, Ireland	2.10.2019-4.10.2019	To participate in the 37th Executive Committee (Ex-Co) meeting of International Energy Agency-Ocean Energy Systems (IEA-OES)
26	Dr. N.V. Vinithkumar	Aalborg, Denmark	9.10.2019-11.10.2019	To participate in 4th edition of DanAqua Expo 2019
27	Shri M.Arul Muthiah	Reykjavik, Iceland	10.10.2019-13.10.2019	To participate in the Arctic Circle Assembly (ACA) meeting.
28	Dr. Dhilsha Rajapan	France	14.10.2019-18.10.2019	To visit the different technological centers and to participate in Knowledge Summit-II
29	Shri B.O. Vishwanath	Horten, Norway	11.11.2019-19.11.2019	To witness Factory Acceptance Test and training by M/s.Kongsberg Maritime AS, Norway
30	Dr. G.Latha	Japan	19.11.2019-22.11.2019	To visit JAMSTEC and to attend meeting of society of Bioacoustics

Sl. No	Name	Place of visit	Period	Purpose
31	Shri. S.Sundar Jesuraj	USA	13.1.2020-17.1.2020	To undergo training on T-Flex Mooring and instrument Calibration at Pacific Marine Environmental Lab (PMEL), NOAA Seattle.
32	Dr.M.A.Atmanand	Paris, France	15.1.2020-17.1.2020	To attend the EPG meeting with the Executive Planning Group members at UNESCO, Headquarters, Paris, France.
33	Dr.G.A.Ramadass	Kingston, Jamaica	15.2.2020-21.2.2020	To attend the 1st part of the council during 26th Session of International Seabed Authority (ISA) and 3rd meeting of the open-ended ad hoc working group

MEMBER OF COMMITTEES

Dr. M.A.Atmanand

- Member of Executive Planning Group to support the development of the UN Decade of Ocean Science for Sustainable Development of Intergovernmental Oceanographic Commission (IOC) of UNESCO, the sole representative from India.
- Chair of Intergovernmental Oceanographic Commission Regional Committee for the Central Indian Ocean (IOCINDIO) of UNESCO.
- Chair IEEE/MTS Oceans conference to be held at Chennai, India in 2022.
- Associate Editor of IEEE Journal of Oceanic Engineering.
- Elected Member of Administrative Committee (AdCom) of IEEE Oceanic Engineering Society (2018 to 2021).
- Senior Member of IEEE.
- Member of Technology Committee of IEEE OES on Underwater Cables and connectors.
- Member, Society for Underwater Technology (SUT).
- Member of Marine Technology Society (MTS).
- Life Member of Ocean Society of India (OSI).
- Fellow of Institution of Engineers (India).
- Member of the International Organizing Committee of International Society for Offshore and Polar Engineers (ISOPE), California, USA.
- Member of AU-NLCIL Innovation Hub for Energy, Environment and Sustainability (ANIHEES) – Anna University.
- Member in National Institute of Wind Energy's Research council.

Dr. Purnima Jalihal

- Representative in the Executive Committee for the Ocean Energy Systems under the International Energy Agency.
- Member of Technical Committee for Technology screening for Jal Jeevan Mission, constituted by Principal Scientific Advisor, Govt. of India.
- Member of Executive Committee of Institute for Energy Studies, Anna University.
- 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.
- Chairperson of Indian Desalination Association (South Zone) Executive Committee.

Dr.M.V.Ramana Murthy

- Member, Expert Appraisal Committee (Infra-1) for projects related to infrastructure development, industrial estate/parks/complexes/areas, export processing zones, special economic zones, biotech parks, leather complexes and national highway projects.
- Member, Expert Appraisal Committee (Infra-2) for projects related to all ship breaking yard including ship breaking unit, airports, common hazardous waste treatment, storage and disposal facilities, ports and harbours, aerial ropeways, CETPs, common municipal solid waste management facility, building/ construction projects, townships and area development projects.
- Member, Expert Appraisal committee for the proposal involving violation of EIA notification.
- Member of finalization of Shoreline Management plan for Tamil Nadu committee.

Dr.R.Venkatesan

- Steering Committee Member for Deep Ocean Observing Strategy (DOOS) Project of UNESCO IOC.
- Steering committee member Asia-Pacific GOOS UNESCO IOC nominated by Govt. of India.
- Data Buoy Cooperation Panel of UNESCO IOC & WMO Chair International Tsunameter Partnership.
- National Consultant SACEP-NORAD-International Maritime Organization by Govt. of India.
- Country focal point of Belmont forum Arctic.
- Member of Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

Dr.G.A.Ramadass

- Member, IEEE Oceanic Engineering Society.

Dr.Dhilsha Rajapan

- Doctoral Committee member, Vellore Institute of Technology, (VIT) Vellore.
- Doctoral Committee member, Anna University, Chennai.
- Expert member in the first academic Industry meet of IIT, Jodhpur on 24th January 2020.
- Committee member for the review of monographs published by DESIDOC, Defense science Publications, Delhi.
- Thesis Examiner to M.G.University, Kottayam, Kerala.

Mr.D.Rajasekhar

- Member of Shipbuilding & Marine Engineering and Safety Aids Sectional Committees TED 17 & 19 under Bureau of Indian Standards.
- Member of Committee for acquisition of Polar Research Vessel for NCPOR-MoES.
- Member in Ship acquisition-GSI.

- An Expert Member in Technical Evaluation Committee for Construction of India's Third Antarctic Station Bharati in Antarctica.
- Member in National Committee towards preparation of Indian proposals for naming underwater features in the maritime areas of Indian interest and submission to the GEBCO Sub-Committee on Undersea Features Names (SCUFN).
- Member of Peer Review Committee (PRC) for Project of NARS "New Acoustic Research Ship' of NPOL, Kochi.
- Member of Ship Acquisition Committee of Tamil Nadu State Fisheries Department.

Dr.G.Latha

- Member of the Working Group on Data Management, International Quiet Ocean Experiment (IQOE), SCOR, USA.
- Member, Expert Committee for Young Scientist, Earth & Atmospheric science, Science and Engineering Research Board (SERB), Government of India.
- Member, Doctoral Committee, Anna University.
- Member, Doctoral Committee, Vellore Institute of Technology.
- Thesis examiner in Goa University and Bharathidasan University.

Mr.Tata Sudhakar

- Chairman, IETE Chennai Centre and Council member IETE New Delhi.
- Member Board of studies Sai ram Engineering College.
- Member Board of studies Saveetha Engineering College.
- Subject Expert for assessment in CSIR- NIO, Goa.

Dr. Vijaya Ravichandran

- Member, Environmental Appraisal Committee for Nuclear, Defense and Strategic Projects in the Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India.
- Member, Committee for prevention of sexual harassment of women, National Institute of Wind energy.
- Member, Joint Committee constituted by National Green Tribunal for inspecting sea water quality along North Chennai coast.

Dr. Basanta Kumar Jena

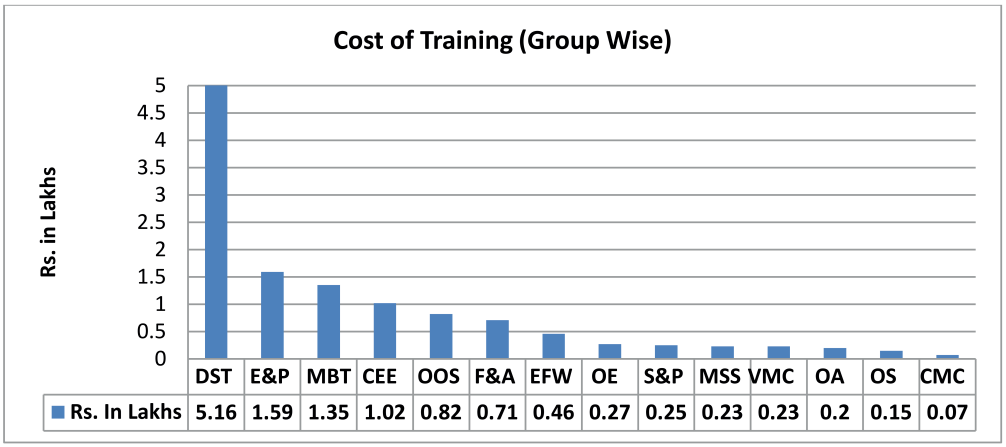
- Member, American Geophysical Union (AGU).
- Associate member, American Society of Civil Engineers.
- Member, Board of Governors of the Coasts, Ocean, Ports, and Rivers Institute, USA.
- Life Member, Ocean Society of India.
- Society Member, Coastal Education & Research Foundation, Inc. (CERF).

HUMAN RESOURCE DEVELOPMENT

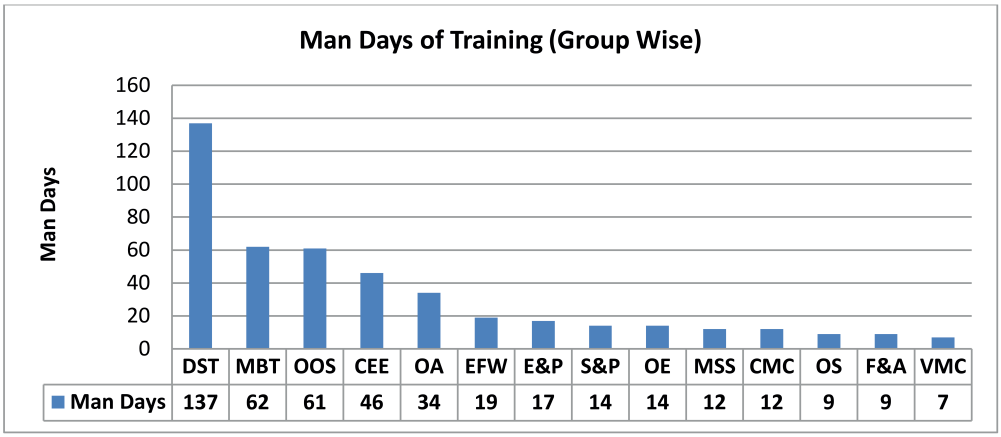
The Human Resource Development (HRD) division organizes training courses in the areas of engineering, software, project management, personality development, product trainings etc. Besides the external training courses, efforts are also made to conduct extra mural lectures by eminent personalities in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

The HRD division also provides both short term (4 weeks to 6 months) and long term (one year or more) project training to students pursuing M. Tech or their equivalent degree programmes, at different educational institutions spread over the country related to ocean technology to fulfil their academic degree requirements. The project topics are ensured to bring value addition to NIOT activities from the student community. In this period of reporting, around 25 students completed the project work in various departments of NIOT. About 123 students carried out their short term internships (minimum 2 weeks- maximum 4 weeks) and 39 students had undergone inplant training (minimum 5 days- maximum 2 weeks) during the summer and winter vacation.

With regard to the staff external training, the division has coordinated trainings cumulating about 453 man-days costing about Rs. 12.5 Lakhs. The section-wise break up is shown in the following charts. The table with the technical and extra mural training details is also presented.



	DST	E&P	MBT	CEE	OOS	F&A	EFW	OE	S&P	MSS	VMC	OA	OS	CMC
Rs. In Lakhs	5.16	1.59	1.35	1.02	0.82	0.71	0.46	0.27	0.25	0.23	0.23	0.2	0.15	0.07



	DST	MBT	OOS	CEE	OA	EFW	E&P	S&P	OE	MSS	CMC	OS	F&A	VMC
Man Days	137	62	61	46	34	19	17	14	14	12	12	9	9	7

Training Undergone by NIOT staff

Sl. No	Name of the Staff	Training Program and Conducted by	Duration
1	**Mr. S.M. Gopalakrishnaa,** Co-ordinator Gr-IV	Training Programme on Public Procurement at NIFM, Faridabad	29.04.2019 to 04.05.2019
2	**Mr. R. Ramesh,** Scientist - E	Training Programme on Lab VIEW advanced architecture and Embedded Control in NIOT	10.06.2019 to 14.06.2019 & 01.07.2019 to 05.07.2019
3	**Mr. Doss Prakash,** Scientist - C		
4	**Mr. R. Ramesh,** Project Scientist - I		
5	**Mr. Shreeram Pandit,** Project Scientist - I		
6	**Ms. K. Jayanthi,** Scientific Officer Gr-II		
7	**Mr. P. Muthuvel,** Scientist - E		
8	**Ms. Nidhi Varshney,** Scientist - D		
9	**Ms. Bala Naga Jyothi,** Scientist - D		
10	**Mr. B.O. Vishwanath,** Scientific Officer Gr-II		
11	**Mr. P. Sridhar,** Project Scientist- I		
12	**Dr. R. Mohan,** Project Scientist - II	Training Programme on Marine Meteorology and operational ocean State forecasting at INCOIS, Hyderabad	17.06.2019 to 21.06.2019
13	**Mrs. K. Vasanthi,** Executive	Training Programme on GST at NIFM Campus , Faridabad	19.06.2019 to 21.06.2019
14	**Mr. Sheik Meeran Mohideen** S. A, Project Technician	Training Programme on STCW Refresher Course, R-PSCRB, R-AFF & R-MFA at Hindustan Institute of Maritime Training, Chennai	05.08.2019 to 07.08.2019
15	**Ms.Sonitha S Saraf,** Junior Hindi Translator	Training Programme on Refresher Translation, Bangalore	17.06.2019 to 21.06.2019
16	**Ms. V.S. Radhika,** Project Scientist - I	Training Programme on CEO course on Marine Infrastructure Development at IIT, Bombay	01.07.2019 to 05.07.2019
17	**Dr. Dhilsha Rajapan,** Scientist - G	National Science Communication Orientation Training Program at CSIR-AMPRI, Bhopal	22.08.2019 to 23.08.2019

Sl. No	Name of the Staff	Training Program and Conducted by	Duration
18	**Mr. S.Sankar,** Project Scientist - I	Training Programme on Annual Hypack, Goa	26.08.2019 to 28.08.2019
19	**Mr. Thennavan R,** Project Scientist - I		
20	**Mr. Swamynandham Jakkoju,** Project Scientific Assistant		
21	**Mr. P. Senthil Kumar,** Project Scientist- II		
22	**Dr. M.Kalyani,** Scientist - D	Training Programme for Women Scientist on "Science and Sustainability in India" at NIAS campus, Bengaluru	23.09.2019 to 27.09.2019
23	**Dr. J. Nasiha,** Senior Research Fellow	Training Programme on Data Science in Climate Research: Perspective on Climate Extremes at TERI-NORCE Research School, New Delhi	15.10.2019 to 18.10.2019
24	**Dr. Sundararajan,** Scientist - E	Online Training Programme on "Ecosystem Modelling with MIKE ECO Lab"	22.10.2019, 29.10.2019, 05.11.2019, 12.11.2019, 19.11.2019
25	**Mrs. K. Chithra,** Scientist - E	Training Programme on Primavera Software in NIOT	25.11.2019 to 29.11.2019
26	**Mr. A.S.Kiran,** Scientist - D		
27	**Mr. R. Srinivasan,** Scientist - E		
28	**Mr. N. Thulasi Prasad,** Project Scientist - I		
29	**Mrs. Bala Naga Jyothi,** Scientist - D		
30	**Mr. K. Gopkumar,** Scientist - F		
31	**Mr. R. Ramesh,** Project Scientist - II		
32	**Dr. Dilip Kumar Jha,** Scientist - B		
33	**Mr. Sajeev. K.S,** Scientific Officer Grade- II		
34	**Mr. Y.V. Narasimha Rao,** Scientific Officer Grade - II		
35	**Dr. M.C. Sanjana,** Scientist - D		
36	**Dr. M. Kalyani,** Scientist - D		
37	**Mr. R. Sundar,** Scientist - D		

Sl. No	Name of the Staff	Training Program and Conducted by	Duration
38	**Ms. A. S. Vijayalakshmi,** Senior Executive	Training Programme on Import & Export Management at NIWE, Chennai	28.11.2019
39	**Ms. Pavithra,** Project Junior Assistant		
40	**Mr. P.S.Karthikeyan,** Supervisor (OS)		
41	**Mr. Ashok Kumar,** Secretarial Assistant		
42	**Ms. N.N. Lavanya,** Junior Assistant		
43	**Ms. Kalaiyarasi,** Project Senior Executive		
44	**Mr. K. Prabhakaran,** Scientist - C	Training Programme on IOT Security Professional at ERNET, Taramani	16.12.2019 to 20.12.2019
45	**Mr. Nitesh Verma,** Project Scientist - I	Training on Python Programming Certificate, Taramani, Chennai	04.01.2020 to 05.01.2020 & 11.01.2020 to 12.01.2020
46	**Mr. K. Thirumurugan,** Scientist - D	Training Programme on Metallurgy for Practicing Engineers (MEPE - 2020), Chennai	31.01.2020 to 01.02.2020
47	**Dr. S. B. Pranesh,** Scientist - D	Training Programme on Advanced Course on Fatigue and Fracture Behaviour of Structures and structural Components at CSIR Campus, Taramani, Chennai	19.02.2020 to 21.02.2020
48	**Mrs. K. Amudha,** Scientist - E		

Conference/Workshop attended by NIOT staff

Sl. No	Name of the Staff	Conference/Workshop	Duration
1	**Mr. Sulabh Srivastav,** Hindi Typist	All India Rajbhasha Special Hindi Workshop and Seminar, Thiruvananthapuram	30.05.2019 to 01.06.2019
2	**Mr. Manoj Vasudevan,** Scientist - D		
3	**Mr. Anand Kishore,** Scientist - C	Advances in Robotics (AIR2019) at IIT Madras, Chennai	02.07.2019 to 06.07.2019
4	**Mr. K. Thirumurugan,** Scientist - C		
5	**Dr. D. Sathia Narayanan,** Scientist - E		
6	**Mr. C. Janarthanan,** Scientist - D		
7	**Dr. A. Ganesh Kumar,** Project Scientist - II	Workshop on "Caenorhabditis elegans based OMICS for future Challenges" at Alagappa University, Karaikudi	09.09.2019 to 13.09.2019
8	**Mr. K. Prabhakaran,** Scientist - C	Seminar on Artificial Intelligence, Automated Driving and Model-Based Design Using MATLAB and Simulink at Hotel Hilton Chennai	17.09.2019
9	**Mr. S. Muthukumaravel,** Scientist - E		
10	**Mr. Nitesh Verma,** Project Scientist - I		
11	**Ms. Balanaga Jyothi,** Scientist - D		
12	**Mr. Moithil Biswas,** Project Scientist - I		
13	**Mrs. P.M. Rajeswari,** Scientific Officer Grade - II		
14	**Ms. K. Chithra,** Scientist - E		
15	**Mr. Vishal Pawan Jain,** Project Scientist - I		
16	**Ms. Harsha Bhaskaran,** Project Scientist - I		
17	**Dr. Martin V. Mathew,** Project Scientist - II	Workshop on Disaster Management, Wayanad	25.10.2019
18	**Dr. G. Dharani,** Scientist - F	All India Special Rajbhasha Hindi Residential Workshop and Seminar at Kodaikanal	25.11.2019 to 27.11.2019
19	**Mr. Sulabh Srivastav,** Hindi Typist		

Sl. No	Name of the Staff	Conference/Workshop	Duration
20	**Mr. S. Krishna Mohan,** Joint Manager	Effectiveness of Commercial Arbitration in India, Kumarakom, Kerala	28.11.2019 to 30.11.2019
21	**Ms. Sonitha S. Saraf,** Junior Hindi Translator	Residential Workshop on Official Language (Rajbhasha,) Goa	09.12.2019 to 11.12.2019
22	**Ms. Neetu,** Junior Hindi Translator		
23	**Mr. M. Vadivelu,** Senior Executive	Residential Workshop on Income Tax at Goa	12.12.2019 to 14.12.2019
24	**Ms. R. Janani,** Senior Research Fellow	Workshop on Ocean Mixing and Monsoon (OMM) at Ahmedabad	21.01.2020 to 24.01.2020
25	**Mr. Keerthivasan,** Senior Research Fellow		
26	**Mrs. T. Sasikala,** Scientific Officer grade - II	Workshop on EMC Standards and Measurements at CIT campus Taramani, Chennai	24.01.2020
27	**Mrs. Nidhi Varshney,** Scientist - D		
28	**Mrs. K. Jayanthi,** Scientific Officer Grade - II		
29	**Mr. Ramasundaram,** Scientist - E	Awareness Programme on Visa Rules of Foreigners, Chennai	07.02.2020
30	**Mrs. N.N. Lavanya,** Junior Assistant	Workshop on Present and Future Trends in GST, IIT Madras Research Park, Taramani	14.02.2020
31	**Mrs. L. Vaidehi,** Junior Assistant	Technical Seminar on Health and Ayurvedic Treatment Method, Arumbakkam, Chennai	20.02.2020

Extra Mural Lectures Delivered

Mr. Gopu & Mr. C. Ravikumar, NIOT delivered a lecture on **"Fire fighting procedure and Evacuation drill"** on 26th April 2019.

Dr. G.S. Kailash, Senior Pulmonologist, delivered a lecture on **"How not to go to a Doctor"** on 1st May 2019.

Dr. R. Suresh, Dy. Director General of Meteorology (Retd), Civil Aviation Division IMD & Head, Regional Met Center, Chennai, delivered a lecture on "**Air Pollution"** on 4th June 2019.

Dr. S. Karunanidhi, Outstanding Scientist and Director, Control Systems Laboratory, Research Centre Imarat (RCI), DRDO, delivered a lecture on **"Emotional Intelligence"** on 10th January 2020.

Dr. Idhya Chandran, Consultant Nephorologist & Dr. Sasi Kumar Chandran, Consultant Urologist of M/s. Chennai Urology and Robotics Institute Hospital (CURI), delivered a lecture on **"Awareness talk on Kidney Health & Prostate Disease**" on 28th February 2020.

Dr. Sreenivasa Varma, Medical Director, Balagangadhara Varma Medical Research Centre, delivered a lecture on "**Corona Virus Infections"** on 5thMarch 2020.

Technical lecture at NIOT

- Dr. Eric D'Asaro, Professor Applied Physical Laboratory (APL), University of Washington, visited NIOT during January 7-8, 2020 for scientific discussion with scientists of NIOT. He delivered a talk on" **Air-Sea Coupling feedback for Monsoon Intra-seasonal Oscillations"** during his visit.

Students / Faculty / Officials visit to NIOT

Sl. no.	Name of the University/Institution	No. of Students/ Faculties	Period of visit
1	Valliammai Engineering College	24	31.05.2019
2	Anna University (International Summer School-2019)	25	14.06.2019
3	Sri Sairam Engineering College	17	24.07.2019
4	RMD Engineering College	60	02.08.2019
5	St. Josephs College of Engineering	55	02.08.2019
6	Apollo Arts and Science College	50	09.08.2019
7	As part for "Electrochemistry & Corrosion camp", various school students, teachers and volunteers	119	16.08.2019
8	KCG College of Technology	47	06.09.2019
9	Rajalakshmi Engineering College	102	13.09.2019
10	Foreign Delegates from Portugal as part of 'Indo-Portuguese Meet' held at IIT, Madras	9	24.09.2019
11	Easwari Engineering College	51	25.09.2019
12	State Institute of Rural Development & Panchayat Raj	25	26.09.2019
13	Apollo Arts & Science College	47	27.09.2019
14	Department of Microbiology, University of Madras	13	16.10.2019*
15	Akshayah Matric Hr. Sec. School, Velachery	37	17.10.2019*
16	Sri Sairam Engineering College	79	18.10.2019*
17	VIT, Vellore	90	18.10.2019*
18	German Delegates visit organized by– Dr.Mishra, ICMAM	12	22.10.2019*
19	Government Higher Secondary School	80	23.10.2019*
20	Vivekananda Vidyalaya School, Thiruvotriyur	110	23.10.2019*
21	St. John's Public School	328	24.10.2019*

Sl. no.	Name of the University/Institution	No. of Students/ Faculties	Period of visit
22	Presidency College & Ethiraj College	17	29.10.2019*
23	Indian Public School, Perungudi	250	22.11.2019
24	AMET, University	50	29.11.2019
25	Prince Shri Venkateswara Padmavathy Engg. College	56	03.01.2020
26	Rajalakshmi Engineering College	87	10.01.2020
27	Bharat Institute of Higher Education (MBT Visit)	94	23.01.2020
28	Gurunanak College	99	24.01.2020
29	JBAS College for Women (SIET)	77	31.01.2020
30	Murugappa Polytechnic	33	07.02.2020
31	Loyola College	63	14.02.2020
32	RMK College of Engineering and Technology	173	21.02.2020
33	Jerusalem Engineering College	138	28.02.2020
34	Velammal Institute of Technology	165	06.03.2020

*Visit of Students to NIOT during October 2019 as part of Silver Jubilee celebrations and IISF 2019.

ADMINISTRATION

The manpower position during the period from 01.04.2019 to 31.03.2020 at NIOT are given below:

STAFF STRENGTH:

The details of sanctioned strength and no. of posts filled are furnished here under:

Sl. No.	Category	No. of Posts Sanctioned			Total	Filled			Total	Vacant			Total
		Regular	CAT Order	Supernumerary		Regular	CAT Order	Supernumerary		Regular	CAT Order	Supernumerary	
1	Director	01	0	0	01	01	0	0	01	0	0	0	0
2	Scientific	87	02	05	94	82	02	05	89	05	0	0	05
3	Technical	54	0	16	70	53	0	16	69	01	0	0	01
4	Administrative	18	0	06	24	17	0	06	23	01	0	0	01
5	Official Lang. Hindi	03	0	0	03	03	0	0	03	0	0	0	0
6	Multi- Tasking Staff	06	0	0	06	06	0	0	06	0	0	0	0
	Total	**169**	**02**	**27**	**198**	**162**	**02**	**27**	**191**	**07**	**0**	**0**	**07**

(a) APPOINTMENTS:

Against the supernumerary posts sanctioned vide MoES communication in Ref.No.MoES/38/01/2018-Estt. dated 29.4.2019, the following staff members reported to duties as the dates indicated against their names.

Sl.No	Name	Post	Date of Appointment
1	Dr S Rajaguru	Scientist-C	28-06-19
2	Shri T S Kumar	Scientist-B	21-06-19
3	Shri Krupa Ratnam	Scientist-B	21-06-19
4	Dr Dilip Kumar Jha	Scientist-B	28-06-19
5	Shri S Ragumaran	Scientist-B	28-06-19
6	Smt A S Vijayalakshmi	Sr Executive	14-06-19
7	Shri M Vadivelu	Sr Executive	17-06-19
8	Smt I Srilakshmi	Sr Executive	27-06-19
9	Smt K Lakshmi	Sr Executive	27-06-19
10	Shri K Stalin	Executive	14-06-19
11	Smt S Isabel Dericks Selvam	Executive	28-06-19
12	Shri S Ravichandran	Technician-Grade-A	24-06-19
13	Shri S Saravanan	Technician-Grade-A	25-06-19

Sl.No	Name	Post	Date of Appointment
14	Shri S Sasikumar	Technician-Grade-A	26-06-19
15	Shri T Nambirasan	Technician-Grade-A	26-06-19
16	Shri P Ramesh	Technician-Grade-A	26-06-19
17	Shri G Dandis Ananda Kumar	Technician-Grade-A	27-06-19
18	Shri D Muthurajan	Technician-Grade-A	27-06-19
19	Shri K Elanchezhiyan	Technician-Grade-A	28-06-19
20	Shri M Athiaman	Technician-Grade-A	28-06-19
21	Shri M Chandrasekar	Technician-Grade-A	28-06-19
22	Shri D Rajan	Technician-Grade-A	28-06-19
23	Shri C Dhanaraj	Technician-Grade-A	28-06-19
24	Shri S Palaiyam	Technician-Grade-A	28-06-19
25	Shri G Velu	Technician-Grade-A	01-07-19
26	Shri N Anand	Technician-Grade-A	03-07-19
27	Shri Sheik Meeran Mohideen	Technician-Grade-A	12-07-19

(b) DIRECT RECRUITMENTS:

1	Shri Trishanu Shit	Scientist-D	01.07.2019
2	Ms Neetu	Junior Hindi Translator	05.08.2019
3	Shri Mahendran Raju	Scientific Assistant	05.08.2019
4	Shri M Palaniappan	Scientist-F (Mechanical)	30.09.2019
5	Shri Hemant Kumar Meena	Scientist–B (Civil)	02.12.2019
6	Smt Rosmy Cheriyan	Scientist -B (Civil)	09.01.2020
7	Smt R Rathikumari	Asst. Manager (On deputation basis)	16.03.2020

(c) PROMOTIONS UNDER MODIFIED FLEXIBLE COMPLEMENTING SCHEME:

Sl.No	Name	Post	With effect from
1	Shri Tata Sudhakar	Scientist-G	1.7.2019
2	Shri N R Ramesh	Scientist-F	1.7.2019
3	Shri S Muthukrishna Babu	Scientist-F	1.7.2019
4	Dr (Smt) Jossia Joseph	Scientist-E	1.7.2019
5	Shri Mullaivendhan	Scientist-E	1.7.2019
6	Dr G Dhinesh	Scientist-E	1.7.2019
7	Dr (Smt) M Kalyani	Scientist-D	1.7.2019
8	Shri K Thirumurugan	Scientist-D	1.7.2019
9	Dr (Smt) Vijaya Ravichandran	Scientist-G	1.1.2020
10	Dr Basanta Kumar Jena	Scientist-G	1.1.2020
11	Shri S Muthukumaravel	Scientist-F	1.1.2020
12	Dr N V Vinith Kumar	Scientist-F	1.1.2020

Sl.No	Name	Post	With effect from
13	Shri P Muthuvel	Scientist-F	1.1.2020
14	Dr Prince Prakash Jeba Kumar	Scientist-E	1.1.2020
15	Dr (Smt) M C Sanjana	Scientist-E	1.1.2020
16	Shri S Ramasundaram	Scientist-E	1.1.2020
17	Shri C Janarthanan	Scientist-E	1.1.2020
18	Dr Tamshuk Chowdhury	Scientist-E	1.1.2020
19	Dr L Anbu Rajan	Scientist-D	1.1.2020

(d) SUPERANNUATION:

Sl.No	Name	Post	Date of superannuation
1	Shri G Sekaran	Technician – Grade- B	29.02.2020

(e) RESIGNATION:

Sl.No	Name	Post	Date of Resignation
1	Shri Trishanu Shit (technical resignation)	Scientist-C	30.06.2019
2	Shri Satya Kiran Raju Alluri (Technical resignation)	Scientist-D	18.03.2020

(f) DEMISE:

Sl.No	Name	Post	Date of Resignation
1	Shri N Ravi alias Gurusamy	Scientist-E	06.01.2020

(g) RE-DESIGNATION - In pursuance to letter No.MoES/18/07/2010-Estt. dated 17/12/2019 of MoES, GoI, New Delhi, the post of Junior Hindi Translator has been re-designated as "Junior Translation Officer" and will not entail any financial implications whatsoever.

(h) SUMMARY OF AUDIT OBSERVATION

Sl. No.	Year	No. of Paras / PA reports on which ATNs have been submitted to PAC after vetting by Audit	Details of the Paras / PA reports on which ATNs are pending		
			No. of ATNs not sent by the Ministry even for the first time	No. of ATNs sent but returned with observations and Audit is awaiting their resubmission by the Ministry	No. of ATNs which have been finally vetted by audit but have not been submitted by the Ministry to PAC
1	2019	-	-	-	-

(i) MATTERS RELATING TO PERSONS WITH DISABILITIES

Sl. No.	Name of the Ministry / Department: National Institute of Ocean Technology, Chennai, Ministry of Earth Sciences	
1	Various activities and the policy decisions taken for implementation of the RPwD ACT, 2016 during Financial Year 2019-2020	The reservation applicable in recruitment of post as provided under the Persons with disability Act, 2016 and it is implemented in NIOT. The accessibility to buildings for persons with disabilities have been provided as per the requirements of the Act.
2	Information about the total budget provision of the Ministry / Department	Total budget Rs. 513.51 Crores
3	Allocation under various schemes for the benefit of persons with disabilities, the amount released and the amount utilized.	No specific scheme under Project O-SMART handled by NIOT has been identified for the benefit of persons with disabilities
4	The number of beneficiaries with disabilities and their percentage in relation to the total number of beneficiaries	In projects implemented by NIOT, it does not arise.
5	Whether a separate chapter in the Annual Report of the Ministry / Department outlining the policy decisions and activities undertaken for the benefit of the Persons with Disabilities has been included? If not, when does the Ministry / Department proposes to do so?	It is included from the current year onwards.
6	A copy of the Annual Report for the year 2019-2020 indicating policy decisions and the activities undertaken by the Ministry / Department for the benefits of persons with disabilities.	This is the Annual Report for the year 2019-20 and the matter is furnished above.

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

Ministry / Department / Organization	:	**National Institute of Ocean Technology, Chennai** **Ministry of Earth Sciences**
Year	:	**2019 – 2020 (April 2019 to March 2020)**

Progress in 2019 – 2020						
	Opening Balance as on 01.04.2019	**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	12	7	16	1	0	26
First Appeals	0	0	0	0	0	0

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

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

No. of times various provisions were invoked while rejecting requests													
Relevant Section of RTI Act 2005													
Section 8 (1)										Sections			
a	b	c	d	e	f	g	h	i	j	9	11	24	Others
0	0	0	0	0	0	0	0	0	0	0	0	0	0

Amount of Charges Collected (in Rs.)		
Registration Fee Amount	**Additional Fee & Any other charges**	**Penalties Amount**
170	790	-

RTI Annual Return Information System (2019 - 2020)	
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 – 6678 3488
Website address of Department / Organization (Please do not write 'http://')	www.niot.res.in

RTI Annual Return Information System (2019 – 2020)	
National Institute of Ocean Technology, Chennai **Ministry of Earth Sciences (Please note that fields prefixed with * are mandatory)**	
* Name of CPIO	Dr. G. A. Ramadass
* Gender	Male
* Designation	Scientist – G
* Address	National Institute of Ocean Technology, Velachery – Tambaram Main Road, Pallikaranai, Chennai.
Pin code	600 100.
Phone No.	6678 3388
Email	cpio@niot.res.in
* Appellate Authority Name	Dr. M.A. Atmanand, Director, NIOT, Chennai

T.A.P. VARADAKUTTI & CO.,
Chartered Accountants,

Old No.50, New No 70, 53rd Street,
9th Avenue, Ashok Nagar, Chennai - 83
✆ Office : 2371 6658, 2489 0665
Mobile : 98410 48947
E-mail : tapvaradakuttiandco@gmail.com

Ref No. Date :.....

05/08/2020

INDEPENDENT AUDITOR'S REPORT

Report on the Audit of the Standalone Financial Statements for the Financial year ended 31.03.2020

Opinion

We have audited the financial statements of NATIONAL INSTITUTE OF OCEAN TECHNOLOGY (NIOT) Chennai which comprise the Balance Sheet as on 31st March 2020 and the Income & Expenditure Account and Receipts and Payments account for the year then ended on that date and notes to the financial statements including the summary of significant accounting policies and other explanatory information.
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 NIOT as at March 31st 2020 and excess of expenditure over income for the year ended on that date.

Basis of opinion

We conduct our audit in accordance with the standards on auditing (SAs) issued by The Institute of Chartered Accountants of India. Our responsibilities under those standards are further described in the auditors responsibilities for the audit of the financial statements section of our report. We are independent of the entity in accordance with the code of Ethics issued by the Institute of Chartered Accountants of India together 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 and the Code of Ethics.We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

T.A.P. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

Responsibility of Management for Standalone Financial Statements.

The Management is responsible for the preparation and fair presentation of the financial statements that give a true and fair view of the financial position, Financial performance,in accordance with the accounting principles generally accepted in India, This responsibility also includes maintenance of adequate accounting records for safeguarding of the assets of the entity and for preventing and detecting frauds and estimates that are reasonable and prudent,and design, implementation and maintenance of adequate internal financial controls,that were operating effectively for ensuring the accuracy and completeness of the accounting records,relevant to the preparation and presentation of the financial statement that give a true and fair view and 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.

T.A.P. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

Report on Other Legal and Regulatory Requirements

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 & Expenditure Account and Receipts and Payments Account dealt with by this report are in agreement with the Books of Account.

4. In our opinion, Balance Sheet and Income & Expenditure Account and Receipts and 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.

For T.A.P.Varadakutti& Co
Chartered Accountants
FRN :004511S

T.A.P. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

Partner
CA. T.A.P.Varadakutti
M.No. 015316
UDIN: 20015316AAAAAW2090

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

BALANCE SHEET AS AT 31ST MARCH 2020

(Amount in Rupees)

LIABILITIES	**Schedule**	**31.03.2020**	**31.03.2019**
CAPITAL FUND	1	3,701,476,278	3,553,712,413
RESERVES AND SURPLUS	2	489,474,614	384,458,491
EARMARKED / SPONSORED PROJECT FUNDS	3	127,933,543	1,189,554,429
CURRENT LIABILITIES AND PROVISIONS	4	2,243,776,454	1,398,306,189
TOTAL		**6,562,660,889**	**6,526,031,522**
ASSETS			
FIXED ASSETS	5	3,515,424,286	3,318,310,673
INVESTMENTS - OCEAN TECHNOLOGY AND EARMARKED / SPONSORED PROJECT FUNDS	6	84,510,557	1,399,661,818
INVESTMENTS - OTHERS	7	1,548,209,020	1,284,512,286
CURRENT ASSETS, LOANS, ADVANCES, ETC.	8	1,414,517,026	523,546,745
TOTAL		**6,562,660,889**	**6,526,031,522**
Significant Accounting Policies	14		
Contingent Liabilities and Notes to Accounts	15		

For National Institute of Ocean Technology, Chennai

As per our Report of even date
For T.A.P. VARADAKUTTI & Co
Chartered Accountants
FIRM REGN.NO.004511S

Date: August 5, 2020
Place: Chennai 600 100

DIRECTOR

CA T.A.P.VARADAKUTTI
PARTNER
Memb No: 015316
UDIN: 20015316AAAAAW2090

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2020

(Amount in Rupees)

INCOME	*Schedule*	2019-20	2018-19
Scientific and Technical Consultancy Services		34,396,168	2,070,000
Other receipt		275,000	405,000
Grants-in-aid - Core Grant	9	353,105,223	310,071,839
Interest Earned	10	10,131,319	14,229,089
Other Income	11	2,342,724	2,950,973
TOTAL (A)		**400,250,434**	**329,726,901**
EXPENDITURE			
Expenditure on Scientific and Technical Consultancy Services		13,678,509	621,000
Establishment Expenses	12	340,913,107	256,721,818
Administrative Expenses	13	70,419,529	59,510,199
Depreciation on assets created out of Core Grants		25,494,693	26,001,582
TOTAL (B)		**450,505,837**	**342,854,599**
Excess of expenditure over income (A-B)		-50,255,403	-13,127,698
Appropriations			
Interest on Savings Bank Account Earned during the Year under the programme "Core Grant" refundable to Ministry of Earth Sciences, Government of India transferred to Schedule 4 - Current Liabilities & Provisions (as per schedule 10)		249,306	8,470,943
Staff welfare fund Appropriations on Scientific and Technical Consultancy Services		725,118	72,450
Balance of Excess of income over expenses on Scientific and Technical Consultancy Services transferred to General Reserve Fund		30,149,554	10,490,669
Balance being excess of Expenditure over Income transferred to Schedule 1- Capital Fund		-81,379,381	-32,161,760
		-50,255,403	**-13,127,698**
Significant Accounting Policies	14		
Contingent Liabilities and Notes to Accounts	15		

For National Institute of Ocean Technology, Chennai

5/8/2020

DIRECTOR

As per our Report of even date
For T.A.P. VARADAKUTTI & Co.
Chartered Accountants
FIRM REGN.NO.004511S

CA T.A.P.VARADAKUTTI
PARTNER
Memb No:015316

Date: August 5, 2020
Place: Chennai 600 100

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2020

(Amount in Rupees)

SCHEDULE 1 - CAPITAL FUND	31.03.20		31.03.19	
BALANCE AS AT THE BEGINNING OF THE YEAR		3,553,712,413		3,158,974,873
Add: Additions during the year	888,221,921		671,976,105	
Less: Transfer/Adjustments	329,980,584		-	
Less: Excess of Expenditure over income	81,379,381		32,161,760	
Less: Provision for depreciation	329,098,090	147,763,866	245,076,805	394,737,540
BALANCE AT THE YEAR END		**3,701,476,278**		**3,553,712,413**

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

T.A.P. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

Schedule -1

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2020

(Amount in Rupees)

SCHEDULE 2 - RESERVES AND SURPLUS		31.03.20		31.03.19	
	Reserves created out of Technical / Consultancy Projects				
i.	**General Reserve Fund**				
	As per last Account	347,092,834		306,297,829	
	Additions during the year	106,195,380		41,314,845	
	Deductions during the year	142,737	453,145,477	519,840	347,092,834
	Sub - Total		453,145,477		347,092,834
ii.	**Staff Welfare Fund**				
	As per last Account	5,184,852		4,401,122	
	Additions during the year	832,919		966,666	
	Deductions during the year	-	6,017,771	182,936	5,184,852
	Sub - Total		6,017,771		5,184,852
iii.	**Scientific & Technical Consultancy Project Equipment Fund**				
	As per last Account	32,180,805		36,459,233	
	Additions during the year	4,153,951		1,698,307	
	Less: Depreciation on the assets created	6,023,390	30,311,365	5,976,736	32,180,805
	Sub - Total		30,311,365		32,180,805
	GRAND TOTAL (i+ii+iii)		**489,474,614**		**384,458,491**

Schedule -2

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

T.A.R. VARADAKUTTI & CO. Chartered Accountants CHENNAI 600 083.

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2020

SCHEDULE-3 EARMARKED / SPONSORED PROJECT FUNDS

Details / Grants pertaining to	Balance as on 1.4.2019	Add: Receipts Grants Received	Add: Receipts Other Receipts	Add: Receipts Interest Earned	Less: Expenditure Expenditure Revenue	Less: Expenditure Project Equipment/WIP	Less: Expenditure Surrender of Interest Earned	Balance as on 31.03.20
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. MoES PROJECT GRANTS								
A. SCHEME-O-SMART								
Energy (OTEC) & Fresh Water & Development of Offshore Structures	21,406,985	189,100,000	30,027,588	-	103,396,696	20,469,415	182,660	116,485,802
Mining Technology Development and Studies in Gas Hydrates	150,799,034	257,500,000	4,391,539	3,683,091	103,167,884	127,507,778	10,372,655	175,325,348
Development of Manned, Unmanned UWV, Marine Sensors, Ocean Electronics & Acoustics	253,394,716	38,000,000	378	-	78,858,825	60,932,635	8,438,862	143,164,772
Ocean Sciences & Technology for Islands	21,977,461	96,500,000	-	-	72,089,383	5,382,619	2,170,280	38,835,179
Sea Front Facility	127,082,958	-	-	-	3,542,849	-	509,112	123,030,997
Establishment of Ballast Water Treatment Technologies Testing Facility	154,746,326	-	-	-	3,506,976	6,648,852	3,813,747	140,776,751
Acquisition of two Coastal Research Vessels	486,461,751	319,000,000	-	-	63,594,444	656,447,458	3,035,074	82,384,775
Extension of continental shelf & Geoscientific studies of the Exclusive Economic zone	961,881	60,000,000	-	-	36,536,415	13,565	-	24,411,901
Deep Ocean Mission	-	105,000,000	-	-	1,180,614	-	-	103,819,386
Pre-investment activity of the two proposed National Oceanarium @ Puduchery and Diu	4,182,525	-	-	-	187,715	-	188,816	3,805,994
Operation & Maintenance of Research Vessels	-68,590,767	498,909,750	2,674	-	1,125,056,705	189,668	-	-694,924,716
Ocean Observation Network	29,335,729	210,800,000	1,025,419	-	374,452,436	629,931	1,578,849	-135,500,068
B.SCHEME- COASTAL RESEARCH SCHEME								
Seawater Quality Monitoring	1,145,085	-	-	19,333	346,588	-	-	817,830
C.SCHEME - INFORMATION TECHNOLOGY								
Information Technology and E-Governance activities	2,475,106	-	-		717,316	-	-	1,757,790
D.SCHEME - RESEARCH EDUCATION & TRANING OUTREACH								
NIOT-Indacon '2019	63,369	300,000	891		364,260	-	-	-
Preparation of Eleven nos of models	-	2,411,000	-	-	967,600	-	-	1,443,400
International Symposia on "ADCORE IP-2019"	-	4,500,000	735,752		5,235,752	-	-	-
SUB-TOTAL - 1 (A TO D)	**1,185,442,159**	**1,782,020,750**	**36,184,241**	**3,702,424**	**1,973,202,458**	**878,221,921**	**30,290,055**	**125,635,141**
2. OTHER GOVERNMENT GRANTS								
National Post- Doctoral Fellowship	550,474	5,714,760	-	50,182	4,667,313	-	-	1,648,103
India International Science Festival 2017	2,661,796	7,900,000	-	74,955	10,636,751	-	-	-
Protection of beach from sea erosion at selected locations along the coast of Odisha	400,000	-	-	4,476	240,455	-	-	164,021
"Digital Poompuhar" network project	500,000	-	-	10,640	24,361	-	-	486,279
SUB-TOTAL - 2	**4,112,270**	**13,614,760**	**-**	**140,253**	**15,568,880**	**-**	**-**	**2,298,403**
TOTAL-1+2	**1,189,554,429**	**1,795,635,510**	**36,184,241**	**3,842,677**	**1,988,771,337**	**878,221,921**	**30,290,055**	**127,933,544**
PREVIOUS YEAR	**217,080,705**	**2,472,934,709**	**486,031**	**47,437,989**	**998,551,178**	**532,295,484**	**17,538,343**	**1,189,554,429**

Schedule-3

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2020

(Amount in Rupees)

SCHEDULE 4 - CURRENT LIABILITIES & PROVISIONS	31.03.20		31.03.19	
A. STATUTORY LIABILITIES				
Tax Dues	24,124,621		10,489,573	
CPF Contribution	9,956,997		9,642,142	
NPS Contribution	1,279,325	35,360,943	801,423	20,933,138
B.OTHER CURRENT LIABILITIES				
Pay & allowances for the month of March 2020	27,978,146		28,184,337	
Outstanding Liabilities	970,552,501		221,971,065	
Interest Refundable to MoES	47,903,957		-	
Earnest Money & Retention money	122,581,478		75,193,485	
NPS Subscription & Contribution - Legacy	50,579,547		732,115	
Interest on Savings Bank Account Earned during the Year under the programme "Core Grant" refundable to Ministry of Earth Sciences, Government of India transferred to Schedule 4 - Current Liabilities & Provisions (as per schedule 10)	249,306	1,219,844,935	8,470,943	334,551,945
Project Advances *(Vide Sub-Schedule:B)*		988,570,576		1,042,821,106
TOTAL (A+B)		**2,243,776,454**		**1,398,306,189**

Schedule-4

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

T.A.R. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SUB-SCHEDULE:B FORMING PART OF SCHEDULE-4 OF THE BALANCE SHEET AS AT 31ST MARCH 2020

Details / Grants pertaining to	Balance as on 1.4.2019	Add: Receipts			Less: Expenditure			Balance as on 31.03.20
		Received & Receivable	Other Receipts	Interest Earned	Revenue	Capital/WIP	Transfer/Adjustments	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PROJECT ADVANCES								
Scientific and Technical Consultancy Services	155,515,773	93,642,983	14,704,808	-	33,145,736	4,153,951	20,717,659	205,846,218
On Deposit : Installation of 1 lakh litres per day capacity Seawater Low Temperature Thermal Desalination Plants at Agatti, Androtti, Minicoy, Amini, Kiltan & Chetlat Islands	887,305,333	500,000,000	-	44,162,670	125,438,021	523,305,624	-	782,724,358
TOTAL - B	**1,042,821,106**	**593,642,983**	**14,704,808**	**44,162,670**	**158,583,757**	**527,459,575**	**20,717,659**	**988,570,576**
PREVIOUS YEAR	**940,083,693**	**189,820,525**	**-**	**51,751,870**	**21,243,989**	**115,520,993**	**2,070,000**	**1,042,821,106**

Sub-Schedule: B

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

T.A.P. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2020

SCHEDULE 5 - FIXED ASSETS

(Amount in Rupees)

S.No	DESCRIPTION	GROSS BLOCK				DEPRECIATION				Provision for loss / unserviceable assets			NET BLOCK	
		Cost/Valuation as on 01.04.19	Additions during the year	Deletions	Cost/Valuation as on 31.03.20	Upto 01.04.19	Additions during the year	Deletion during the year	Total upto 31.03.20	Upto 01.04.19	Additions during the year	Total upto 31.03.20	As on 31.03.20	As on 31.03.19
A.	**FIXED ASSETS created out of MoES Grants**													
1	**Lands-Freehold**													
	NIOT Campus, Pallikaranai	35,367,827	-	-	35,367,827	-	-	-	-	-	-	-	35,367,827	35,367,827
	Freehold Land -Dollygunj A&N Islands	3,729,070	-	-	3,729,070	-	-	-	-	-	-	-	3,729,070	3,729,070
	Seafront Facility - Land at Nellore, Andhra Pradesh	121,981,248	-	-	121,981,248	-	-	-	-	-	-	-	121,981,248	121,981,248
2	**Buildings**	-			-	-			-	-	-	-	-	-
	Buildings & Infrastructure at NIOT Campus	548,689,759	3,031,394	-	551,721,153	354,810,585	18,818,224	-	373,628,808	-	-	-	178,092,345	193,879,174
	Building at ACOSTI, Port Blair	27,893,543	-	-	27,893,543	21,159,230	678,381	-	21,837,612	-	-	-	6,055,931	6,734,313
3	**Equipment**	-			-	-	-		-	-	-	-	-	-
	General Equipment	155,794,814	2,303,104	-	158,097,918	103,834,338	6,676,469	-	110,510,807	-	-	-	47,587,110	51,960,476
	Project Equipment under MoES Projects Grants	6,256,016,285	1,614,619,813	329,980,584	7,540,655,514	4,456,020,610	328,419,709	-	4,784,440,319	60,952,724	-	60,952,724	2,695,262,472	1,739,042,952
	TOTAL UNDER (A)	**7,149,472,546**	**1,619,954,311**	**329,980,584**	**8,439,446,273**	**4,935,824,763**	**354,592,783**	**-**	**5,290,417,545**	**60,952,724**	**-**	**60,952,724**	**3,088,076,004**	**2,152,695,060**
B	**Capital work in progress**	**1,133,434,809**	**632,769,611**	**1,369,167,502**	**397,036,918**	-	-	-	-	-	-	-	**397,036,918**	**1,133,434,809**
C	**Fixed Assets created out of Scientific & Technical Consultancy Projects**													
1	Scientific & Technical Equipment	138,495,844	4,153,951	-	142,649,795	106,315,039	6,023,390	-	112,338,430	-	-	-	30,311,365	32,180,805
	GRAND TOTAL (A+B+C)	**8,421,403,199**	**2,256,877,873**	**1,699,148,086**	**8,979,132,985**	**5,042,139,802**	**360,616,173**	**-**	**5,402,755,975**	**60,952,724**	**-**	**60,952,724**	**3,515,424,286**	**3,318,310,673**
	PREVIOUS YEAR	**7,844,571,128**	**576,832,071**	**-**	**8,421,403,199**	**4,765,084,679**	**277,055,124**	**-**	**5,042,139,802**	**60,952,724**	**-**	**60,952,724**	**3,318,310,673**	**3,018,533,725**

Schedule-5

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

T.A.R. VARADARAJULU & CO. CHENNAI 600 083. Chartered Accountants

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2020

(Amount in Rupees)

SCHEDULE 6 - INVESTMENTS -MoES Grants	31.03.20	31.03.19
a. Deposits with Banks	84,510,557	1,399,661,818
TOTAL	**84,510,557**	**1,399,661,818**

(Amount in Rupees)

SCHEDULE 7 - INVESTMENTS - OTHERS *(All the investments are with Nationalised Banks in Short Term Deposits)*	31.03.20	31.03.19
a. Funds received for rendering Scientific and Technical Consultancy Services	180,109,372	134,644,225
b. General Reserve Fund	508,530,947	338,309,632
c. Staff Welfare Fund	3,152,613	4,241,249
d. Deposits from other Agencies	856,416,088	807,317,180
TOTAL	**1,548,209,020**	**1,284,512,286**

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT *CHENNAI*

5/8/2020

Schedule-6 & 7

T.M.P. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2020

(Amount in Rupees)

SCHEDULE 8 - CURRENTS ASSETS, LOANS & ADVANCES		31.03.20	31.03.19
A.	**CURRENT ASSETS**		
	Balance with Banks in Savings Accounts	701,064,258	292,342,420
	Bank Fixed Deposits (earmarked for Margin Money for LC Opened)	150,000,000	-
B.	**LOANS AND ADVANCES**		
i	***Capital Advances***		
	Land Acquisition for Sea Front Facility at Nellore, Andhra Pradesh	57,424,945	58,483,793
	Advance to CPWD for Infrastructure	145,254,599	26,911,360
ii	**Staff Advances**		
	Non-Interest bearing Advances to employees	1,563,439	333,977
	Interest bearing Advances to employees	190,281	175,673
iii	***Advances and other amounts recoverable in cash or in kind for for value to be received***		
	Recoverable from Revenue Authorities	24,279,204	23,120,896
	Prepaid Expenses	7,478,748	8,130,195
	Project Advances	255,980,304	46,153,971
	Advance Payment to Suppliers	12,611,520	9,626,409
	Other Receivables	17,099,089	2,445,020
iv	***Interest accrued but not due***	41,570,639	55,823,031
	TOTAL	**1,414,517,026**	**523,546,745**

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

5/9/20

Schedule-8

T.A.P. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF INCOME & EXPENDIUTRE ACCOUNT AS ON 31ST MARCH 2020

(Amount in Rupees)

SCHEDULE 9 - GRANTS	2019-20		2018-19	
Grants-in-aid received from MoES	507,760,000		481,800,000	
Add: Amount of Interest & Other Incomes earned during the year 2018-19	8,470,943		7,952,460	
Less: Interest Earned Surrendered to MoES	5,345,720	510,885,223	-	489,752,460
Less: Amount allocated for Capital Expenditure and transferred to Capital Fund				
(1) Building & Infrastructure Activities at NIOT, Chennai	2,500,000		2,500,000	
(2) General Equipment	7,500,000		7,500,000	
(3) Excess Expenditure incurred during 2018-19	-		129,680,621	
(4) Terminal Benefits to Employees	147,780,000	157,780,000	40,000,000	179,680,621
TOTAL		**353,105,223**		**310,071,839**

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

5/9/2020

Schedule-9

T.R. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT AS ON 31ST MARCH 2020

(Amount in Rupees)

SCHEDULE 10 - INTEREST EARNED	2019-20	2018-19
On Savings Account	249,306	3,532,439
On Term Deposits	-	1,987,531
Interest Earned on Scientific & Technical Consultancy Services	9,882,013	8,709,119
TOTAL	**10,131,319**	**14,229,089**

(Amount in Rupees)

SCHEDULE 11 - OTHER INCOME	2019-20	2018-19
Rent Received	1,317,559	1,145,789
Sundry Receipts	1,025,165	1,805,184
TOTAL	**2,342,724**	**2,950,973**

Schedule-10 & 11

T.A.P. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT AS ON 31ST MARCH 2020

(Amount in Rupees)

SCHEDULE 12 - ESTABLISHMENT EXPENSES	2019-20	2018-19
Pay & Allowances	306,951,941	230,171,379
CPF Contribution	9,956,997	9,642,142
NPS Contribution	14,221,330	8,955,347
Medical Reimbursements	2,533,923	2,459,228
Children's Education Allowance	4,231,800	1,281,770
Leave Travel Concession	3,017,116	4,211,952
TOTAL	**340,913,107**	**256,721,818**

SCHEDULE 13 - ADMINISTRATIVE EXPENSES	2019-20	2018-19
Computer Maintenance/LAN/Software / Maintenance of Plant & Machinery	15,940,555	12,174,230
Electricity & Water Charges	11,079,503	10,271,749
Campus Maintenance Expenses	24,957,691	20,524,106
Vehicles Running and Maintenance	869,737	1,167,542
Conveyance Expenses	1,612,115	808,696
Travel Expenses	4,579,285	3,329,142
Subscriptions to Journals & Bulletins	1,441,974	1,187,114
Expenses on Seminars & Workshops	754,348	249,551
Communication Expenses	1,367,011	993,344
Printing and Stationery	1,939,666	1,788,130
Advertisement & Publicity	149,614	607,245
Rent, Rates and Taxes	2,209,943	2,648,106
Hospitality Expenses	658,375	1,329,162
Professional charges	932,377	1,161,015
Auditor's Remuneration	70,800	88,500
Other Administrative Expenses	1,856,535	1,182,567
TOTAL	**70,419,529**	**59,510,199**

Schedule-12 & 13

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

5/9/2020

T.V. VARADAKUTTI & CO. CHENNAI 600 083. Chartered Accountants

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2020

(Amount in Rupees)

RECEIPTS	2019-20	2018-19	PAYMENTS	2019-20	2018-19
I. Opening Bank Balances (Opening bank balance of Canara bank NPS a/c omitted during the previous year now included Rs.7,32,115/-)	292,342,420	198,510,787	**I. Expenses- Assistance to Autonomous Bodies**		
			a) Establishment Expenses	244,140,468	221,549,828
			b) Administrative Expenses	60,565,118	54,788,041
II. Grants Received			**II. Payments made against funds for various projects**		
a) Assistance to Autonomous Bodies	507,760,000	481,800,000			
b) MoES Project Grants	1,782,020,750	2,458,074,167	a) MoES Project Grants	1,067,866,135	601,726,245
c) Sponsored Project Grants from other sources	13,614,760	17,061,142	b) Sponsored Projects Payments from other sources	19,535,542	32,538,478
d) Deposit from other agencies	500,000,000	107,500,000	c) Deposit from other agencies	118,401,281	27,490,927
III. Scientific & Technical Consultancy Services - RECEIPTS	81,218,839	80,166,838	**III. Scientific & Technical Consultancy Services - PAYMENTS**	50,262,310	38,980,553
IV. Deposits Matured	2,413,196,034	1,963,021,553	**IV. Deposits Made**	1,476,100,418	3,012,379,883
			V. Purchase of Fixed Assets	1,145,803,799	476,422,054
V. Interest Received	115,257,048	37,459,453	**VI. Interest remitted to MoES**	35,635,775	-
VI. NPS Subscriprtion & Contribution Received (Includes amount transferred from CPF Account Rs.6,59,14,788/-)	69,254,833	17,763,734	**VII. NPS Subscriprtion & Contribution deposited to NSDL**	19,407,401	17,982,828
VII. Other Incomes	12,131,215	2,359,940	**VIII. Other Payments**	934,444,417	649,199,253
VIII. Any Other Receipts	86,431,022	61,682,896	**IX. Closing Bank Balances**	701,064,258	292,342,420
TOTAL	**5,873,226,921**	**5,425,400,510**	**TOTAL**	**5,873,226,921**	**5,425,400,510**

For National Institute of Ocean Technology, Chennai

DIRECTOR

As per our Report of even date
For T.A.P. VARADAKUTTI & Co
Chartered Accountants
FIRM REGN.NO.004511S

CA T.A.P.VARADAKUTTI
Partner
M. No: 015316
UDIN: 20015316AAAAAW2090

Date: August 5, 2020
Place: Chennai 600 100

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULE-14 : 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 and accorded renewal of recognition vide letter No. 11/358/98-TU-V dated 18th March 2019 from 1st April 2019 to 31st March 2022.

(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 18th March 2019 has accorded renewal of registration upto 31st March 2022 and availing of exemption for Customs Duty in terms of Government Notifications No.51/96-. Customs dated 23rd July 1996 and subsequent amendments; No.47/2017 –Integrated Tax (Rate) dated 14.11.2017; No.45/2017-Central Tax (Rate) dated 14.11.2017; No.45/2017 Union Territory Tax (Rate) dated 14.11.2017 & G.O. (Ms) No.161 dated 14.11.2017 and subsequent amendments.

(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.

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(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 onwards.

(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 Principles (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 receipt basis.

(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.

4. FIXED ASSETS:

(i) Fixed Assets are carried at cost less depreciation limited to residual value.

(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 specified in Income Tax Act, 1961.

(ii) Depreciation relating to O-SMART Scheme are charged to the assets and deducted from the respective Capital Fund.

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(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.

(iv) Depreciation relating to assets created out of Core Grants are charged to the assets and also shown in Income & Expenditure account.

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) The Institute is receiving fund each year for certain specified project / schemes approved by Ministry of Earth Sciences, Government of India for the purpose of acquiring assets and meeting revenue expenses towards research and development activities of this Institute. The receipts and utilization of these specified funds for the projects/ schemes are shown in Schedule – 3 forming part of Balance Sheet.

(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 income as well as expenditure are charged to Income & Expenditure Account in the year of completion of the project.

8. 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 the resultant difference, if any, is recognised as exchange loss or gain as the case may be.

9. UNIFORM FORMAT OF ACCOUNTS FOR CENTRAL AUTONOMOUS BODIES:

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

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10. 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 paid from the funds created for Terminal benefits.

For NATIONAL INSTITUTE OF OCEAN TECHNOLOGY

DIRECTOR

Date: August 5,2020
Place: Chennai 600 100

As per our Report of even date
For
T.A.P. VARADAKUTTI & Co.
Chartered Accountants
Firm Reg. No: 004511S

CA T.A.P.VARADAKUTTI
Partner
M. No: 015316
UDIN: 20015316AAAAAW2090

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SCHEDULE- 15 : CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS

1. Contingent Liabilities

a. 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. M/s.Williamson & Associates has terminated the contract vide its letter dated 16th October 2018 and NIOT is yet to take its action regarding the above termination letter. NIOT also not yet decided regarding the Pending capital commitment on account of the above contract amounting to Rs.6,76,06,155/- (US$ 8,96,990.25 converted at INR at the exchange rate as on 31st March 2020) being 15.62% of the contract value.

b. Relating to Arbitration award Rs.3,01,99,447/-:
After the expiry of the contract period on 16/12/2013 in respect of the total management contract of vessel Sagar Nidhi by ABS Marine Services Pvt Ltd., the vessel was handed over back to NIOT on 31/01/2014 after the expiry of 46 days and NIOT has invoked the three Performance Bank Guarantees given by ABS Marine Services Pvt Ltd. amounting to Rs.1,12,92,811/- and advance Bank Guarantee amounting to Rs.51,68,477/-. There is an Arbitration award against NIOT but favouring ABS Marine Services Pvt Ltd amounting to Rs.3,01,99,447/- consisting of Rs.1,37,38,159/- towards vessels management charges for 46 Days and Rs.1,64,61,288/- towards refund of Bank Guarantees and further, the award in favour of NIOT and against ABS Marine Services Pvt Ltd. amounting to Rs. 7,95,86,686/- towards damages arising out of the breach committed by ABS Marine Services Pvt Ltd. Since the SLP filled by NIOT in respect of above award is pending for hearing before the Honourable Supreme Court, no adjustments were made in the books of accounts in respect of the above.

c. Contingent Liability in respect of Letter of Credit opened by Bank in favour of NIOT - Rs.14.52 Crores.

d. Capital Commitments not provided for but treated as Contingent Liability:
In respect of Development of Personnel Sphere for Manned Submersible as per MoU between NIOT and VSSC dated 8th May 2019, for the amount of Rs.47.31 Crores, a sum of only Rs.17.00 Crores has been paid as per the demand notes raised by VSSC during the FY 2019-20. The balance sum of Rs.30.31 Crores is a pending commitment of NIOT in the nature of a contingent liability in respect of the above MoU since the payment has to be made by NIOT as and when demand notes are raised by VSSC.

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2. 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. Total accrued liability in respect of retirement gratuity & Leave encashment as per CCS (Pension Rules) provided for in respect of the regular employees of NIOT as on 31st March 2020 is Rs. 24,84,66,407/- comprising of liability in respect of Gratuity Rs.10,56,68,067/- and in respect of Leave encashment Rs.14,27,98,340/-.Out of which NIOT has received MoES Grants towards retirement benefits Rs.18,77,80,000 towards liability upto FY 2017-18 as One time grant for terminal benefits for Gratuity and Leave encashment. The balance of Rs.6,06,86,407/- (including the amount due in respect of FY 2018-19 Rs.3,41,30,129/-) has been provided during FY 2019-20 and included in the establishment expenses in the Income & Expenditure account during the current year. The Actuarial Valuation has not been done for making the above provisions. Further the amount has not been deposited in any specific retirement benefit fund plan but kept in the Fixed Deposits with banks and NIOT is in the process of identifying a suitable Fund Manager for managing the Terminal benefits for Gratuity and Leave encashment

3. Non Settlement of Insurance Claims

a. Total estimated loss of Rs. 21.65 Crores has been reported by NIOT to the insurance Companies during the various periods starting from 2011-12 to 2017-18 but the Insurance companies have not yet settled the claims. Out of loss of Rs. 21.65 Crores, NIOT has already deducted prior to 31.03.2019 a sum of Rs. 4.83 Crores from the Capital Fund account by reducing the same in the Fixed Assets schedule as 'unserviceable assets'. Regarding the balance amount of Rs.16.82 Crores, the competent authority has not yet given its approval for writing off the loss.

b. A sum of Rs.1.26 Crores has already been deducted from the Capital Fund account prior to 31.03.2019 by reducing the same in the Fixed Assets schedule as 'loss of assets' which occurred during sea trials of deep sea mining in FY 2015-16 since the assets were not insured. The competent authority has not yet given its approval for writing off the loss of Rs.1.26 Crores.

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4. MoES Project Grants – Implemented by NIOT and project grants sanctioned and received from Ministry of Earth Sciences

a. During the financial year 2019-20, NIOT received total amount of Rs.178,20,20,750/- (PY 2018-19: Rs.245,80,74,167/-) as Grants-in-aid for various projects under the Scheme.

b. The balance of Rs.12.56 Crores as per Schedule 3 forming part of Balance Sheet is the net amount after deducting negative balances of Rs.69.49 Crores against 'Operation & Maintenance of Research Vessels' and Rs.13.55 Crores against 'Ocean Observation Network' under the Scheme O-SMART.

c. The payments made to Shipping Corporation of India booked under the project 'Operation & Maintenance of Research Vessels' includes Rs.39.71 Crores being payment made during the year towards bills of FY 2018-19. Further the current year bills Outstanding Rs.28.45 Crores has been provided for in the accounts and adjusted in the above project account.

d. Capital Advances comprising of (i.)Advance for Land Acquisition for Sea Front Facility at Nellore, Andhra Pradesh Rs.5,74,24,945/- and (ii.)Advance to CPWD for Infrastructure Rs.14,52,54,599/- and further the Project Advances Rs.25,59,80,304/- and Advance payment to Suppliers Rs.1,26,11,520/- appearing under 'Loans and Advances' in Schedule 8 to Balance Sheet were not adjusted in the expenditure 'Project Equipment/ WIP' under Schedule 3 'Earmarked/ Sponsored Project Funds' since these payments are also made out of the MoES Grants for specific projects under Scheme O-SMART but directly debited to 'Advance Account' and shown under the head Current Assets.

e. Interest Rs.37,02,423/- earned and accrued during the year is refundable to the MoES.

f. Surrender of Interest earned Rs.3,02,90,055/- is the interest refunded during the year.

5. Grant in Aid – Core Grant

NIOT received an amount of Rs.50,77,60,000/- during the financial year 2019-20 (Previous Financial Year 2018-19 : Rs.48,18,00,000/-) as Grants-in-aid towards Manpower, operational expenses and maintenance from the Ministry of Earth Sciences as Core Grant in the form of recurring and non-recurring grants as specified under Schedule-9 forming part of Income & Expenditure account.

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6. Accounting for Depreciation of Rs.36,06,16,173/- in the Fixed Assets Schedule.

a. Depreciation Rs.2,54,94,693/- is charged to Income & Expenditure Account on Assets created out of Core Grant and deducted from the Fixed Assets value shown in Schedule -5 – Fixed Assets forming part of Balance Sheet.

b. Depreciation Rs.32,90,98,090/- is charged against Capital Fund on Assets created out of Scheme O-SMART Grants and deducted from the Fixed Assets value shown in Schedule -5 – Fixed Assets forming part of Balance Sheet.

c. Depreciation Rs.60,23,390/- is charged against Scientific & Technical Consultancy Project Equipment Fund in Schedule 2 forming part of Balance Sheet on Assets created for Scientific & Technical Consultancy Projects and reduced from the Fixed Assets value shown in Schedule -5 – Fixed Assets forming part of Balance Sheet.

7. Interest Earned

a. During the Financial Year 2019-20, the Interest Earned under the MoES Projects for the Scheme : O-SMART Rs.4,48,29,001/- and Core Grant Rs.70,26,684/- amounting to Rs.5,18,55,685/- (Actual Interest Received is Rs.4,79,03,955/- and Interest Accrued is Rs.39,51,729/-) out of which Rs.4,79,03,955/- has been remitted to Ministry of Earth Sciences during the financial year 2020-21 as per GFR Rule 230(8).

b. The amount of Rs.2,49,306/- being Interest earned under Core Grant during the year 2019-20, shown under Current Liabilities since it is payable to the MoES.

8. 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 NIOT 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. However Utilisation certificate for the year ended 31st March 2020 is not yet received and no adjustments made in the books against such advances.

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 NIOT, encumber or alienate any mortgage lien or charge by way of hypothecation, pledge otherwise, or dispose of the

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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.

9. Completed projects dedicated to the Nation for Public use Rs.33.00 Crores

On completion of construction/ laying of Submerged reef in Promenade Beach at Puducherry & Submerged Dyke off Kadalur - Periyakuppam and dedicating the same to the Nation for public use, the amount spent by NIOT out of Grants from MoES under the project titled 'Technology and Development of Offshore Structures' and kept under Project Equipments under Scheme O-SMART has been reduced by Rs.33.00 Crores and correspondingly the Capital Fund is also reduced by the same amount during the year.

10. The total turnover/ gross receipts declared for Scientific & Technical Consultancy Services as per GST Returns filed for FY 2019-20 Rs.10,07,58,686/- is as per the tax invoices raised by NIOT on the clients. However the accounting policy followed by NIOT for accounting Income from Scientific & Technical Consultancy Services is based on Completed Contract method as per Significant Accounting Policies vide Note 3(ii) above.

11. GST ITC short claimed than reported in FORM GSTR–2A auto-populated in the GST Portal by Rs. 25,85,90,949/- during the FY 2019-20. Similarly GST Input short claim as reported in FORM GSTR-2A in earlier years are as follows:
FY 2018-19: Rs.19,55,52,310/-
FY 2017-18: Rs.9,73,05,178/-
Since GST Input as reported in FORM GSTR-2A being short claim is on account of GST Paid by NIOT on Inward Supplies of Capital Goods and Other Expenditures for various projects done out of Earmarked/ Sponsored Project Grants of MoES are debited/ absorbed in the relevant project expenditure account including the GST Paid to the suppliers on account of the project and not claimed as Input to be adjusted against the GST Payable by NIOT.

12. Taxation

Since NIOT is registered under section 12AA of the Income Tax Act, 1961 and in view of there being no taxable income under Income Tax Act, 1961; no provision for Income tax has been considered necessary.

13. Bank A/c No. 2874101012336 in the name of NIOT NPS ACCOUNT maintained at Canara Bank, NIOT Campus, Pallikaranai, Chennai – Opening Balance as per Bank statement as on 01/04/2019 Rs.7,32,115 is brought into account only in the current year, which was not reflected in the Balance Sheet of earlier years. A sum of Rs.6,59,14,788/- has been transferred from CPF Account to NPS Account comprising of both NIOT's Contribution and Employees Contribution

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since employees were transferred from CPF Scheme to NPS Scheme since the employees joined NIOT after 1st January 2004.

14. Figures shown in the accounts are rounded off to the nearest rupee.

15. Previous year figures have been regrouped / reclassified wherever necessary.

16. Schedules 1 to 15 are annexed to and form an integral part of the Balance Sheet as at 31st March 2020, Income and Expenditure Account and Receipts and Payments account for the year ended on that date.

Signatures to Schedule **1** to **15**

For NATIONAL INSTITUTE OF OCEAN TECHNOLOGY

DIRECTOR

Date: August 5, 2020
Place: Chennai 600 100

As per our Report of even date
For
T.A.P. VARADAKUTTI & Co.
Chartered Accountants
Firm Reg. No: 004511S

CA T.A.P.VARADAKUTTI
Partner
M. No: 015316
UDIN: 20015316AAAAAW2090

A round table discussion on "Shore Protection and Remediation using Ecofriendly Alternative Designs" (SPREAD 2019) was organized at NIOT on 16th December 2019 to disseminate the experience and knowledge gained through the implementation of the shore protection measures in Puducherry and Kadalur Periakuppam.

The Central Indian Ocean (IOCINDIO) Leadership Workshop for Developing the "Regional Framework for Coastal Vulnerability towards the Safety, Security & Sustainable Development of Member States in the Indian Ocean" was conducted at NIOT during 06-07 January 2020.

International Women's Day was celebrated on March 10, 2020 at NIOT. Mrs.Anitha Atmanand graced the occasion as the Chief Guest. Various competitions were organized and prizes were given.

Autonomous Coring System (ACS) deployment

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