Celebrating 25 Years
NIOT
NATIONAL INSTITUTE OF OCEAN TECHNOLOGY · CHENNAI ·

"Surging from the silver year in the oceans towards the golden"

ANNUAL REPORT 2018-19

National Institute of Ocean Technology

(Ministry of Earth Sciences, Govt. of India)

"Atal Centre for Ocean Science and Technology for Islands" (ACOSTI) in Port Blair was dedicated to the Nation, by Dr. Harsh Vardhan, Hon'ble Union Minister for Science & Technology and Earth Sciences, Govt. of India, on 15th September 2018.

New Coastal Research Vessel (CRV) SAGAR TARA was successfully launched on 25th December, 2018 by Smt.Nutan Goel, wife of Dr.Harsh Vardhan, Hon'ble Union Minister for Science & Technology and Earth Sciences, Govt. of India

"Surging from the silver year in the oceans

Dr. Harsh Vardhan, Hon'ble Union Minister for Science & Technology and Earth Sciences, Govt. of India, has dedicated the restored beach at Puducherry to the Nation on 24th January 2019 in the gracious presence of Dr.Kiran Bedi, IPS, (Retd.) Hon'ble Lt. Governor of Puducherry and Hon'ble Chief Minister Sri V. Narayanaswamy. He also dedicated the restored beach at Kadalur Periyakuppam.

INSTITUTE AT A GLANCE

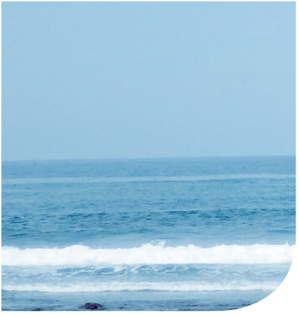
Organization

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

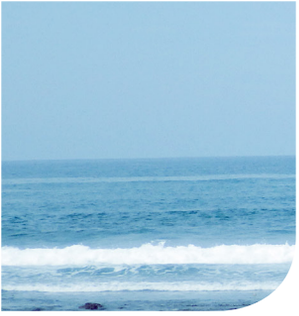
- To develop world class technologies and their applications for sustainable utilization of ocean resources.
- To provide competitive, value added technical services and solutions to organizations working in the oceans.
- To develop a knowledge base and institutional capabilities in India for management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



MEMBERS OF THE GOVERNING COUNCIL AND THE GENERAL BODY OF NIOT FOR THE YEAR 2018-19

Sl.No.	Name	Designation
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
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.Bhaskar Ramamurthy** Director, IIT Madras	Member From 30th May 2017 To 8th May 2018
	Dr.S.A.Sannasiraj HOD, Dept. of Ocean Engg., IIT Madras	Member From 9th May 2018
7.	**Dr. O.R.Nandagopan** Director, NSTL, Vizag	Member From 30th May 2017 Till 8th May 2018
8.	**Shri Kedarnath Shenoi** Director, NPOL, Kochi	Member From 30th May 2017 Till 8th May 2018
	Shri.S.Anantha Narayanan Former Director, NPOL, Kochi	Member From 9th May 2018
9.	**Dr.M.V.Ramana Murthy** Director, NCCR, Chennai	Member From 30th May 2017
10.	**Dr.M.P.Wakdikar** Advisor, Ministry of Earth Sciences, New Delhi	Permanent Invitee From 30th May 2017
11.	**Dr.B.N.Suresh** Former Director, ISRO	Member From 9th May 2018
12.	**Representative,** Niti Aayog, New Delhi	Permanent Invitee From 30th May 2017
13.	**Dr.M.A.Atmanand** Director, NIOT, Chennai	Member Secretary From 8th February 2018

TABLE OF CONTENTS



FROM THE DIRECTOR'S DESK

It is with a great zeal of happiness, that I present the Annual Report of the activities of the National Institute of Ocean Technology (NIOT) during 2018-19, the Silver Jubilee year. NIOT is the first autonomous body started, in November 1993 under the erstwhile Department of Ocean Development, Government of India (now the Ministry of Earth Sciences) and it is my privilege to present the report during its 25th year of celebration recording remarkable achievements and highlighting such as an array of technology demonstrations, societal programs, conferences, symposia and visits of several national and international dignitaries, which have showcased the performance of NIOT towards achieving national goal.

To cater to the demands of an island community and to demonstrate the technology on renewable ocean energy, NIOT has commenced work on Ocean Thermal Energy Conversion (OTEC) based desalination plant in Kavaratti, Lakshadweep islands. The Foundation Stone for the same was laid by the Honorable Union Minister for Earth Sciences (HMoES), Dr. Harsh Vardhan on the 22nd of October 2018. The first prototype wave-powered navigational buoy was augmented with oceanographic instruments and demonstrated off Kamarajar Port, Chennai. The tender to identify the industry to establish two numbers of 1 MLD (Million Litre per Day) Low Temperature Thermal Desalination plants using the waste heat from Tuticorin Thermal power plant is being issued.

The inter-ministerial activity towards delivering fresh water to the island community with the well-demonstrated technology of NIOT is in full swing with the work on installation of Low Temperature Thermal Desalination Plant in the six islands of Lakshadweep, namely Amini, Kadamat, Chetlat, Kalpeni, Kiltan and Androth proceeding well. Towards the restoration of the lost beach along the coastal stretch of Pondicherry, construction of the submerged steel reef structure, the first of its kind was completed and installed in August 2018 and more than 60 m stretch of beach is reclaimed. As Pondicherry is a tourist city, this received much appreciation from the general public, the Government of Puducherry and the media. The restored beach was dedicated to the nation by the HMoES Dr. Harsh Vardhan on January 24, 2019 in the presence of the Lt. Governor and Chief Minister of Pondicherry as well as the Secretary, MoES.

Another sustainable, environment friendly measure for beach restoration was achieved in Kadalur village, along the Tamil Nadu coast, by successfully demonstrating submerged dyke based

methodology in open coastal waters for the first time in the country. This was dedicated to the nation by the HMoES Dr. Harsh Vardhan on January 24, 2019 in the presence of the Secretary, MoES. Seabed Investigations for the Government of Gujarat as well as the Hydrodynamic and Sediment Model Studies for the Gulf of Khambhat were conducted. The final report also was submitted.

Towards the realization of Manned Submersible for carrying three personnel to the depth of 6000 m, the preliminary design for the subsystems under mechanical, electrical, electronics and life support systems to proceed for critical design was completed. Based on this, vehicle hydrodynamic shape, mass budget and general arrangements drawings are finalised. Shallow water ROV was utilized for search operation to locate NSTL missing object in the Bay of Bengal and for underwater inspection at sea water intake sump at Kalpakkam for the first time after 40 years of its construction. As an inter-institutional activity, shallow water ROV is developed for CMLRE, Cochin for biodiversity observations.

To harvest the non-renewable resources of manganese nodules, a reduced undercarriage system of the underwater mining machine for polymetallic nodule mining from deep sea, was tested on soft soil with an in-house developed sinkage prevention mechanism. A new deep sea winch with 7000 m electro-optic umbilical cable was installed and commissioned on-board the Ocean Research Vessel, Sagar Nidhi in Dec 2018 for deployment and operation of the mining machine. Medium Voltage Variable Frequency Drives of 250 and 500 kVA were tested successfully and realized for mining machine operation. An improved in-situ tester for 6000 m depth operational capability also was developed with independent shear vane and penetration cone arrangement for evaluation and measuring the seabed soil strength properties.

A Buried Object Detection Sonar (BODS) was developed by incorporating an upgraded transmitter array jointly with Bharat Electronics Ltd. (BEL), Bangalore. With this up-gradation, the system capability for detection of buried objects is increased to 6 m below the sea floor when compared to the earlier version capability of 2 m below the sea floor.

Development of 500m workable Deep Sea Autonomous Underwater Profiling Drifter (D-AUPD) was completed and it was field tested in Bay of Bengal (BoB) off Chennai at 60m water depth.

As an Inter institutional work with National Centre for Polar and Ocean Research, Goa, NIOT successfully deployed an autonomous passive acoustic monitoring system in an independent mooring at 200m depth, near the IndArc mooring, in the Kongsfjorden, Arctic on 16th July 2018. A Deep ocean ambient noise measurement system was successfully incorporated in the OMNI buoy mooring and deployed at AD09 location (Lat 8.14 N Lon 73.18E) in the Arabian Sea. Also an enhanced Vector Sensor array along with compass and tilt sensor was deployed off Chennai for source localization applications. On 25th September 2018, the Secretary, MoES Dr. M.Rajeevan released the Online Laboratory and Quality Management system that was developed in-house, for the NABL accredited Acoustic Test Facility.

We could successfully continue to maintain the Indian Moored Buoy Network (12- Deep Ocean and 4-Coastal, 4-Tsunami and 1-CALVAL) and provide support to NOAA/PMEL for the maintenance of the RAMA buoy network. OMNI buoys provided significant observations during cyclones. Tropical cyclone heat potential data were provided to IMD during cyclones. The best operational practices and quality control processes followed by the Indian moored buoy system had helped to achieve an average met-ocean data return of 90%. Dr. M. Rajeevan, Secretary, MoES, inaugurated the Centre for Ocean Realtime iNformation viEw and Archives (CORNEA) facility at the shore-station of NIOT on 24th January 2019.

An MOU was signed with the Virginia Institute of Technology (VIT) for undertaking joint collaborative work for Ocean Technology related activities. We could Support national and international organizations in the deployment of moorings such as OceanSITES (AD07 buoy), technical and operational support and cruise participation to WHOI mooring, USA and in the deployment of Flux Buoy in Bay of Bengal.

The Atal Centre for Ocean Science and Technology for Islands, Port Blair in Andaman and Nicobar Islands is declared as the nodal agency by A&N Administration for propagation of Open Sea Cage Culture and Seaweed culture technology. We were able to extract Scytonemin, an anti UV compound from cyanophycean microalgae which was isolated from the sea ice of Nella Fjord, Antarctica. A novel species of bacteria of the genus Bacillus was isolated from deep sea sediment from 1870 m depth off Andaman Sea and named Bacillus andamanensis sp. nov.

The new Coastal Research Vessel (CRV), Sagar Tara was launched in accordance with the ship building traditions on 25th December, 2018 at 04:00 hrs by Smt. Nutan Goel, wife of Dr.Harsh Vardhan, Hon'ble Union Minister. A letter of appreciation was received from Indian the Coast Guard for Vessel Management Cell team and the crew of Sagar Manjusha for contribution towards Maiden joint exercise of the Coast Guards of India and Vietnam "Sahyog HOP TAC 2018" held in the BoB on 5th October 2018.

Towards indigenisation efforts, technology Licensing Agreements have been signed with Indian Industries for commercialisation of Remotely Operable Vehicle (ROV) technology, indigenously developed Drifting Buoys with INSAT Communication, Wireless Expendable CTD system and Robo Coastal Observer (RCO) through the National Research Development Corporation, New Delhi.

The Master plan for Seafront Research Facility (SRF) at Pamanji and Facility for Administrative, Computational and Training (FACT) at Chittedu site was finalized and approved by the Project Review Coordination Committee during September 2018. Securing the campuses comprising compound wall, fencing and allied infrastructural facilities for both Pamanji and Chittedu sites was completed during August 2018. Testing facility for conducting the algal culture, consisting of raceway ponds, store room and pump room was completed for taking up further research activities.

All the above achievements were possible because of the highly dedicated NIOT's personnel working together towards the common goal of achieving the country's demands in the ocean technology sector in delivering the product as well as capacity building in the country.

NIOT won many accolades and National Research Development Corporation's "National Societal Innovation Award 2018" for the "Development of Polar and Shallow water ROV" is worth mentioning.

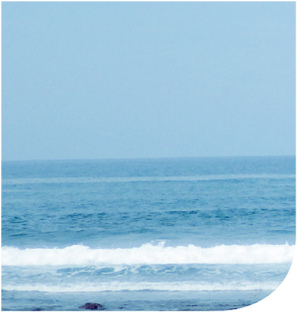
On the occasion of this glorious year of Silver Jubilee celebrations, I express my deep sense of appreciation to the scientific and administrative community of NIOT for their untiring efforts in demonstrating critical technologies for the benefit of the country's growth. I am very thankful to Dr.M. Rajeevan, Secretary, Ministry of Earth Sciences, and his team of scientists at program division, for providing administrative and financial guidance in the various ongoing activities of NIOT. I would like to thank also the members of Governing Council, Finance Committee, Scientific Advisory Council and other review boards for their constant support and advice. I place on record my sincere thanks to my colleagues at MoES and other sister institutions for all support rendered during the reporting period of 2018-19.

I will be failing in my duty if I don't thank the editorial team under Dr.Latha who did an excellent job in compiling painstakingly the input from various groups of NIOT.

(M.A.ATMANAND)

MAJOR ACCOMPLISHMENTS OF THE YEAR 2018-19

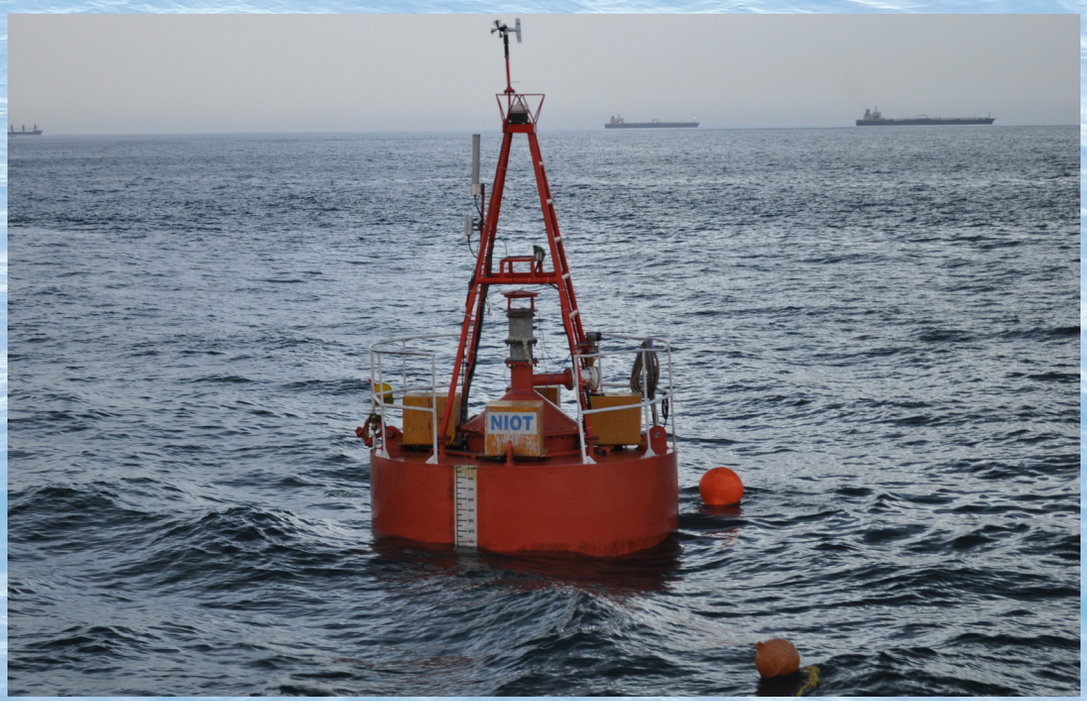
- Foundation stone for OTEC powered LTTD plant was laid on 22nd October 2018 at Kavaratti by HMoES.
- Wave powered navigational buoy was successfully demonstrated with the integration of oceanographic instruments off Kamarajar port, Chennai.
- Successful construction and launching of submerged steel reef weighing 900T was achieved during August 2018 for restoration of beach at Puducherry. A wide beach to an extent of 60m was formed and dedicated to the nation by HMoES on 24th January 2019. The formed beach is being widely used by public and tourist for recreation purpose.
- Successful demonstration of submerged dyke for providing a sustainable environmentally friendly measure for beach restoration of Kadalur coastal villages was accomplished for the first time in open coastal waters. Beach restored at Kadalur villages was dedicated to the nation by HMoES Dr.Harsh Vardhan on 24th January 2019 in the presence of Secretary, MoES.
- General arrangements of subsystems and Preliminary design for the Mechanical, Electrical, Electronics and Life support systems of the 6000m metre depth rated manned submersible were completed in-house.
- NIOT team won the National Research Development Corporation's 'National Meritorious Invention Award 2018' for the development of Polar and Shallow water ROV. Award was presented by Dr. V K Saraswat, Hon.member of NITI Aayog, Govt. of India, on 30th March 2019 at Ahmedabad. An agreement for transferring Remotely Operated Vehicle technology to M/s Bharat Electronics Limited, Bangalore, on non-exclusive basis through NRDC, was signed during the ceremony.
- Underwater search operation of NSTL object using the Shallow water ROV was conducted at a depth of 70m in Bay of Bengal during March 2019 and Underwater inspection at Madras Atomic Power Station (MAPS) sea water intake sump at Kalpakkam brought out abundant growth of fauna in the pipes.
- A new deep sea winch with 7000 m electro-optic umbilical cable (6000 m depth rated) has been installed and commissioned on-board Sagar Nidhi in December 2018.
- Up gradation of Buried object scanning sonar has resulted in detection of objects buried up to 6 m below sea bed, compared to earlier 2 m.
- Spar type open fish cage culture system was demonstrated at Andaman Islands, subsequently development of rigid spherical type fish cage systems and internet of things (IoT) based biomass estimation system is in progress.
- The Ocean Acoustics team of NIOT, with the support of OOS team and NCAOR, has successfully deployed an autonomous passive acoustic monitoring system in an independent mooring at 200m depth, near the IndArc mooring, in the Kongsfjorden Arctic on 16th July 2018.



- Deep ocean ambient noise measurement system was successfully incorporated in the OMNI buoy mooring and deployed at AD09 location (Lat 8.14 N Lon 73.18E) in the Arabian sea.
- OMNI buoys provided significant observations during cyclones. Buoys along Fani Cyclone path helped in saving millions of lives. Successfully developed Robo Coastal Observer (RCO) and its Technology was transferred to industry through NRDC at Hyderabad on 27th April 2018.
- Scytonemin, anti UV compound was extracted from cyanophycean microalgae isolated from the sea ice of Nella Fjord, Antarctica.
- Atal Centre for Ocean Science and Technology for Islands, Port Blair was inaugurated by HMoES on 15th September 2018 and it has been declared as the nodal agency by A&N Administration for propagation of Open Sea Cage Culture and Seaweed culture technology at Andaman and Nicobar Islands.
- New Coastal Research Vessel (CRV) Sagar Tara was successfully launched on 25th December, 2018 by Smt.Nutan Goel, wife of Dr.Harsh Vardhan, Hon'ble Union Minister as per the ship building traditions.

ENERGY AND FRESH WATER

Stone laying ceremony for OTEC powered LTTD plant at Kavaratti



Demonstration of wave powered navigational buoy with oceanographic instruments at navigational channel of Kamarajar Port, Chennai

ENERGY AND FRESH WATER

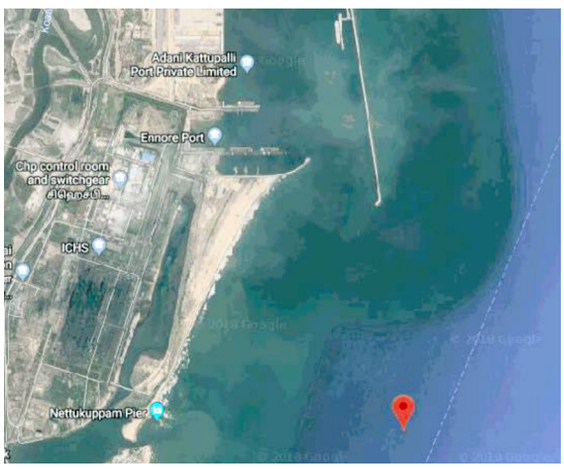
The mandate of the programme is to develop technologies related to harnessing of ocean renewable energies and generating fresh water from the ocean. Development of technologies for Low Temperature Thermal Desalination (LTTD) using coolant water discharge from thermal power plant and offshore deep sea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

Wave energy powered navigational buoy

Continuing with the development towards small capacity off-grid wave energy devices and for industry usage, a wave powered navigational buoy with the integration of additional oceanographic instruments was successfully demonstrated. The buoy was in continuous operation during August - November 2018 near the navigational channel of Kamarajar Port in Chennai. This wave energy device consists of floating body, oscillating water column, power module comprising of turbine and generator assembly and battery charging electrical system. A single unit unidirectional impulse turbine (UDI), which works only in exhaling stroke of OWC, along with Permanent Magnet Direct Current Generator (PMDC) makes the power module of the wave powered navigational buoy.

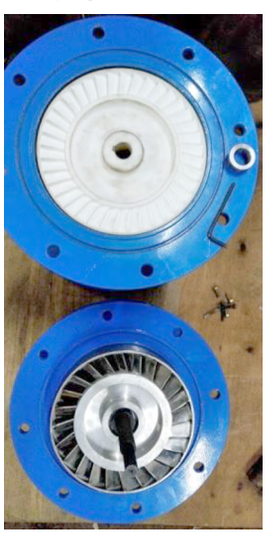
Electricity generated is used for powering beacon lamp and oceanographic sensors (wind & water current) housed on the buoy. Measured oceanographic parameters are transmitted hourly to port authorities through GSM communication by in-house developed data-logger system. Besides serving the purpose as a navigational aid, the buoy is also useful for real time assessment of these oceanographic parameters. This completely indigenous navigational buoy can be an option to imported ones. It is also planned to give a few more such buoys to other ports for testing. Transfer of technology to industries is currently underway.

Towing of the buoy to site

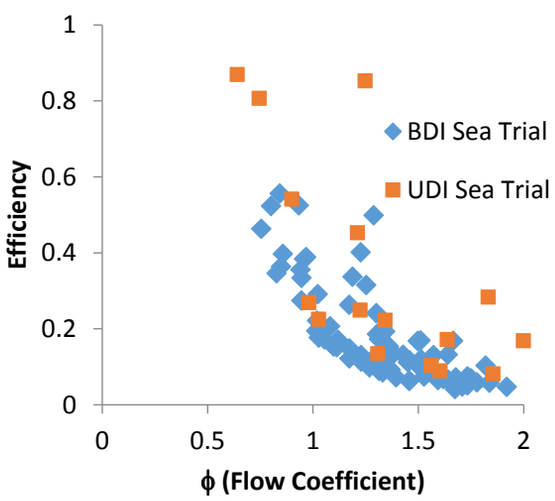


Deployment site (~ 17 m depth, 3.5 km off port)

Unidirectional turbine



Bidirectional turbine



Performance analysis of power module

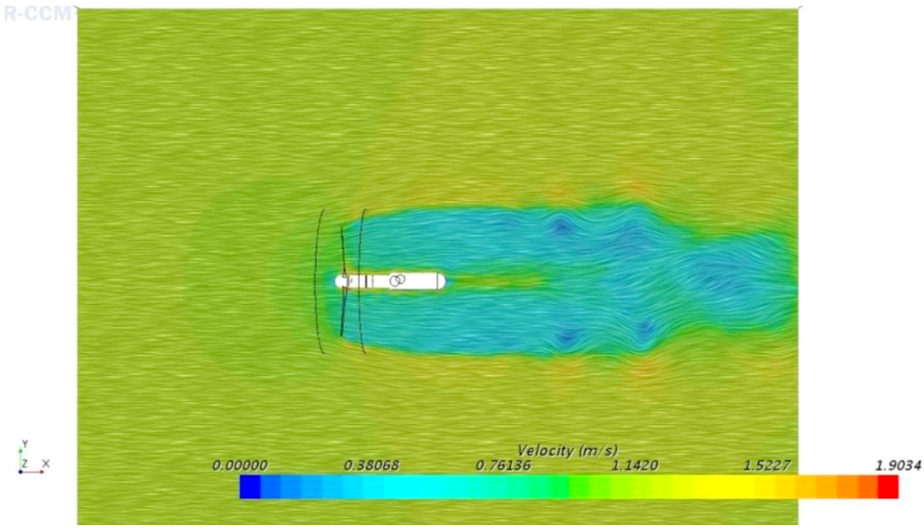
Turbine development for wave energy device

In collaboration with IIT- Madras a new bidirectional impulse (BDI) turbine with matching damping characteristics of the existing unidirectional impulse (UDI) turbine of diameter 196 mm was developed, fabricated and tested in oscillating airflow test rig at IIT Madras. The BDI turbine has been designed using multi-objective optimization technique and hybrid genetic algorithm. This turbine along with existing single UDI was tested in real conditions by fitting them on the wave powered navigational buoy. Higher rotational speed and efficiency was observed for the UDI turbine for given range of pressure drop and flow coefficient of the turbine. A 5 kW BDI turbine has also been designed based on the outcome of laboratory and field trials. In a separate study, in order to enhance the energy conversion further, a new power module with a twin unidirectional turbine of diameter 196 mm was designed and fabricated and mechanical run test has been completed. The end objective is to compare performance of the two power modules a) twin unidirectional and b) bidirectional for scaling up.

Harnessing hydrokinetic energy in ocean currents

CFD studies of axial flow tidal turbine

As part of the joint development work on axial flow turbine with University of Edinburg, UK the axial flow turbine of 1.2 m diameter was analysed based on the details provided for studying the loads over blade span for structural design. Performance evaluation of the turbine using Imposed speed approach and Dynamic Fluid Body Interaction (DFBI) studies were carried out in CFD. A meeting was held during 19-20 April 2018 at the University of Edinburgh which was attended by all consortium partners of the project including a scientist from NIOT. Numerical, experimental and field results and findings from all the partners were presented and discussed during the meeting. Subsequently, experimental values have now been shared by the University which is being used for comparison of turbine performance characteristics arrived at from NIOT CFD studies. These data are being incorporated for further improvement in the CFD model.



Velocity vectors in the CFD model along the flow domain

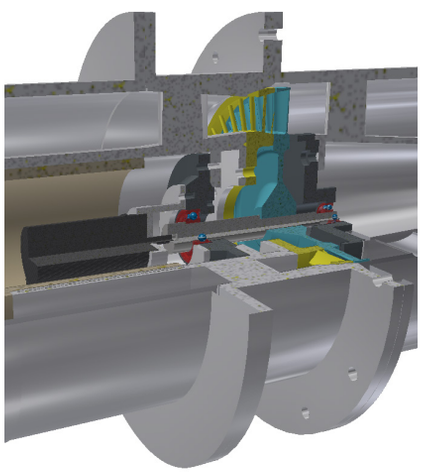
OTEC powered desalination plant at Kavaratti

Towards efforts for establishment of the proposed OTEC powered desalination plant at Kavaratti, several activities were taken up. Detailed survey report including report for EIA clearance was prepared. Land survey was carried out for assessing plant construction activities. Memorandum of Understanding (MoU) with U.T. Lakshadweep Administration was signed on 21st May 2018 at MoES, New Delhi. A detailed EIA report was submitted to LCZMA for clearance and subsequently a meeting with LCZMA was held on 29th Sep 2018. Simulations were carried out in CORMIX for predicting the dispersion and dilution of discharged cold water for the finalization of the EIA document. The foundation stone for the plant was laid at the project site on 22nd October 2018 by Hon'ble Minister of Earth Sciences. Administrative Order for the project has now been issued. Detailed tender specifications for all the disciplines are under advanced stage of preparation.

OTEC-Desalination laboratory at NIOT

Experiments were carried out in the laboratory for the assessment of various components of Open cycle OTEC and LTTD system. Fresh water and electricity were generated in the laboratory during the period under report. The leakages and other issues are being addressed for improving turbine performance.

Open Cycle OTEC power module under testing

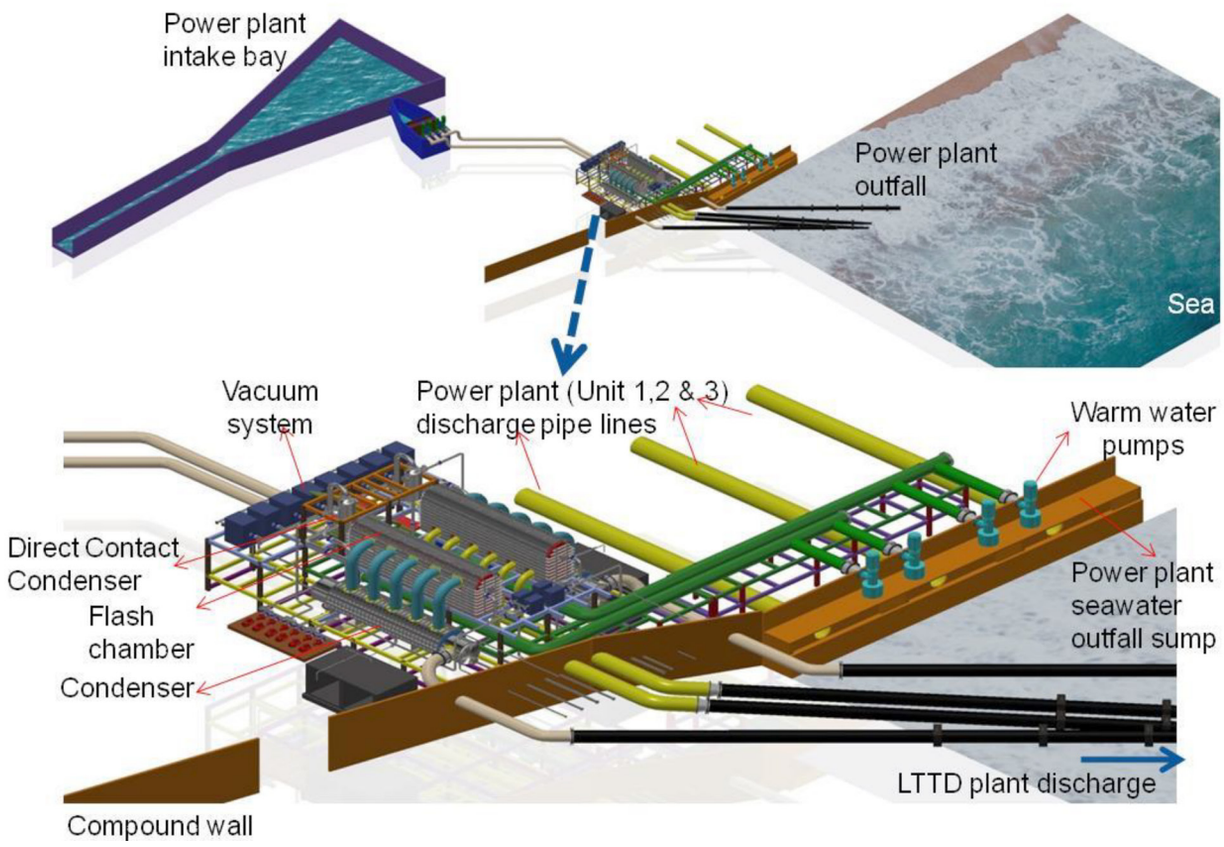


CAD image of Turbine assembly

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

As part of setting up of a LTTD plant of 2x1 MLD capacity in Tuticorin thermal power station (TTPS), the tender document (NIT) was prepared by NIOT and floated in NIC portal on 20.09.2018 after undergoing various reviews from Independent External Monitors (IEMs), expert appointed by MoES and Technical Evaluation Committee (TEC) members. A site visit for the potential vendors was arranged on 09.10.2018. A pre-bid meeting was arranged at NIOT on where the bidder's

clarifications were addressed. Based on the Pre-Bid meeting decisions, the NIT and drawings were revised and uploaded in NIC portal on 05.03.2019.



Overall plant layout

OCEAN STRUCTURES AND ISLAND DESALINATION

Dedication of restored beach at Puducherry by HMoES, Dr. Harsh Vardhan

A view of the Puducherry beach after successful launching of Submerged Steel Reef

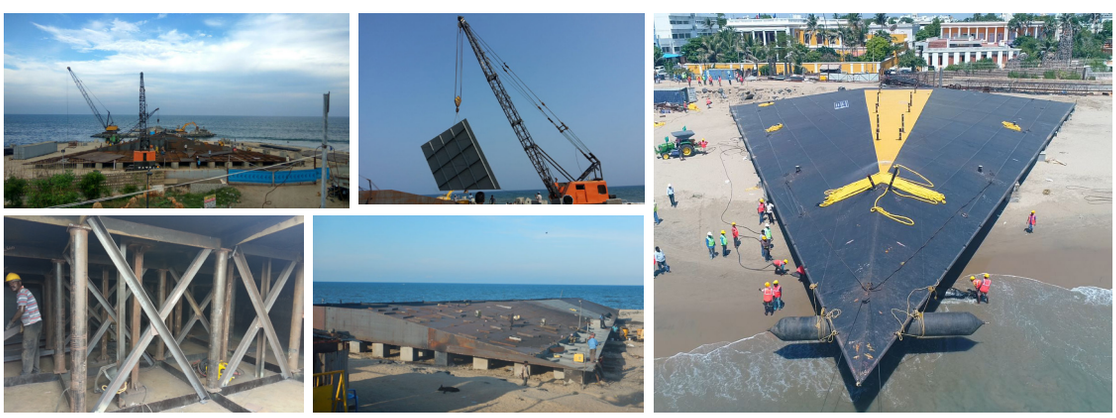
OCEAN STRUCTURES AND ISLAND DESALINATION

Under this programme, the following major activities are being carried out.

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

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

The coastline of Puducherry has suffered from severe erosion due to natural and anthropogenic activities. MoES-NIOT was requested by the Puducherry government to restore the lost beach along Puducherry city. Based on extensive scientific studies, Northern near shore reef and Southern offshore reef along with beach nourishment was proposed for restoring the lost beach along Puducherry. MoES-NIOT took up the implementation of the northern reef at a cost of Rs.25 crores. The construction activities were initiated in May, 2017 and were completed by August, 2018. As a part of this project, a wedge shaped steel reef weighing 900T was constructed at the shore and launched into the sea by adopting indigenously developed methodology. The southern offshore reef is taken up by Puducherry Government under smart city project with technical support from MoES-NIOT. A wide beach has formed as a result of the project that supports the overall well-being of the coastal



Construction and Launching of the Steel Reef

environment and also expects to improve tourism potential. The beach is being monitored regularly with periodical surveys of near shore topography, bathymetry and oceanographic parameters.

A workshop was conducted by NIOT on 11th October 2018 and presided over by the Hon'ble Lt. Governor of Puducherry, to disseminate the design philosophy and institutional knowledge gained through the implementation of the project. Hon'ble Minister for Earth Sciences formally dedicated the project on 24th January 2019 in a function held at Puducherry. The project has been appreciated by the public, media, civil society and government officials alike.

Union Minister praises NIOT for beach restoration

Says it is proof of excellence in science

Mission accomplished: Union Minister Harsh Vardhan inaugurating the restored Puducherry beach on Thursday. L-G Kiran Bedi, left, and Chief Minister V. Narayanasamy are with him. • S.S. KUMAR

SPECIAL CORRESPONDENT
PUDUCHERRY

Union Minister for Science and Technology Harsh Vardhan on Thursday showered praise on the National Institute of Ocean Technology (NIOT) for its beach restoration work in Puducherry. He said it was an example of India's success story in the field of science and technology.

Inaugurating the restored beach, Dr. Vardhan said the project was an example of innovative science and the outcome was there for everyone to see. NIOT, which completed the restoration work, had executed similar projects in other parts of the country.

He said that India was ranked among the top 10 nations in the world in the field of science and technology.

While India was caught unawares during the 2004 tsunami, now its early tsunami warning system was now ranked among the best in the world.

India was ranked fourth in the world in weather forecast, third in nanotechnology and sixth in scientific publications.

Dr. Vardhan said steps would be taken for extension of the beach by creating another artificial reef on the southern side.

"I will pursue this project with officials in the Ministry and ensure that the beach is extended on the southern side," he said.

App for good deed

The Minister urged people to take care of the Green Social Responsibility and perform at least one "Green Good Deed" every day to bring about significant changes in the environmental conditions. "After a lot of research, the Ministry has come up with more than 700 small acts that can help improve our environmental conditions. We call them the Green Good Deeds. If every citizen can pursue at least one green good deed every day that would be of immense benefit to our future generations. The app is available in Google Play Store and the App Store," he added.

Funds sought

Lieutenant Governor Kiran Bedi called upon the Ministry of Earth Sciences to allocate adequate funds for extension of the beach on the southern side. Terming it as a worthwhile investment, Ms. Bedi said the beach was the economic backbone and ambassador of the Union Territory and the investment could be recovered in a few years. She said that dredging must be done only by the Government of India and the work could be entrusted to the NIOT.

Chief Minister V. Narayanasamy said that the government was planning to start container movement from Chennai to Puducherry after the capital dredging.

The government was also planning to extend the Beach Promenade till Muthialpet, he said.

Minister for Social Welfare M. Kandasamy; Chief Secretary Ashwani Kumar; M. Rajeevan, Secretary, Ministry of Earth Sciences; M.A. Atmanand, Director, NIOT; and M.V. Ramana Murthy, Director, National Centre for Coastal Research; were present.

The Hindu, 25 January 2019

THE TIMES OF INDIA, CHENNAI | PUDUCHERRY | VELLORE | NEYVELI
FRIDAY, JANUARY 25, 2019

TIMES REGION

Will be one of top three scientific countries by 2030: Harsh Vardhan

Bosco.Dominique
@timesgroup.com

Union minister Harsh Vardhan dedicating the northern nearshore reef established at a cost of Rs 25 crore as a part of the beach restoration project in Puducherry on Thursday.

Puducherry: Union science and technology, environment, forest and climate change and earth sciences minister Harsh Vardhan said India will be one of the top three scientific countries in the world by 2030. The minister was in Puducherry to dedicate the northern nearshore reef established at a cost of Rs 25 crore as a part of the beach restoration project.

"This model (beach restoration project) we are trying to make, is not a success story for India but for the whole world. National institute ofocean technology has done an extraordinary study evolving an extraordinary way for the restoration of the beach," he said.

Vardhan praised India's Tsunami early warning system saying that India has been rated as the best and number one in the world in tsunami early warning system."We were caught unaware when 2004 tsunami struck. Now in 2019, we are rated as the best and number one in issuing tsunami early warnings in the world. We never gave a false tsunami warning so far," he said.

Lauding the coutry's achievements in technology, he said India was ranked fourth in the world in weather and cyclone forecast.

"We have the best fleet of research vessels in the world next only to the United States, UK and Japan. We launched a research vessel last month and will be launching one more research vessel shortly. Similarly, we are ranked third in nanotechnology and sixth in scientific publication in the world," he said.

Lieutenant governor Kiran Bedi and chief minister V Narayanasamy also spoke at the function.

Times of India, 25 January 2019

செயற்கை கடற்கரை அர்ப்பணிப்பு விழா

■ புதுச்சேரி கடற்கரையில், செயற்கை மணற்பரப்பை, மத்திய அமைச்சர் ஹர்ஷ வர்தன், பொதுமக்களுக்கு அர்ப்பணித்து, கல்வெட்டை திறந்து வைத்தார். அருகில், கவர்னர் கிரண்பேடி, முதல்வர் நாராயணசாமி, அமைச்சர் கந்தசாமி.

புதுச்சேரி, ஜன. 25–

புதுச்சேரி கடற்கரையில் உருவாக்கப்பட்ட செயற்கை மணல் பரப்பை, மத்திய அமைச்சர் ஹர்ஷ வர்தன், பொதுமக்களுக்கு நேற்று அர்ப்பணித்தார்.

புதுச்சேரி கடற்கரையில், முன்பு இருந்த அழகிய மணல் பரப்பு, கடல் அரிப்பு காரணமாக அழிந்து போனது.

கடற்கரையில் மீண்டும் மணல் பரப்பை உருவாக்க மத்திய அரசின் புவி அறிவியல் அமைச்சகம், தேசிய பெருங்கடல் தொழில்நுட்ப நிறுவனம் இணைந்து, 25 கோடி ரூபாய் செலவில், கடற்கரை மறு சீரமைப்பு திட்டத்தின் கீழ் செயற்கை மணல் பரப்பை உருவாக்க முடிவு செய்து, அதற்கான பணிகளை கடந்த இரண்டு ஆண்டுகளாக மேற்கொண்டு வந்தது.

அதன்படி, புதுச்சேரி தலைமைச் செயலகம் எதிரில், கடற்கரையில் இருந்து, 120 மீட்டர் தூரத்திற்கு, முக்கோணம் போன்ற அமைப்பு உருவாக்கப்பட்டது.

அதில் கருங்கற்கள், சிமெண்ட் கட்டைகள் மற்றும் இரும்பினால் ஆன கட்டமைப்பு ஏற்படுத்தப்பட்டு, 900 டன் எடை கொண்ட இரும்பிலான ராட்சத மிதவை (கெய்சன்) கடலில் மூழ்கடிக்கப்பட்டு நிலை நிறுத்தப்பட்டது.

அதன்பின், திட்டமிட்டபடி, புதுச்சேரி கடற்கரையில்சிறிது, சிறிதாக மணல் பரப்பு உருவானது.

இந்தியாவில், முதல் முறையாக நவீன தொழில் நுட்பத்தில், புதுச்சேரியில் செயற்கை கடற்கரை மணல் பரப்பு திட்டம் வெற்றிகரமாக செயல்படுத்தப்பட்டது.

புதுச்சேரி செயற்கை கடற்கரையை, பொதுமக்களுக்கு அர்ப்பணிக்கும் விழா நேற்று நடந்தது. முதல்வர் நாராயணசாமி தலைமை தாங்கினார். கவர்னர் கிரண்பேடி முன்னிலை வகித்தார்.

மத்திய அமைச்சர் ஹர்ஷ வர்தன், செயற்கையாக உருவாக்கப்பட்ட மணல் பரப்பை பொதுமக்களுக்கு அர்ப்பணித்தார்.

Dinamalar, 25 January 2019

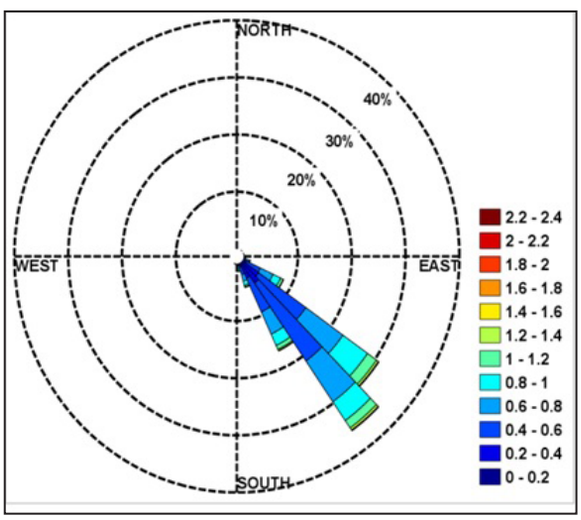
View of Steel Reef after Launch

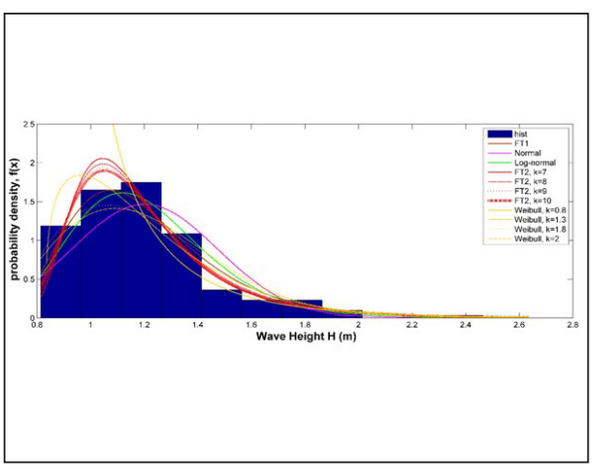
View of beach after Steel Reef Launch

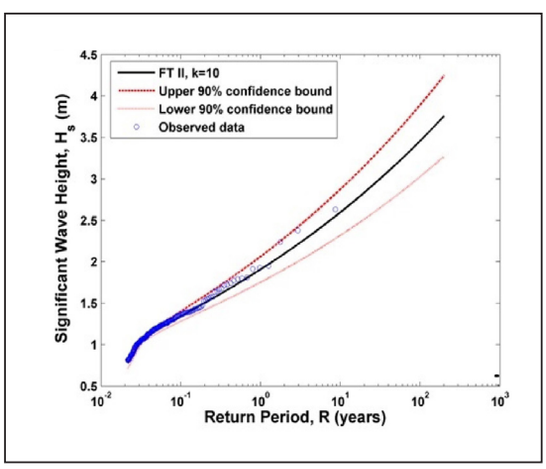
Estimation of wave forces (breaking & non-breaking) through wave structure interaction studies

Full scale experiments are being conducted on seawater intake caisson/structure at Agatti, where wave (incident & reflected) and tidal parameters are measured continuously from March 2012 to March 2019 (7 years) by bottom mounted directional wave recorders. The wave pressure data analysis was carried out and the total pressure acting on the caisson has been estimated for the pre monsoon, monsoon and post monsoon seasons. Numerical simulation is carried out and the predicted total pressure acting on the structure was validated. The field experiment is being continued to observe the long term wave data for detail probabilistic analysis. The study results are provided to Indian Road Congress to prepare Guidelines for estimation of wave loads on structures.

Extreme wave analysis was carried out with data collected in long term and return plot and encounter probability plot are developed. These plots are used in estimation of significant wave height and risk of storm event with return period of R year. The equation for calculating peak spectral period associated with significant wave height was developed by fitting three parameter power law. The hydrodynamic parameters and design parameters presented here gives the brief understanding of wave climate in coastal waters of Lakshadweep. These are very useful in preliminary planning, calibration of hindcast wave models and design of various types of costal structures.







Field experimental studies of Wave Structure Interaction

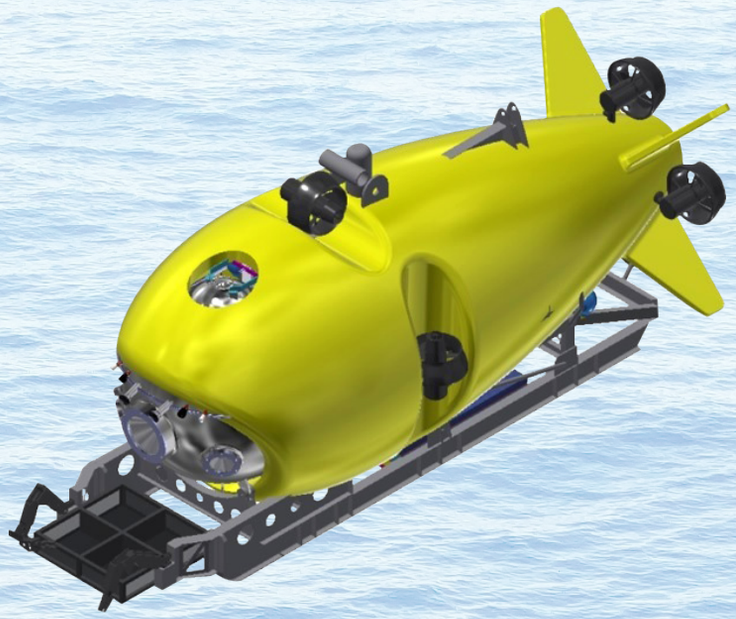
Establishing desalination plants in the Islands of UT Lakshadweep:

Local population in UT Lakshadweep group of Islands depends only on the rainfall for their drinking water needs. Most of the local Island communities were using the well water for their domestic purpose, leading to widespread prevalence of water borne diseases. After the commissioning of Desalination plants using LTTD technology in Kavaratti in 2005, the water borne related diseases

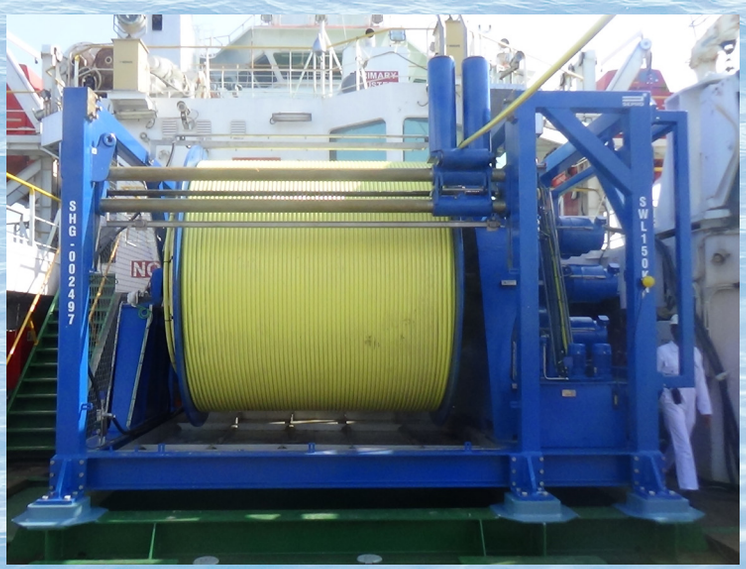
had been reduced drastically. Consequently, two more such plants are commissioned in Minicoy and Agatti in the year 2011. Based on the continuous operation, easy maintenance and uninterrupted supply of drinking water to these three Islands and request from UT Administration, six more LTTD based plants with increased capacity of 1.5 Lakh liter per day has been taken up by MoES-NIOT at a cost of Rs. 187.87 crores with a project duration of 2 years in Amini, Androth, Chetlat, Kadamat, Kalpeni, and Kiltan Islands of UT Lakshadweep. The work has already been commenced in the Islands.

Process equipment and HDPE Cold water pipe line

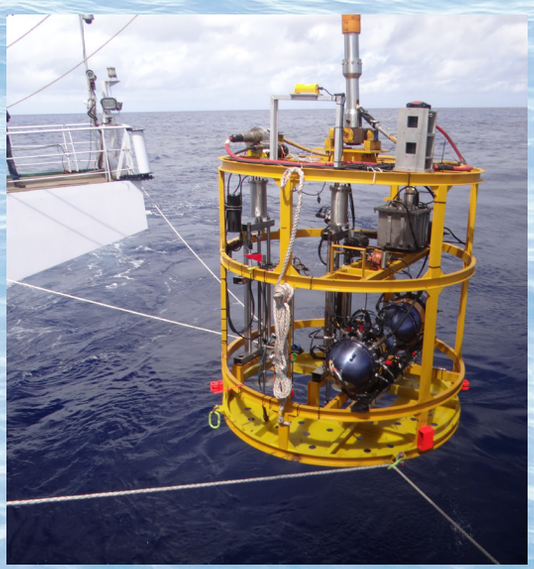
DEEP SEA TECHNOLOGIES



Conceptual view of the 6000 m depth rated Manned Submersible



Deep Sea Cable 7000 m and AHC winch onboard ORV Sagar Nidhi



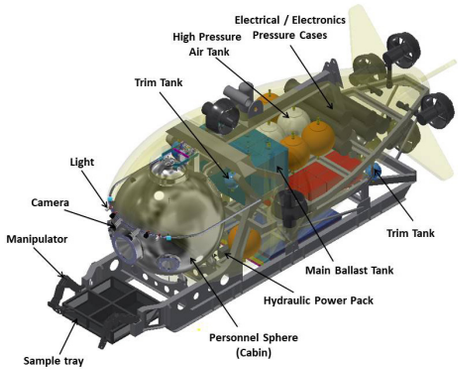
In situ Soil tester for 6000 m depth

DEEP SEA TECHNOLOGIES

The mandate of the Deep Sea Technologies group is to develop technology along with capability building for the exploration and exploitation of deep ocean mineral resources such as poly-metallic manganese nodules and hydro-thermal sulphides occurring at Central and Southern Indian Ocean and gas hydrates within Exclusive Economic Zone. These technologies are also useful for the oceanographic, polar and industrial applications..

Manned Submersible

Preliminary design towards development of a 6000m depth rated Manned Submersible, capable of carrying 3 persons with operation duration of 12 hours and emergency endurance of 72 hours is completed. The system concept and preliminary system design were reviewed and specifications were finalised for the development of personnel sphere/human capsule, life support systems, ballast systems, propulsion systems, underwater battery, power distribution system, sensors, control hardware and navigation. Life support system studies were performed to estimate the oxygen requirement and carbon-di-oxide scrubber design optimization. Preliminary general arrangement of all envisioned subsystems has been completed to undertake hydrostatic and hydrodynamic studies.



General arrangements of manned submersible with major subsystems

- In-house design by NIOT was reviewed and approved for completion of the system configuration to finalize subsystem design parameters.
- MoU is being signed with VSSC-ISRO for the development of deep water personnel sphere.
- A hydrostatic and hydrodynamic study for stability/performance assessment of manned submersible was initiated in association with IIT Madras.
- Human life support systems for the manned submersible is developed in-house and tested in the acclimatization sphere to understand the safety and comfort of three personnel for the envisaged endurance.
- Preliminary design of reliable and redundant power and control hardware architecture is completed. The symmetric configuration is designed to provide adequate redundancy in electrical, electronic and mechanical systems as per the Classification society requirement.

- Preliminary design of Navigation and Communication system is completed for the manned submersible and the procurement of the commercial off-the-shelf sensors and systems are undertaken.
- Based on the recent advancement in battery technologies and detailed reviews during system concept and preliminary design, Li-Po chemistry battery housed in pressure balanced enclosures has been chosen to take advantage of high energy density for manned submersible operation and control.

Deep Sea Mining

Sinkage Prevention Test during Soft Seabed Soil Locomotion

During earlier soft soil seabed locomotion sea trials of the underwater mining machine, excessive sinkage had been experienced and corroborated with tank tests at NIOT. Sinkage leads to bulldozing resistance, rear down attitude thus pushing the pick-up assembly up, immersing of sensors in soil and results in very high pull-out forces during retrieval.

Thus experiments were performed on a reduced model undercarriage with various mechanisms to prevent sinkage and aid effective locomotion. A skid system has been observed to be effective in model tests in the soft soil mud tank and the same design will be incorporated in the main undercarriage system.

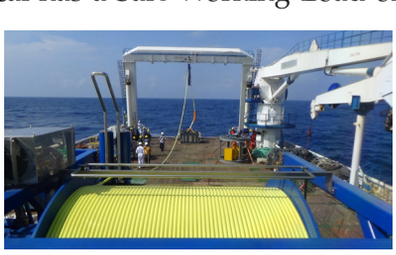
Harbour Acceptance Tests and Sea Acceptance Tests of 7000 m length Deep Sea Cable and Active Heave Compensation winch system

Testing without Skid

After 2nd Run

Testing with Skid

A new deep sea winch with 7000 m electro-optic umbilical cable (6000 m depth rated) has been procured and installed on-board ORV Sagar Nidhi in Dec 2018 for launching the underwater mining machine up to a depth of 5500 m water depth in the polymetallic nodule field at Central Indian Ocean. Harbour and Sea Acceptance Trials were completed to prove the system handling capability. The winch-umbilical has a Safe Working Load of 10.5 ton cable pull load and can sustain 150 kW



Winch and Umbilical cable test onboard ORV SagarNidhi

power at 6000 kV. This system will be used for the Experimental Under Carriage trials planned at CIOB during 2019.

Factory Acceptance Tests of Slurry Transport Hose

High pressure slurry transport hose (1000 m length), proposed to be used for pumping the nodule and sea water slurry to the mother ship, were received after pressure and tensile tests at the Original Equipment Manufacturer (OEM) premises at Norway (M/s Fenner Mandals). The hoses shall withstand an internal burst pressure of 175 bar and 10 ton tensile load, at slurry flow and will be used for the test pumping trials from intermediate depths.

Pressure and Leak testing of 1000 m long Slurry Hose and tensile test facility

Medium Voltage Variable Frequency Drives (MVVFD)

MVVFDs of 250 and 500 kVA were procured for powering the underwater mining machine and slurry pump. These were tested successfully at the OEM premises (M/s Siemens, Ltd, Jundiai, Sao Paulo, Brazil) in Sep 2018 and received at NIOT in Jan 2019. These drives would be used to control and operate high power medium voltage subsea motors, fitted on the deep sea mining machine and the high-pressure pump frame unit, through the 7000 m long power umbilical. The MVVFD drives are installed within a custom-built container with HVAC. The drives were tested with 150kW,

250 & 500 kVA MVVFD Units

MVVFD installed into custom-built Containers

6000V motor on no load with 6400m subsea cable at NIOT. Testing of the system with load shall be undertaken on board the ship – Sea Acceptance Tests (SATs), using the 7000 m long umbilical cable.

Unmanned Underwater Vehicle

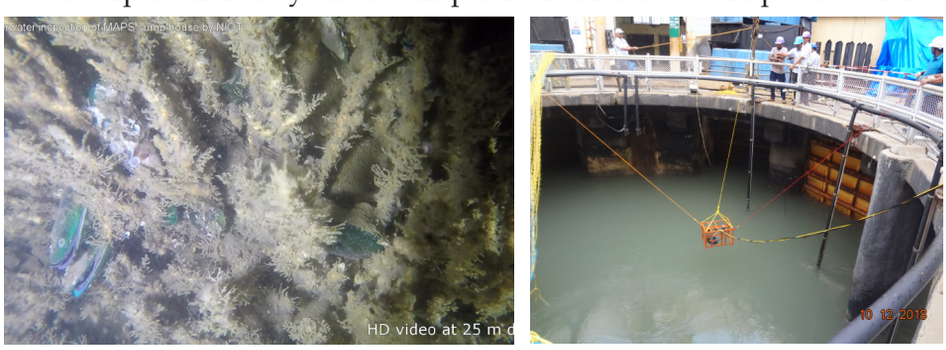
Support activity for NSTL - DRDO in the Bay of Bengal using shallow water / polar remotely operated vehicle (PROVe)

PROVe deployed in Bay of Bengal (off Visakhapatnam) and Underwater images captured from Bay of Bengal search site at 66 m depth

The PROVe was deployed to support activities of Naval Science and Technology Laboratory (NSTL), Vishakhapatnam in the Bay of Bengal. The ROV was deployed in three locations and operated at a depth of 66 m in the Bay of Bengal during March 2019. The images of the ROV deployment and captured underwater visuals by the ROV mounted high definition cameras are given below

Underwater search operation of NSTL object in the Bay of Bengal using shallow water / polar remotely operated vehicle (PROVe)

An underwater imaging skid comprising high definition cameras, LED lights and 100 m long underwater cable wasrealized and deployed for carrying out underwater inspection up to a depth of 52 m in the Kalpakkam Madras Atomic Power Station (MAPS) sea water intake sump during Jan 2019. Underwater videos of the sump walls upto 52 m were acquired and tunnel inspection was carried out at 50 m depth. After 40 years of sump construction it was inspected for the first time and

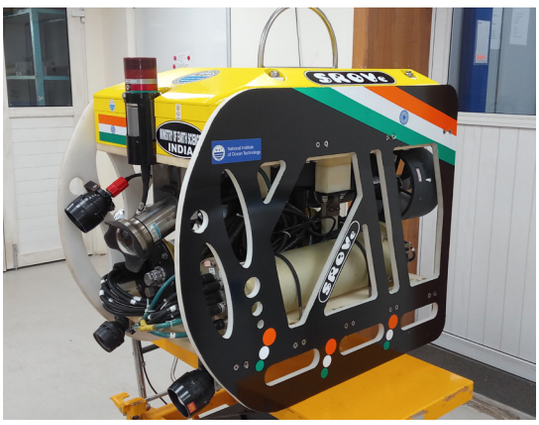


Underwater imaging skid was deployed and Underwater images of sump house at 25m and 52m water depth

brought out occurrence of green mussels which needs further remidial measured to be addressed by MAPS.

Development of a Shallow water ROV for CMLRE

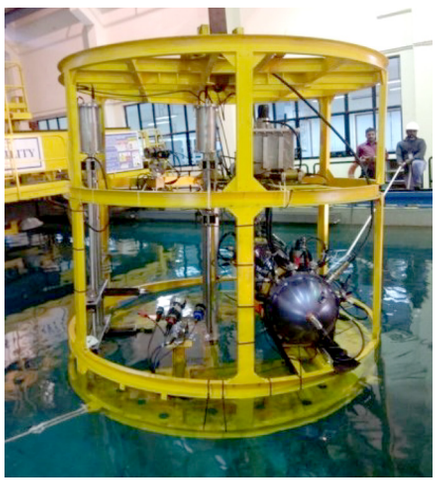
A shallow water ROV is being developed for the Centre for Marine Living Resources for Ecology (CMLRE), Cochin for carrying out bio-diversity studies up to a depth of 300m. Polypropolyene frame, syntatic foam and pressure rated enclosures are fabricated and assembled. Data telemetry and power system for surface and subsurafce system are being developed in-house.



View of developed Shallow water ROV

In-situ Soil Tester depth rated for 6000 m depth

An improved in-situ tester has been developed with independent shear vane and penetration cone arrangement for evaluation and measuring the seabed soil strength properties. The soil tester has also been equipped to collect sediment core samples for comparison in non-pressurized conditions and also equipped with camera to assess nodule distribution and abundance. The soil tester is powered electrically. The controls, instrumentation and data acquisition system, with software have been

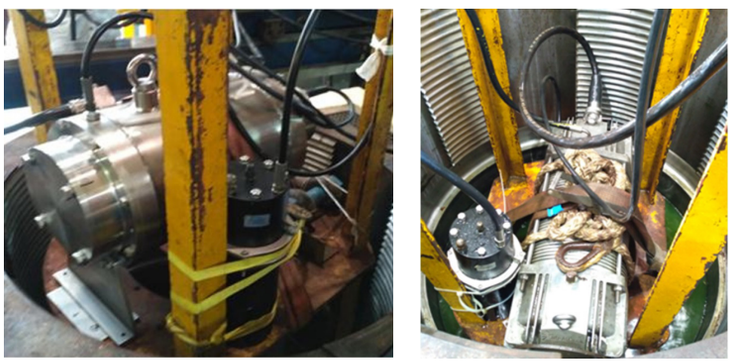


In-situ soil tester test in ATF

tested and has been integrated into the unit. The assembly of the units has been completed and was tested in Acoustic Test Facility at NIOT. The Unit will be used during the sea trial at Central Indian Ocean Basin during Apr 2019; the soil tester will be deployed first to assess the seabed conditions, before the mining machine would be deployed for locomotion tests.

Subsea Motor Tests under Hyperbaric Conditions

Subsea electric motor loads during starting and running under low temperature and high pressure have been observed to be high due to increase in viscosity of the oil used for pressure equalisation. To assess and estimate the changes, two subsea motors were tested for power loss due to oil viscosity changes in the hyperbaric chamber.

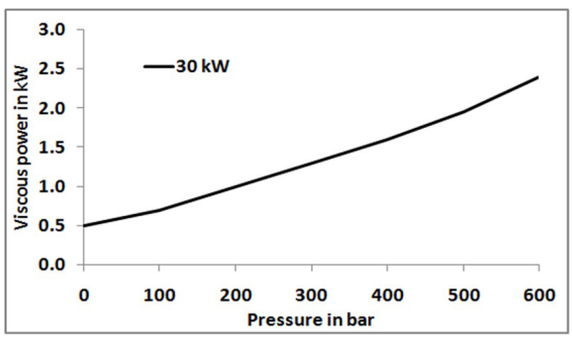


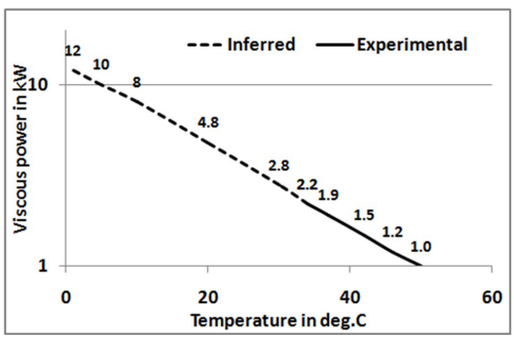
30 kW and 60 kW motor tested in Hyperbaric Chamber

Power loss of 30kW motor at 600bar

- A pressure compensated (hydraulic oil 32) 30kW, 3000V sub-sea electric motor was tested in no load condition up to 600 bar pressure at 35ºC.hyperbaric chamber.
- The Viscous power at ambient pressure was 0.5 kW and at 600 bar pressure it was 2.5 kW

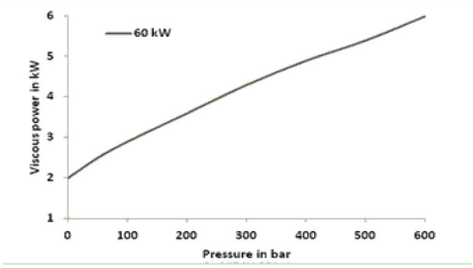
Power loss of 60kW motor at 600bar

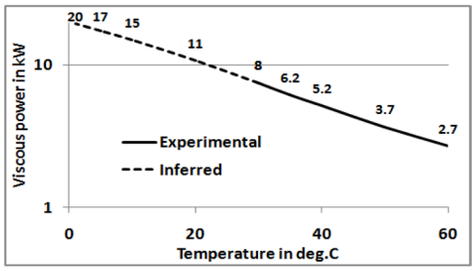




- A similar experiment which is done on the 30kW motor is carried out on the 60 kW, 3000 V deep sea motor.
- Under ambient conditions the motor consumes a power of 2 kW which increases to about 6 kW at 600bar at 35ºC.

- The viscous drag power which was about 6 kW at 35ºC reduced to 2.7 kW at 60ºC





- Based on the hyperbaric experiments done on 30 kW and 60kW motor, it was observed that the motors require about 30% of the rated capacity to overcome the pressure-induced viscous drag at 600 bar pressure and 2ºC temperatures.
- The estimations could be used for subsea motors power requirements due to the viscous drag. To reduce the power loads in underwater, especially due to low temperature, suitable pressure compensated oil preheat/heating systems are being designed for incorporation

Technology for Gas Hydrates

Wire-line Autonomous Coring System

A wire-line Autonomous Coring System (ACS) capable of taking long core samples for a length of 100 m below the sea floor up to 3000m water depths is developed in association with Williamson & Associates, USA. System regular maintenance activity is carried out and mobilized for long core sampling with NIOT drilling team for sampling in December 2018. ACS is ready for further trials based on next fair weather season.

Gas hydrate laboratory experiments

A laboratory set up to measure the petro physical properties has been established in house for characterizing the physical properties such as thermal conductivity and acoustic (Primary wave) property of gas hydrate reservoirs. Studies are undertaken to understand variation in acoustic parameters during methane hydrate formation and dissociation phases to evolve the quantitation of methane hydrate saturation from seismic observation.

View of Gas Hydrate laboratory set with high pressure and low temperature reactors

OCEAN ACOUSTICS

Deployment of the Independent mooring of the Ambient Noise Measurement System

NIOT and NCPOR Scientists with the RV Lance Team

OCEAN ACOUSTICS

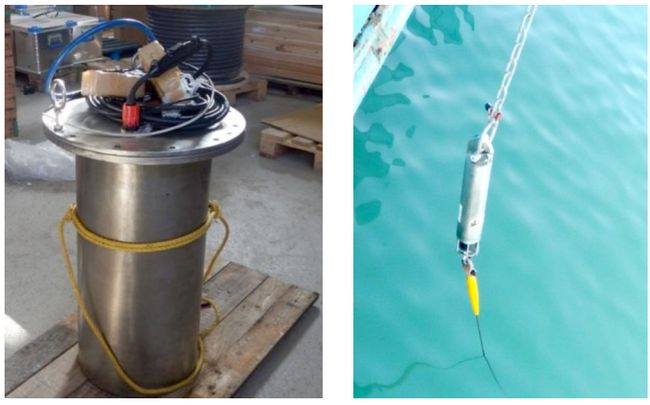
The Ocean Acoustics programme of NIOT has been focusing on development of acoustic systems for ocean applications such as ambient noise measurements, acoustical oceanography, underwater communication and coastal surveillance. Further to the successful accomplishment of autonomous real time ambient noise system for shallow water applications and development of vector sensor array , the focus is on development of passive acoustic systems for Polar region, Deep water region and coastal surveillance applications. 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)

Development of Ambient Noise System for Polar Region Measurements

Deployment of Ambient Noise Measurement System (ANMS) in the Arctic Region

A totally indigenous autonomous Ambient Noise Measurement System (ANMS) for operations in the polar region has been developed as an independent mooring system with buoyancy steel floats, tilt sensor, acoustic release and sinker weight and successfully deployed in the Kongsfjorden Arctic (Lat: N 78°56.791′ and Long: E 12°01.845″) on 16th July 2018 at 200m ocean depth, closer to the IndArc mooring.

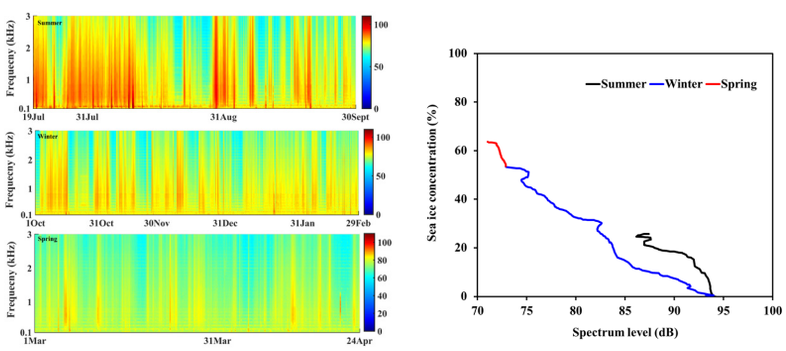


Deployment of the system in the Arctic

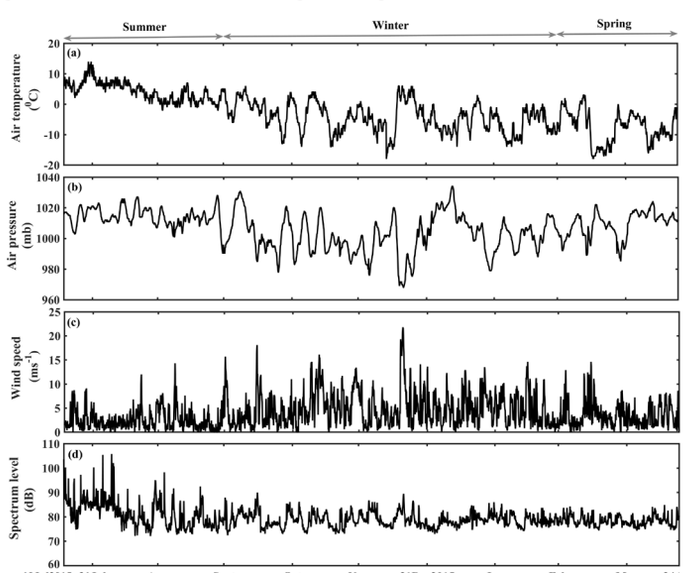
The ANMS has two distinct components; the Data Acquisition System (DAS) with indigenously developed underwater pressure casing and two hydrophones. The DAS consists of NI based data acquisition card along with a processor and is designed for 8 months data collection. The system was qualified with various tests like buoyancy, pressure and environmental tests before dispatch to the Arctic region. The sampling is hourly at a frequency of 25kHz for 180 seconds. The hydrophones are positioned at 46.5 m and 61.7 m from the sea surface.

Variability of under-ice noise due to the environmental conditions

Measurements of ambient noise during July 2015–April 2016 covering boreal summer, winter and spring season is examined, using daily sea-ice concentration, wind speed, air temperature and air pressure. Oceanographic parameters (conductivity, temperature and current speed) were obtained from the IndArc mooring. The spectrogram shows that temporal variation of ambient noise level follow the seasonal cycles, where the noise spectrum levels are higher during boreal summer, followed by winter and spring. The noise levels are higher in summer season due to the open water conditions, which depend on the combined effect of wind stress, ice calving and melting of the bubble noise. However, the noise levels are lower in winter followed by spring that can be associated with the sea ice concentration. The high ambient noise level is generated by the impact of calved ice in the frequency band of 0.2-0.6 kHz. The daily ambient noise levels over the study period are negatively correlated with the presence of sea ice concentration.



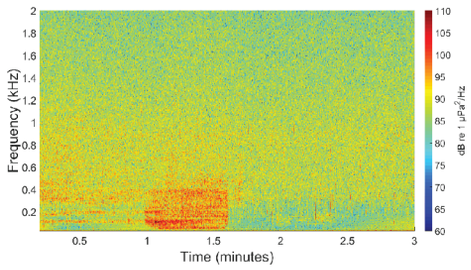
Spectrograms of under-ice noise levels in the Kongsfjorden during boreal (a) summer, (b) winter, (c) spring, and (d) the daily averaged noise spectrum level of frequency band (0.1-1kHz) over daily averaged sea ice concentration with season.



Time series of environmental variables and under-ice ambient noise levels (0.1-1kHz) in the Kongsfjorden during summer, winter and spring. (a) Air Temperature, (b) Air pressure, (c) Wind speed, and (d) Noise spectrum level.

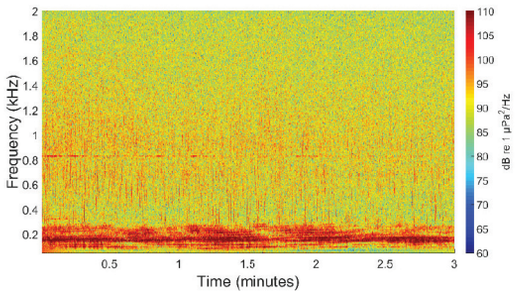
Underwater Ambient Noise in the Kongsfjorden, Arctic during Summer

Ambient noise measurements during summer 2016 from August to October shows strong association with ice breaking and shipping sources. The analysis shows that maximum ambient noise is produced at frequencies less than 2 kHz, during summer 2015 and 2016. It is observed that the noise levels in glacial fjords throughout the summer period go beyond 100 dB, which is very loud.



Spectrogram of the iceberg melting noise and iceberg calving noise

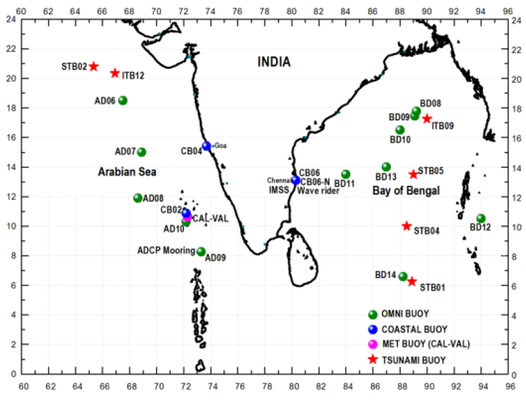
It is observed that the entire ice calving noise falls in the frequency band <500 Hz and the ambient noise level has increased by 10-20 dB from normal values. Shipping is a core source of low-frequency noise in the ocean. Underwater ship noise is mainly from propeller and is a loud source, creating high noise level at frequencies <400 Hz. At frequencies below 400 Hz, ambient noise levels are increased by 15–20 dB due to distant shipping.



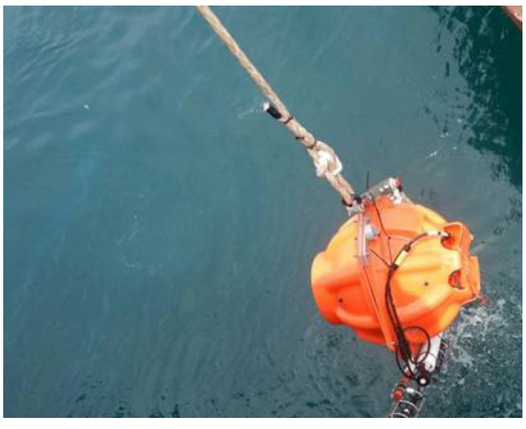
Spectrogram of the Shipping noise

Development of Deep Water Ambient Noise System and Conducting Deep Water Measurements

SOFAR channel depth has immense application for underwater communication. SONAR operations are affected by variations in sound speed in the vertical plane. For the SONAR operations to be put in use, the details of SOFAR channel depth and its variability is an essential prerequisite. The SOFAR channel acts as a wave guide for acoustics and low frequency sound wave within the channel may travel thousands of miles before dissipating. The SOFAR channel depth is determined using sound



Measurement location near AD9



Development of Deep Water Ambient Noise System

speed minimum criteria. Hence the ideal positioning of the hydrophones are near the sound speed minimum and below the sound channel critical depth. Effective acoustic channel in the Arabian sea measurement location lies well below 500 m from the sea surface.

A deep water noise measurement system has been acquired and tested in the hyperbaric facility and ATF of NIOT. It consists of glass sphere which holds the hydrophone, data acquisition system (DAS) and power pack. The DAS is designed for 12 months data collection. The system configuration of the deep water system is given below.

The system was tested with DAS and hydrophone at Acoustic Test Facility of NIOT with known source of frequency at 3m water depth. In order to test the system in the open sea, a field trial was conducted off Chennai at 42m depth. The DANMS with hydrophones were lowered to a depth of 21m from the surface and it collected data for 2 hours.

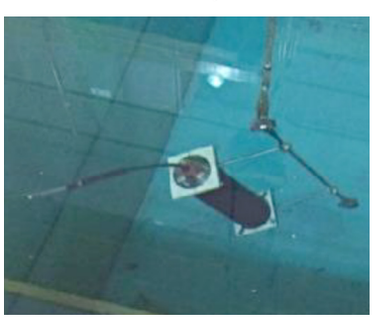
Subsequently, the system was made ready for incorporation with OMNI buoy mooring. The Deep ocean ambient noise measurement system was successfully incorporated in the OMNI buoy mooring and deployed at AD09 location (Lat 8.14 N Lon 73.18E) in the Arabian sea in November 2018.

Vector Sensor Array Enhancements towards Coastal Surveillance Applications

The aim is to enhance the Vector Sensor Array system as a compact unit and conduct more sea trials for coastal surveillance applications. The pre amplifier circuit for vector sensor array (VSA) elements have been enhanced and tested in the lab. A new compass module is incorporated and the complete characterization of the system has been carried out at the Acoustic Test Facility.

Testing at Acoustic Test Facility

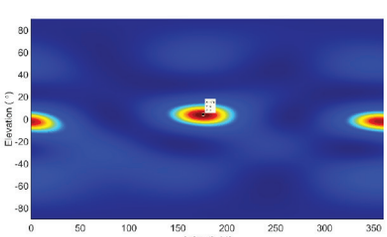
Vector sensor array was kept at 3m depth in the ATF tank and acoustic transmitter was placed at different azimuth and data has been acquired at each position using vector sensor array by keeping the array in vertical position



Testing of VSA at ATF

Known source transmission experiments in the Chennai harbour

Active acoustic measurements have been made on 27th November 2018 in the Chennai harbor area, at 5m depth. Single tone frequencies of 6 kHz, 5 kHz, and 4 kHz have been transmitted and VSA received the signals. Direction of Arrival (DoA) estimation carried out and was in good agreement with the measurements.



DoA estimation

Deployment of Vector sensor array system off Chennai

After the active experiment, the VSA along with CTD and tilt sensor has been successfully deployed as an autonomous system for source localization applications, in coastal waters off Chennai on 28th November 2018, at an ocean depth of 16m. VSA was positioned in the mid of the water column and retrieved after a month. The system was configured to collect ambient noise with the sampling rate of 25kHz, for a duration of 60 seconds, at an interval of one hour.

Vector sensor array being deployed in the ocean

Upgradation and Maintenance of Acoustic Test Facility (ATF)

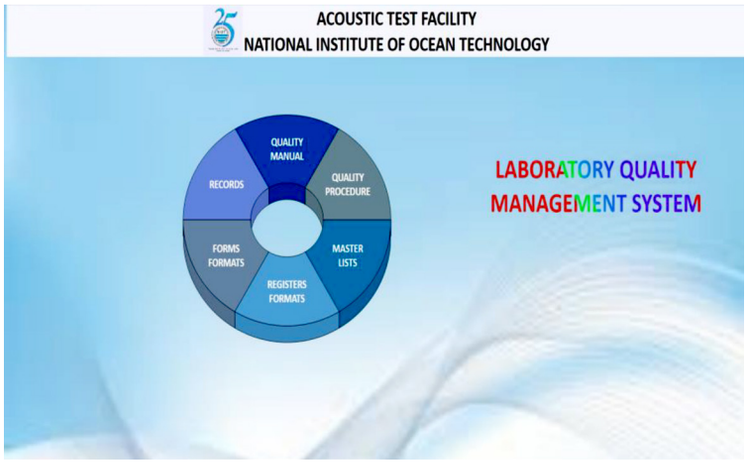
Participation in Key comparison calibration of NPL UK with 7 other countries

NIOT was invited to participate in the Key comparison calibration of hydrophones in the frequency range 250Hz to 500kHz, organized by NPL UK under the auspices of the Consultative Committee on Acoustics Ultrasound and Vibration (CCAUV) which is a part of the International Committee of Weights and Measures (CIPM), NIOT received hydrophones from National Physical Laboratory, UK during April 2018. The calibration was carried out during May 2018. After completion, hydrophones have been sent back to NPL, UK along with the report on calibration.

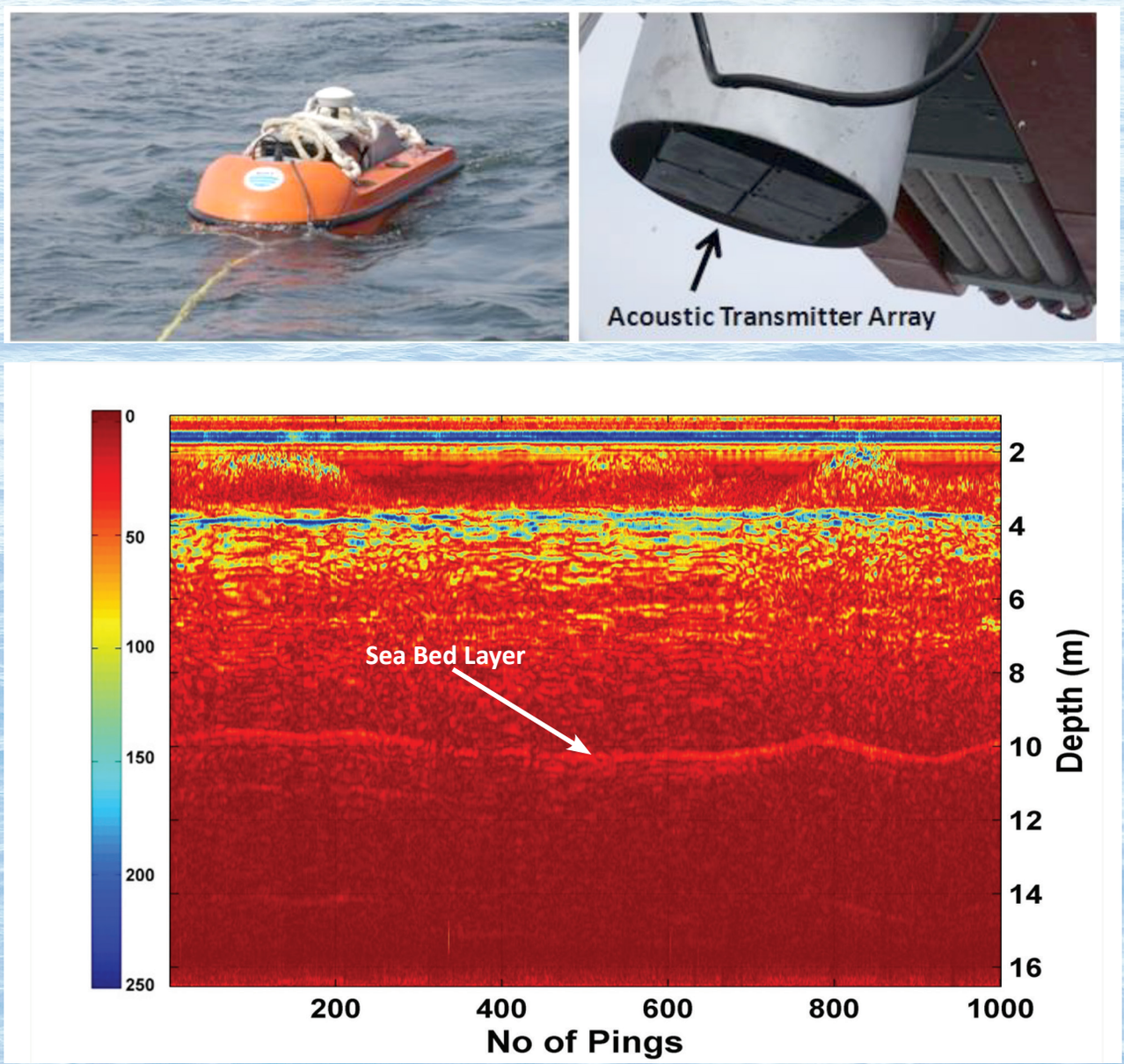
Laboratory Quality Management System

The 'Laboratory Quality Management System' software has been developed inhouse based on the requirements of ISO/IEC 17025: 2017 standard. It encompasses online approval process, database for laboratory management system documents, customer requests, equipments, training record for laboratory personnel, internal audit process and day to day maintenance of records.

Secretary MoES Dr.M.Rajeevan released the Online Laboratory and Quality Management system for the NABL accredited Acoustic Test Facility on 25.9.2018 and it is operational now.



Laboratory quality management system software



Bottom view of the upgraded buried object detection sonar with acoustic transmitter array

MARINE SENSORS SYSTEMS

The focus of the Marine sensors systems programme is the following:

- 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

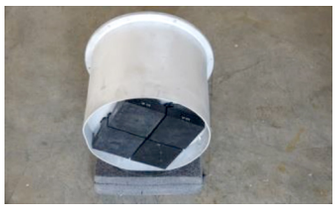
Development of Indigenous Modular Buried Object Detection Sonar

The prime objective of the Marine Sensor Systems program is indigenous development of acoustic transducers, sensors and imaging systems for underwater applications. The developmental program includes demonstration of technology, realization and testing of prototype systems in the field. In the past year, the group has proven its capability to develop the indigenous modular Buried Object Detection Sonar for shallow water applications (up to ~30 m). A number of sea trials were conducted and results were reported in various journals and international conferences.

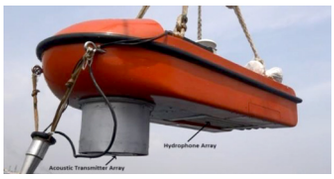
System up gradation with NIOT-BEL Transducer array

The Modular Buried Object Detection Sonar (BODS) developed by the group has been further upgraded by incorporating a transmitter array jointly developed by NIOT, in collaboration with Bharat Electronics Ltd (BEL), Bangalore under an MoU. A patent has already been granted to NIOT for the transducer technology in the year 2016, and the technology was transferred by NIOT to BEL. The modified configuration replaces, 21kg, 500 W single element with a 20 kg, 1kW, four element (2x2) array, with a Source Level (SL) of 200 dB re 1 µPa. The array comprises of four smaller size transmitter elements, compared to larger single element used in the earlier configuration. This modified design provided better results compared to the previous version.

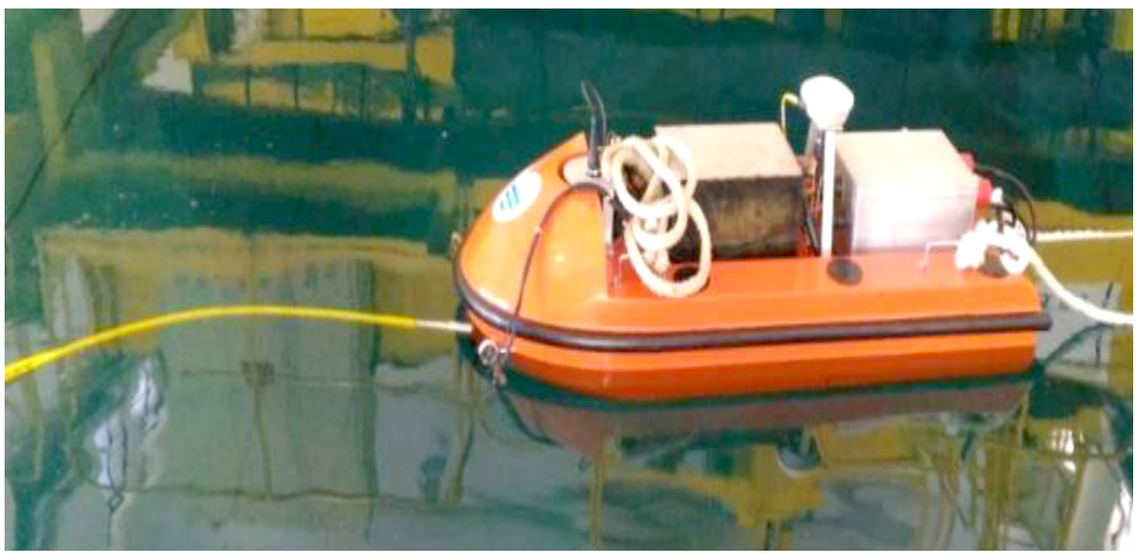
Acoustic transmitter used earlier



2 x 2 Acoustic transmitter array



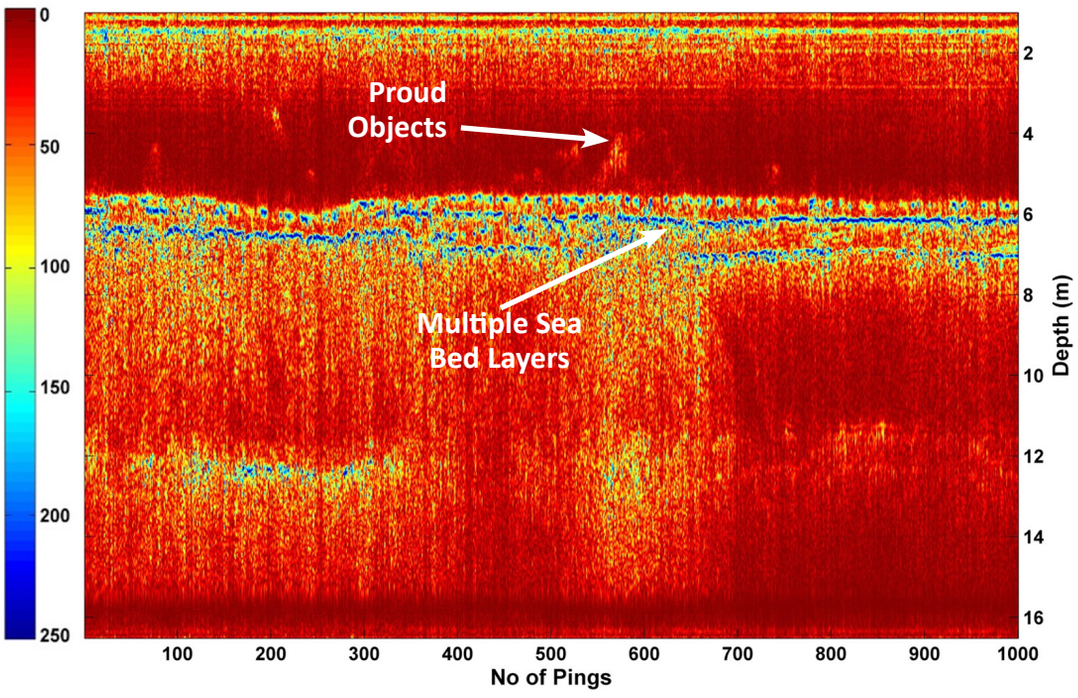
Bottom view of the sonar with 2x2array



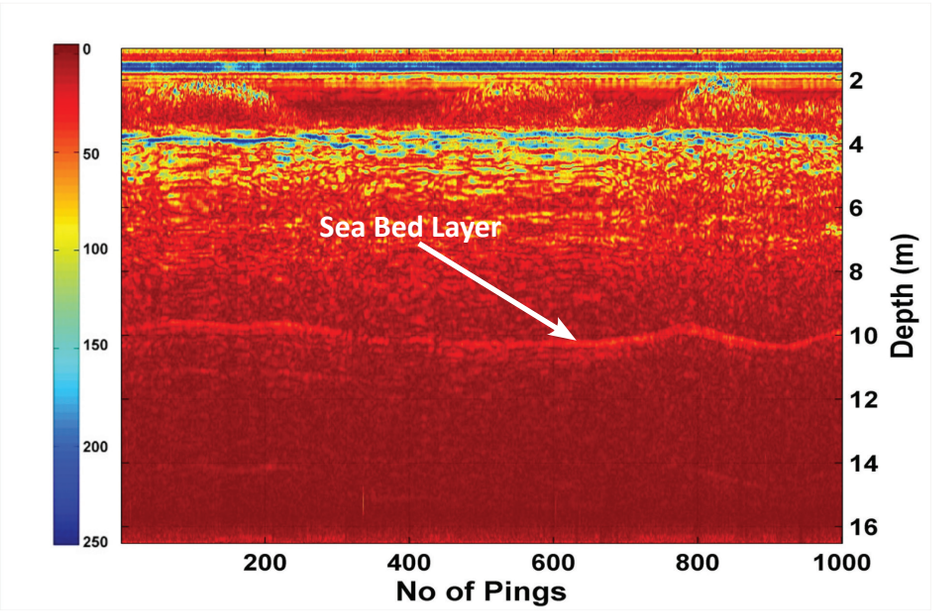
Modified sonar during tests

Sea trial results

Sea trial was conducted off the Royapuram Harbor in Tamil Nadu, India [Lat. 13.13 N, Lon. 80.30 E]. The sediment type at the site was clay mixed with sand. The water type was brackish. Data was collected and processed both online and offline for further analysis.



Multiple buried sea bed layers detected at site



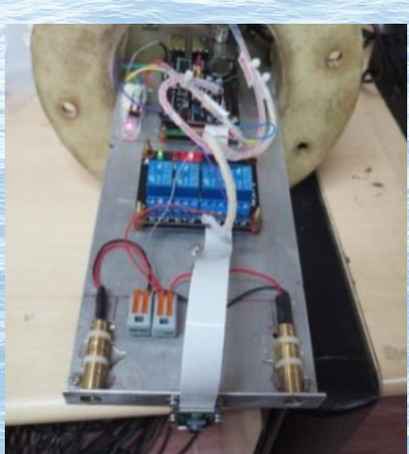
Sea bed layer at 6m depth from sea bottom

Multiple buried sea bed layers were observed at some regions of the test site and the corresponding image is shown in the figure. Layer detection up to 6m below the sea bed was also observed with the modified sonar system. The observance of the higher penetration and multi layers has resulted Phase-1 of the project as a Sub-Bottom Profiler. This is a spinoff of the main objective. Efforts are being made to transfer the technology to Industry for commercial production through NRDC, New Delhi.

OCEAN ELECTRONICS

INSAT- based drifting Buoy

Deep sea AUPD



IoT based Biomass estimation

Spar type open sea fish cage system

C' Profiler system

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. Presently this group is involved in the development of Deep sea autonomous underwater profiling drifter (D-AUPD), Drifting buoys with INSAT communication, Open sea fish cage culture technologies, C Profiler system and Development of sensor for the measurement of salinity etc.

Deep Sea Autonomous Underwater Profiling Drifter (D-AUPD)

The first proto type unit, 500m workable DAUPD was designed and built in-house using 1000CC variable buoyancy engine. It was tested at underwater acoustic research facility (UARF) of NPOL in Idukki Lake, Kerala for few cycles. System was operated up to the depth of 110m and the performance was satisfactory.

Second unit was built and necessary functionality test including Mission cycle test in hyperbaric chamber by simulating sea water column condition (only pressure) for Descent cycle, Drift with Active Ballast Control and Ascent cycle were carried out. Also, the float was tested in hyperbaric chamber to check the control valve zero leakage at 50 bar pressure. This was field tested in the Bay of Bengal (BoB) off-Chennai.

DAUPD-2 assembled view

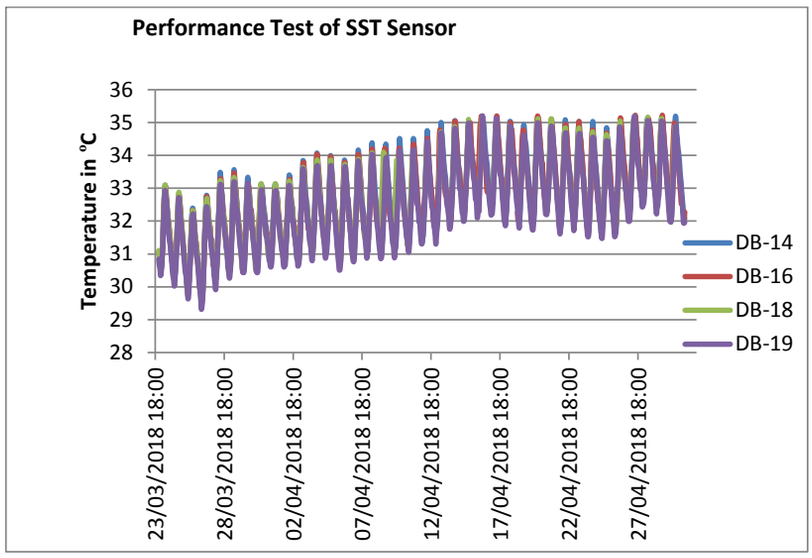
Field deployment

Drifting buoy (Pradyu) with SST & Barometric Sensor

Indigenization of Drifting Buoy with INSAT Communication

NIOT has successfully completed the indigenization of INSAT - based drifting buoy (DB) technologies and technology is transferred to two identified Indian industries and trial production

of 20 units completed. Also, technology licensing agreement was signed with two industries as part of commercialization purposes. So far 14 systems were deployed in Indian waters and the results were published in reputed National / International journals and conferences. Systems were extensively tested at NIOT before deployment at sea. Improvisation of trial produced drifting buoys in terms of increasing endurance, reliability and transmitter functionality is under progress.

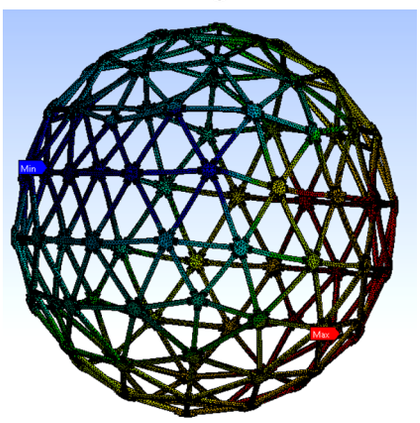


Performance Test of SST Sensor

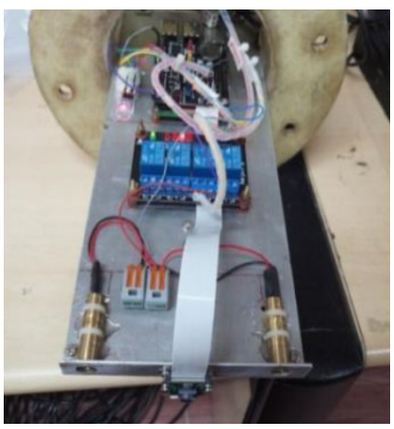
Design and development of non-contact type conductivity sensor as a laboratory model has been completed. The system was tested for complete range of ocean salinity. Fabrication of electronics and housing for field workable model is in progress.

Open sea fish cage culture technologies

Automatic fish feeder



Rigid spherical type fish cage view



Biomass estimation system

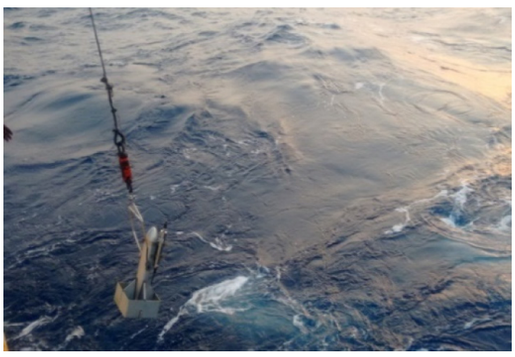
The group has taken up the development of suitable open sea fish cage culture system with feeding mechanism in support to Marine Biotechnology Group (MBT) of NIOT. Basically fish cage systems are classified into two types, namely rigid spar type fish cages and rigid sphere type systems. The

necessary electronics and control mechanism to operate and submerge the system at a desired depth of 10-12m from sea surface is also developed. These fish cage culture systems are being implemented with automatic submergence features using buoyancy devices and control systems, which will enhance and protect fish growth from manual intervention and adverse weather conditions. Group has already demonstrated the functionality of spar type fish cage system at Andaman Islands.

A floating type fish feeder mechanism with electronically controllable valve has been developed and necessary subcomponents fabricated. The feeder operates and feeds the fish cage at predefined time intervals using embedded control system. Design and analysis of 12m diameter rigid spherical type fish cage culture system is in progress. IoT based biomass estimation system has been developed in-house and the field testing and performance evaluation is in progress.

C-Profiler

Development of C-Profiler to measure real time CTD data from ships/boats is in progress. The project envisages tow fish with a conductivity, temperature and depth (CTD) sensor as payload collecting mixed layer data while vessel in motion and designed for 500m depth. It consists of a tow fish which is tethered to the ship by an EM Cable and does the basic 'tow-yo' type of shallow water profiling using onboard winch. Functionality test of winch is depicted in the figure below.

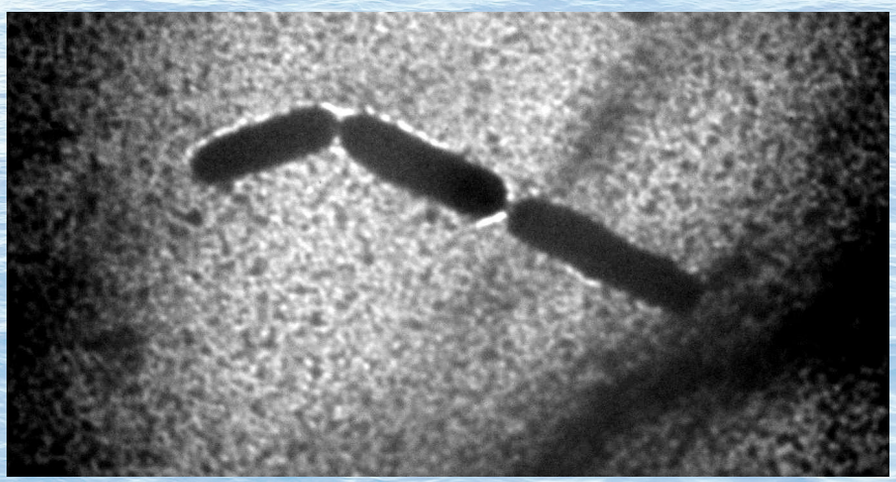


C Profiler field testing

Winch for the C Profiler operations

OCEAN SCIENCE AND TECHNOLOGY FOR ISLANDS

Paddle wheel operated raceway pond



Bacillus andamanensis TEM

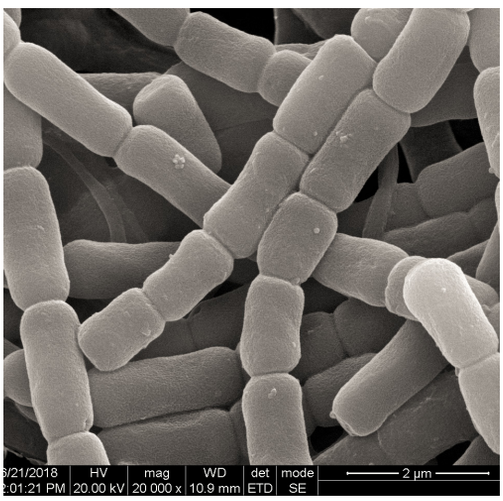
Testing of submersible cage at North bay

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 .

Marine Algal Biotechnology: Experiment of ionic liquids and pressurized liquid extraction of astaxanthin from Thalassiosira punctigera isolated from Antarctica was completed and a maximum astaxanthin yield of 13.61 ± 0.89 mgg-1 yield was obtained at 20% w/w, ionic liquid at 35 C and 90 min and 31.34 ± 1.36 mg/g was obtained 70 bar pressure at 80 C, and 20 min respectively. Extraction and characterization of Scytonemin, a UV screening compound from Antarctic cyanophycean microalgae grown at different salinity and nitrate source and maximum cytonemin concentration of 525.45.± 15.59 mg1 was obtained at 30 psu and 542.25 ± 22.3 mg1 25ºC in ammonium nitrate respectively. Phylogentic analysis of six diatoms isolated from Antarctic Brokeness peninsula was completed using nuclear-encoded small sub unit (SSU) r DNA. Pilot scale paddle wheel operated raceway pond of 25 ton with the inoculums scale up pond and flocculation facility has been developed for mass culture of microalgae for production of high valuable products like lutein, chlorella growth factor.

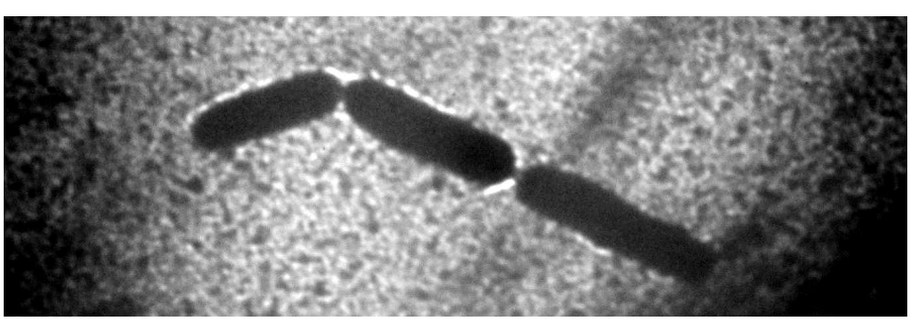


Nostoc punctiforme from -Antarctica

Pilot scale paddle wheel operated raceway pond

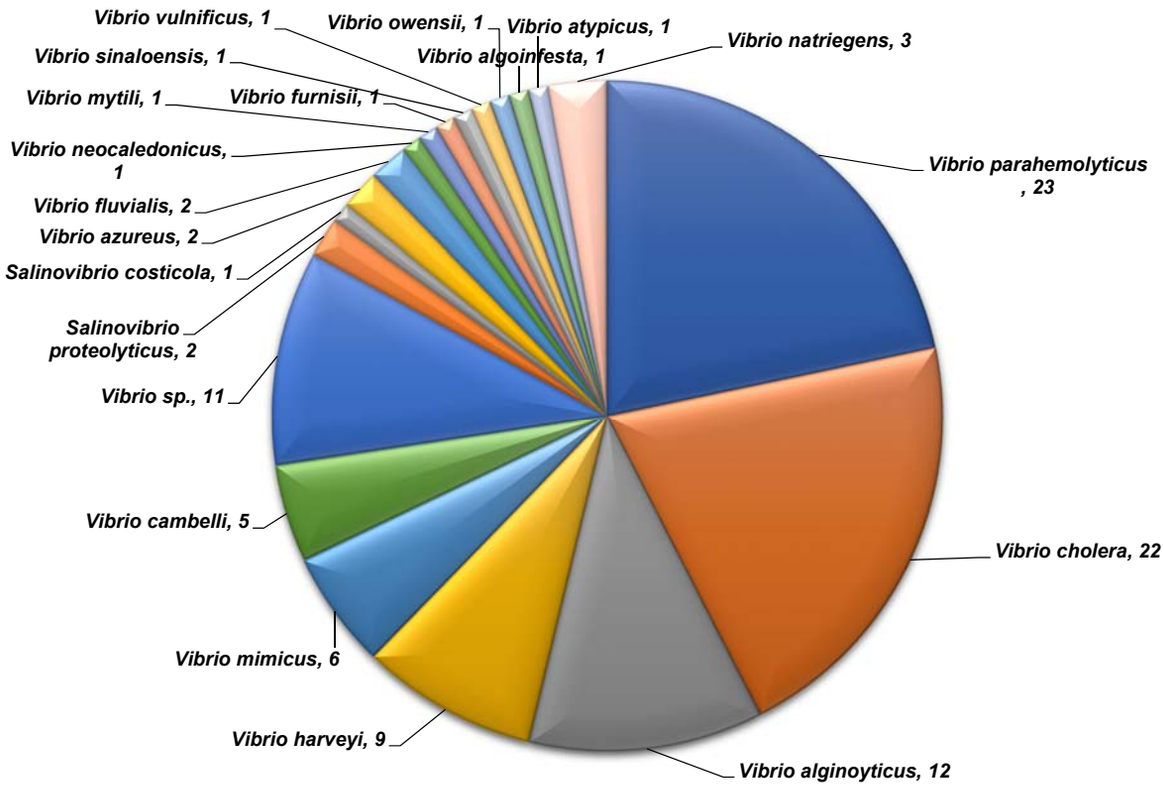
Seaweeds of Andaman and Nicobar Islands were screened for bioactive compounds like Phlorotannin, Fucoidans and Poly unsaturated fatty acids. Edible macroalgae Gracilaria salicornia and Gracilaria sp. were collected and cultured in the laboratory with recorded relative growth rate of 0.955 % / day in laboratory condition. Acanthophores picifera and Gracilaria sp. collected are being cultured in bamboo raft and the growth rate is being monitored. Liqid biofertilizer and biostimulant production from Sargassum cinerium and Hormophysa was carried out by anaerobic fermentation method.

Microbial Biotechnology: A new species of bacteria was isolated from deep sea sediment from 1870 m depth off Andaman Sea. Based on physiological, chemotaxonomic (fatty acid, peptidoglycan, quinone and polar lipid compositions) and 16S rRNA and dna K gene sequences the bacteria was identified as novel species of the genus Bacillus, and named as Bacillus andamanensis sp. nov. A total of 17 strains of deep sea Salinospora sp. were isolated from the deep sea sediment collected from 1190 m depth off Barren Island and the salinosporamide-A biosynthesis gene cluster of Salinospora sp. NIOT-BA64 was cloned in pTZ57R/T and transformed into E. coli JM109. Deep sea fungus Penicillium citrinum was cultured at 100 bar in high pressure culture system and the comparative analysis of FAME indicated increased production of long chain saturated fatty acids such as pentadecanoic acid (C-15), heptadecanoic acid (C-17) and octadecanoic acid (C-18) in elevated pressure. Piezotolerance Ascotricha sp. isolated from 1235 m deep-sea sediment was successfully cultured in high pressure-low temperature (100 bar pressure and 20^{o}C) microbial cultivation system. Ascotricha produced 4 molecules bioactive molecules such as diphenylmethane, 1,6-Cyclodecadiene, sesquiterpenes and dihydro-cis-alpha-copaene-8-ol.The polyketide synthase-I, PKS-II and AHBA synthase, NRPS genes of the deep sea Streptomyces fenghuangensis NIOT.Ch.34 were amplified. The cloning and sequencing of NRPS and PKSII genes showed hits to ABC transporter substrate-binding protein and Streptomyces sp. JAJ-06 beta-ketoacyl-acyl carrier protein synthase. Hydrocarbon degrading fungus that utilizes spent engine oil and crude oil as carbon source was isolated from marine sediment collected at 3538 m depth off-Mangalore. Self-immobilized fungus degraded >85% of total hydrocarbons after 10 days of incubation with 1% (v/v) of spent engine oil at 28 ± 2^{o}C. Studies on diversity of Vibrio sp. from Port Blair Bay reveled presence of 150 vibrio like species. Biochemically and molecular analysis confirmed 107 isolates as Vibrio sp., representing 19 species. Molecular characterization of betaine aldehyde dehydrogenase gene (GbsA) and betaine

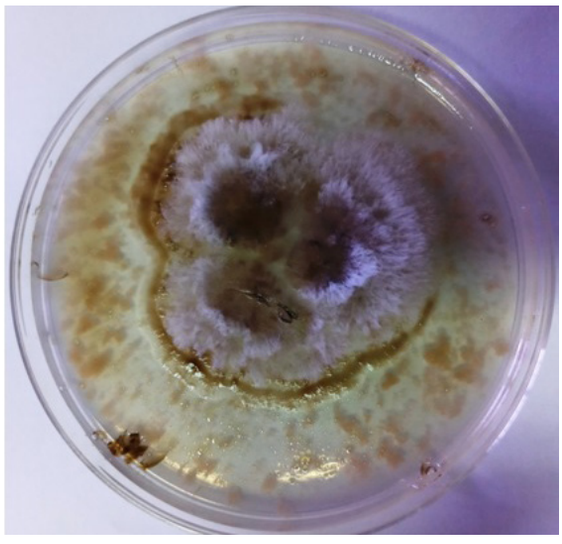


Bacillus andamanensis TEM

alcohol dehydrogenase gene (GbsB) genes from Bacillus sporothermodurans NIOT-DSB21 revealed that the gene was encoded by polynucleotides of 1623 bp and 1072 bp respectively.



Vibrio Species diversity Port Bair



Hydrocarbon degrading by deep sea fungus

Open Sea Cage Culture: For initiation of capture-based aquaculture (CBA) in offshore cages a survey on availability of milkfish seed was carried out in Sangumal, Dhanuskodi, Kundhukkal, Mandapam and Vethalai and identified availability of large number of seeds during the month October to November. As a part of brood stock development Caranx ignobilis average body weight 3.5 and seabass, Lates calcarifer of average body weigh 205 kg were stocked in 9 m wide open sea cages at North Bay, Port Blair. The growth performances of these brood stocks are being continuously monitored. The submersible cage deployed at North Bay was tested for ascending after long duration of deployment. The operating pressure to surface the cage system increased from 2.716 bar to 3.267 bar, due to detachment of a buoyancy buoy and biofouling.The fishermen selfhelp group engaged in open sea cage culture with the technical support of NIOT participated in World Brackishwater Aquaculture Conference and presented their success in open cage culture of seabass and cobia at Ollaikuda in farmer's conclave session.

Damage of cage frame by mechanized trawler

Rectified cages ready for redeployment - Thuplipalem

Testing of submersible cage at North bay

Establishment of Ballast Water Treatment Technologies – Test Facility (BWTT-TF): To meet the inlet water requirement as per the IMO G8 guideline for testing and validation of ballast water treatment system in BWTT-TF, the physico-chemical parameters of the, open sea was found to be most favorable as a source of intake water with the addition of suitable additives or surrogates. Heavy metals were well within the permissible level in water and sediment. The establishment of test facility is primarily divided into marine structure and land based structure. The marine structure comprises of seawater intake system with approach trestle and sump, whereas, the land based structure comprises of storage tanks, control tanks, test tanks, pipelines, pumps, etc. Geotechnical investigation was completed and the specification for construction of trestle based seawater intake system has been completed. EIA clearance for establishment of trestle based seawater intake system was obtained from Ministry of Environment and Forest and Climate Change.

Seawater quality monitoring in Port Blair Bay: To detect changes in coastal water quality, predict pollution levels and to undertake associated activities like determination of seawater quality criteria to facilitate actions that ensure protection and preservation of marine environment, the sea water quality monitoring programme was undertaken in the coastal waters in and around Port Blair. Biological parameters like zooplankton, phytoplankton showed variations in seasons, but maximum

population density was observed at Minnie Bay and Junglighat Bay. Thus, Junglighat Bay (A Major Fishing Harbour) and Phoenix Bay (A Major Inter- Island Passenger Harbour) has to be monitored more-frequently and are of pollution concern. Trace metal concentration was observed to be vary seasonally and concentration of metals Cu, Ni, Zn and Pb was above permissible limits for both water and sediments in sites like Junglighat Bay, Phoenix Bay etc. However, trace metal distribution in soft tissues of different finfishes and shellfishes revealed that seafood of Port Blair Bay is safe for human consumption.

COASTAL AND ENVIRONMENTAL ENGINEERING

Dedication of restored beach at Kadalur villages to the nation by HMoES Dr.Harsh Vardhan

Kadalur Periyakuppam Village before and after beach restoration

COASTAL AND ENVIRONMENTAL ENGINEERING

The main objective of Coastal and Environmental Engineering group is to develop environmentally sustainable solutions for beach restoration and shoreline management by integrating state-of-the-art field measurements, numerical modeling studies and comprehensive detailed engineering designs

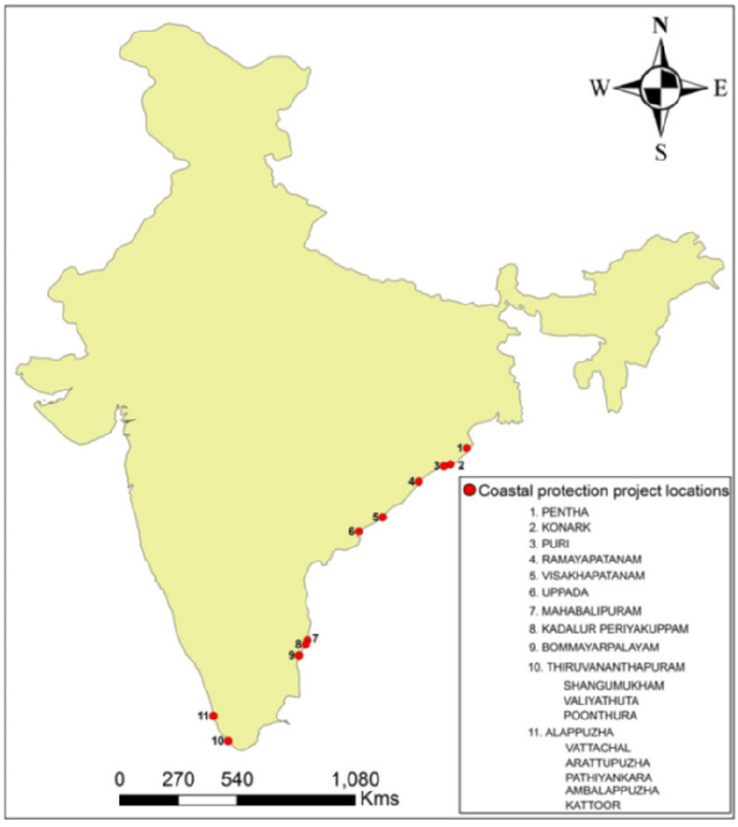
The major projects taken up by the group are

A. MoES Projects

- Performance assessment of coastal infrastructure along the Indian coast to assist in design of environmentally friendly structures for coastal protection.
- Development of design criteria for coastal infrastructure for extreme environmental loadings by assessment of waves, currents and tide parameters
- Geoscientific studies of the Exclusive Economic Zone (EEZ)
- HF Radar network as part of OON-NIOT

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

The project aims in assessing the performance of various coastal structures installed with the primary objective of shore protection. The response of the shorelines to these coastal protection structures are identified so as to aid in developing solutions for sustainable management of coastlines particularly with potential stakeholder interests like societal issues, fishing, industry, tourism etc. Presently field demonstration of submerged dyke installation is successfully completed at Kadalur fishing villages in Tamil



Coastal protection studies along Indian coast – carried out/proposed

Nadu and performance monitoring is being carried out. Design of environmentally friendly sustainable shore protection schemes for Poonthura, Visakhapatanam, Bommayarpalayam, oceanographic observations at Kadalur Periyakuppam, Chennai coast and Vizhinjam are undertaken upon the request by the stakeholders.

Demonstration of environmentally friendly shore protection measures for fishing villages off Kadalur

- Successful installation of submerged dyke covering about 1.76 km of the three fishing villages
- Continuous monitoring of response of the shoreline and submerged dyke being carried out along with minimal scour protection works.
- Beach over a width of 40 m has formed all along the Chinnakuppam village coastline and erosion has subsided and beach has grown in front of Periyakuppam village while beach in Aazhikuppam village is stabilizing
- All the three villages were protected from erosion during high waves generated during Gaja and Phethai cyclones of December 2018.
- HMoES Dr. Harsh Vardhan dedicated the restored beach at Kadalur villages to the nation on January 24, 2019 at Kadalur Periyakuppam in the presence of Secretary, MoES.

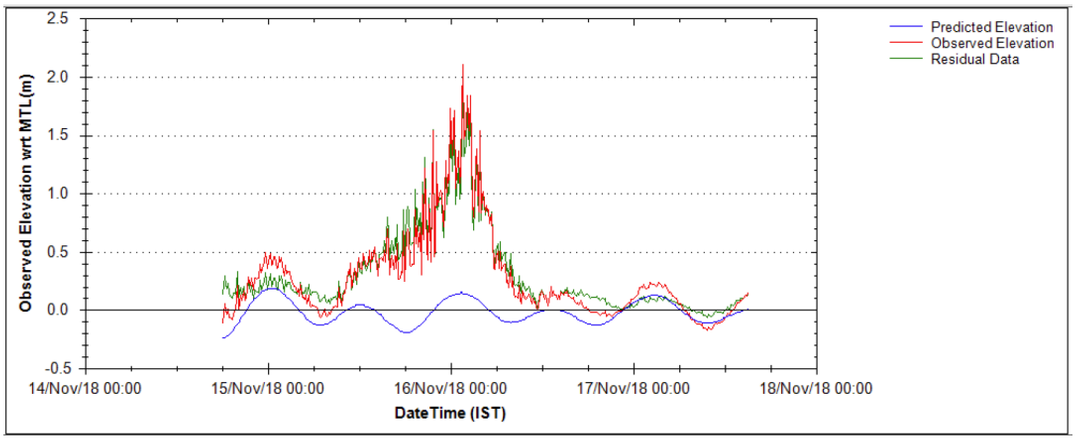
Development of design criteria for extreme environment by assessment of waves, currents and tide parameters

Coastal Monitoring System

- The coastal monitoring system provides tide and met ocean parameters along the Indian coast.
- Involves operation and maintenance of 6 tide stations & 8 automatic weather stations
- Data is transferred to FTP server in real time through GPRS modem.
- Surge height observed from tide gauge during Gaja cyclone on 16th Nov 2018.
- Carried out tide analysis of 19 stations observed along Indian coastal waters since 2010. A tide prediction tool has been developed for tidal predictions and tidal constituents for model boundaries.

Wave model

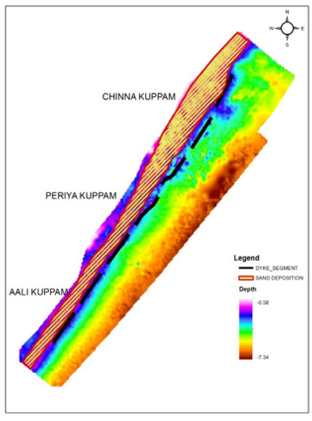
- Wave simulation between 2017 and 2018 with revised mesh including Islands were carried out. The deep and shallow water observations were compared with model results.



Surge observation during Gaja cyclone

Indian Coastal Ocean Radar Network (ICORN)

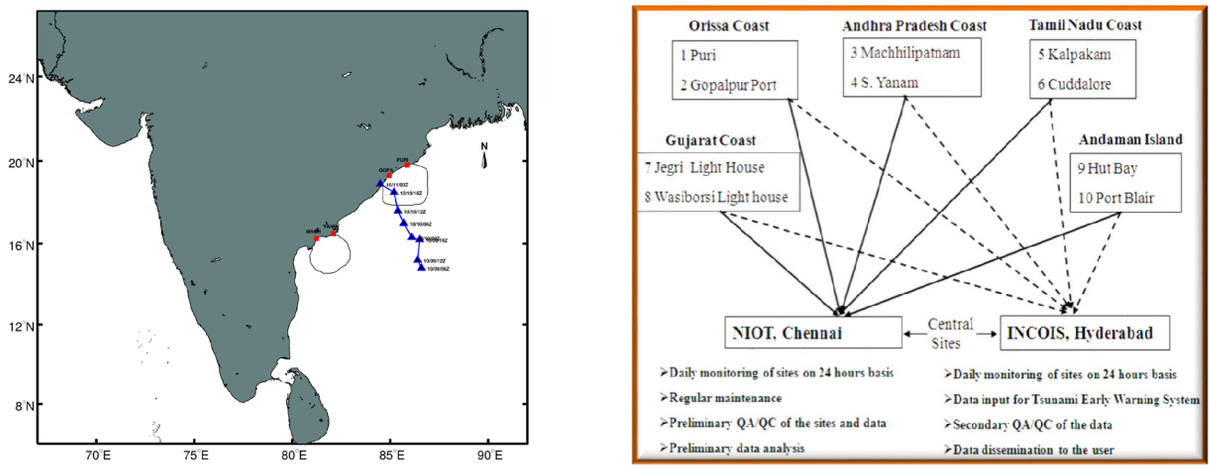
Shoreline change with the construction of submerged dyke



Bathymetry chart showing sediment deposition behind submerged dyke

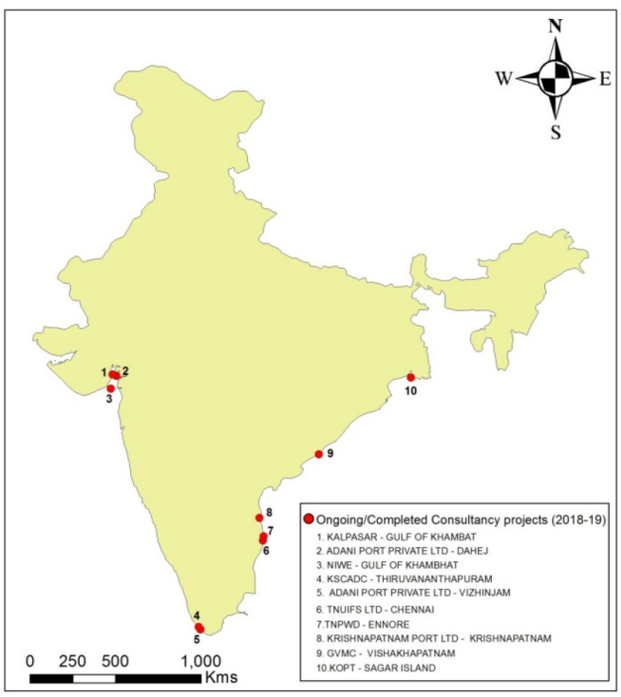
Indian Coastal Ocean Radar Network (ICORN) is operated and maintained and 10 HF Radar systems are functional along Indian coasts. This project is under Ocean Observation Network (OON) Program of MoES. The data from 10 remote sites are transferred simultaneously to central servers at NIOT, Chennai as well as INCOIS, Hyderabad. The data is disseminated to various research organizations and academia through INCOIS.

ICORN is currently covering only a small portion of the Indian coast which is more than 7500 km, and it is planned to extend to other parts of the country to boost the coastal ocean observation. A workshop on HF radar network along Indian coasts was organized during 24-25, January, 2019.



HF Radar locations

B. Industry Sponsored Projects



Hydrodynamic and Sediment Model Studies and Related Measurement for Gulf of Khambhat Development

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

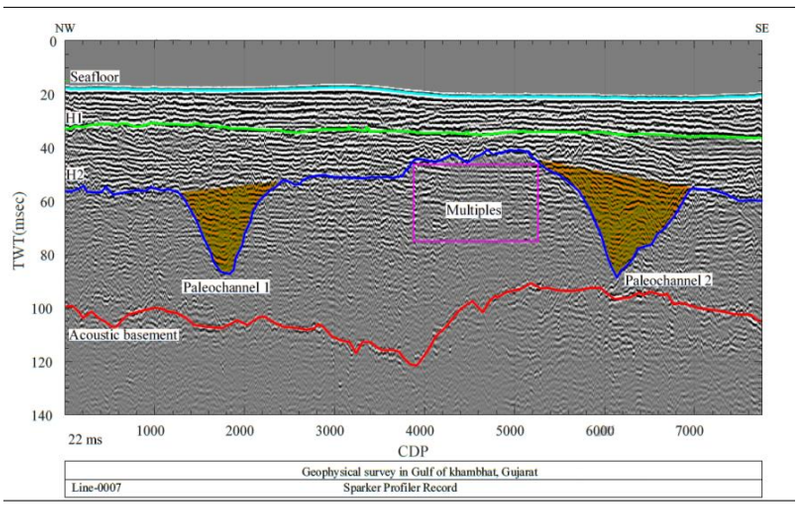
- Numerical simulations were carried out to study the effect of Bhadbuth barrage and combined effect of Kalpasar dam and Bhadbuth barrage on downstream of Bhadhbudh and Gulf of Khambat. Successfully completed the project in all respects.

Shoreline change study for Adani Petronet (Dahej) port Pvt Ltd. using satellite images

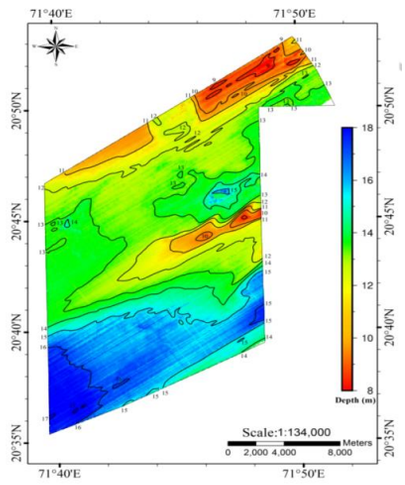
- Assessed the shoreline change over the 5 km coastline on either side of Dahej site from 2011 to 2018. Identified the spots of erosion and accretion along the site location.

Geophysical Investigations at Gulf of Khambhat and Gulf of Mannar

In order to develop offshore wind farms in Gujarat and Tamil Nadu region, NIWE has proposed to carryout geophysical investigations such as bathymetry, side scan sonar, sub bottom profile, and magnetometer surveys and to determine the borehole locations at 5 locations at Gulf of Khambhat, Gujarat covering an area of 302sq.km. Met Ocean observation, particularly of wave and current for one month is measured for validating the model results (Tide is included as a part of bathymetry survey). The geophysical investigation study was started on 24th Dec, 2018 and completed on 29th Jan, 2019.



Bathymetry survey coverage off Jaffrabad, Gulf of Khambhat.

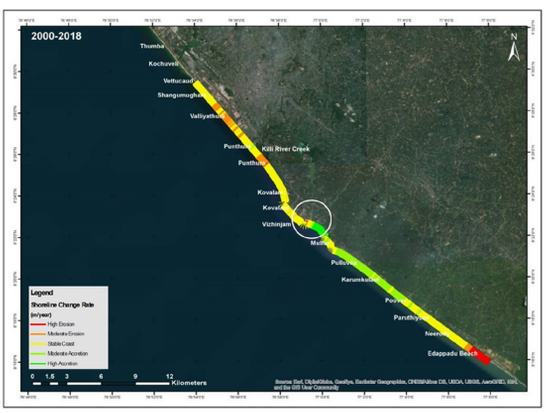


Sub-Bottom profile survey off Jaffrabad, Gulf of Khambhat

Shore Protection Studies at Poonthura in Thiruvananthapuram

Kerala State Coastal Area Development Corporation (KSCADC) has requested NIOT for providing suitable mitigation scheme to arrest/minimize the coastal erosion at Poonthura along the Thiruvananthapuram coast, Kerala. Shoreline change studies carried out using satellite imageries and beach profiling data. Volume of beach loss is estimated. Sediment transport studies carried out using DHI LITPACK. Based on initial assessment a preliminary report is submitted evaluating various shore protection options such as Sand nourishment, Segmented submerged dykes and Groyne system. Field data collection, numerical modelling and detailed engineering are being carried out to finalize suitable shore protection scheme.

Shoreline change analysis of Vizhinjam coast using satellite images



Shoreline change Analysis

Shoreline change assessment carried out for the years 2000-2018 using high resolution (LISS IV-5m) data and corresponding beach profile analysis (at Valiyathura) has been done. Shoreline change analysis (Before and after 2010, Five yearly change analysis and Seasonal change analysis for the year Feb 2017-18) carried out using high resolution satellite (2.5m) images. Beach profile analysis (annual, inter annual, seasonal and monthly) performed from February 2015 to September 2018. Validation of shoreline derived from the satellite image with the beach profile data. Location specific analysis (satellite image and beach profile) of high erosion site – Valiyathura. A Final Annual report comprising the above analysis has been submitted along with the periodical half yearly and quarterly reports.

Scientific studies for sustainable opening of Cooum river mouth

The project involves designing a sustainable solution for keeping the Cooum River mouth open and providing an ecofriendly solution.

Proposed Solution – Curved river training walls

Comprehensive data comprising tide, grab sample collection, water quality, biological, geotechnical measurements and bathymetry in the open sea up to 10 km upstream of Cooum River were collected. Measures necessary for maintaining minimum tidal interaction assessed so as to enable flows within the River. Detailed analysis of shoreline changes based on statistical methods using high resolution satellite imageries (5 m resolution, minimum 5 imageries in the last 15 years) were carried out. Numerical modelling using DELFT 3D for selecting a suitable sustainable solution for Cooum mouth opening at the confluence and tidal flushing / prism modelling studies for upstream areas were carried out. Numerical model studies included 3 different scenarios. Study report has been submitted to client (Tamil Nadu Urban Infrastructure Financial Services Ltd.)

Sustainable shoreline management for Ennore coast

Kamarajar Port Limited (KPL) approached the Tamil Nadu Public Works Department (TNPWD) to provide them support for providing a sustainable solution for keeping the Ennore Creek mouth open as part of compliance requirements for the stipulations specified in their Environmental Clearance.

In addition to the groins, KPL proposes to provide training walls to the Ennore Creek to keep the mouth open as a societal measure. On the request of TNPWD, NIOT has carried out scientific studies for arriving at sustainable shoreline solution for Ennore creek, including dredging requirements inside the Ennore Creek for ensuring tidal influx to ensure improvement in water quality.

Scientific studies related to shoreline morphology assessment and creek training works for expansion of Krishnapatnam Port Company Limited

Krishnapatnam Port Company Limited (KPCL) has approached NIOT for carrying out comprehensive scientific studies to meet their statutory compliance requirements. Study of shoreline changes and anti-erosion works has been completed using shoreline change model LITPACK by DHI. Comprehensive field data collection for marine ecology and creek rerouting has been carried out for three seasons. Modelling for alteration of Kandaleru creek using Delft-3D has been completed and no significant impact of creek rerouting was observed from the study. Study on Mangroves, mudflats, beaches and creek changes using satellite imageries have been completed. Impact of dredging on shoreline using hydrodynamic module of Delft-3D and Wave tranquility study using Celeris are being carried out.

Coastal Erosion Mitigation and Shoreline Management plan for Visakhapatanam

Shoreline of Visakhapatanam has been undergoing coastal erosion for several decades. As a consequence, some of the infrastructure built along the shoreline is already under threat and several others are likely to be damaged in the near future. Greater Visakhapatanam Municipal Corporation (GVMC), Government of Andhra Pradesh has requested NIOT and Deltares to carry out a study in order to define conceptual designs for possible mitigation options and to draft a shoreline management plan for Vishakapatanam. The study area is between south of Gangavaram to North of Rushikonda for a stretch of 35 km.

Detailed project inception report and Detailed Analysis report on the field data collected were submitted to GVMC. Numerical model studies for the present scenario are completed and the studies including interventions are being carried out.

Study on impact on dredge material on ecology for proposed Sagar port by Kolkata Port Trust

The Kolkata Port Trust (KoPT) proposes to dredge the existing navigational channels of Haldia port to cater the navigational needs of larger freighters. Detailed studies for water quality, sediment and biological characteristics including elutriate tests as per the statutory requirements were conducted by NIOT on KoPT request. The studies included segregation of possible contaminant, dispersion pattern based on water flow direction, historical status of water quality, biota availability, assess the pollution status of the environment and select organisms for bioassay studies. Detailed dredge dump modeling and biological analysis studies concluded that, dredging and dumping can be undertaken without any change in turbidity and pollution in the dump location.

OCEAN OBSERVATION SYSTEMS

Robo Coastal Observer

Testing of RCO

Robo Boat

Sagar Bhoomi Sea Trials

Micro Plastics sample collection

CORNEA

ADDRESSS

Mobile App

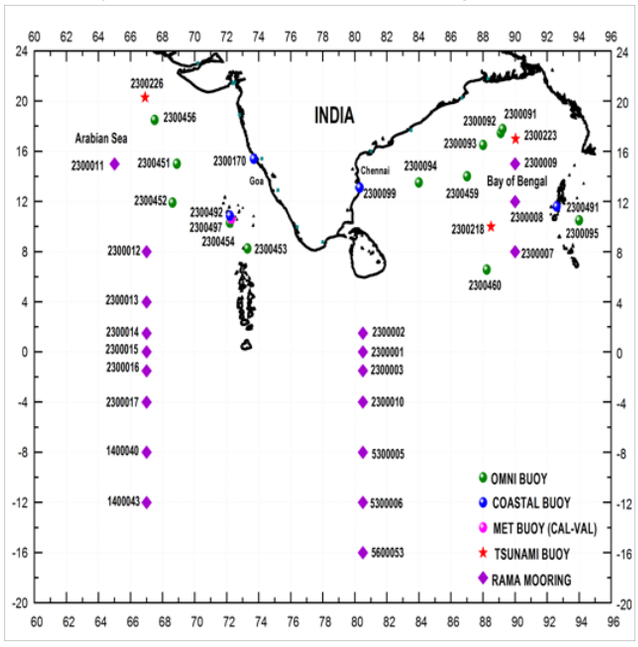
OCEAN OBSERVATION SYSTEMS

The main objectives of the Ocean Observations Systems programme are three fold.

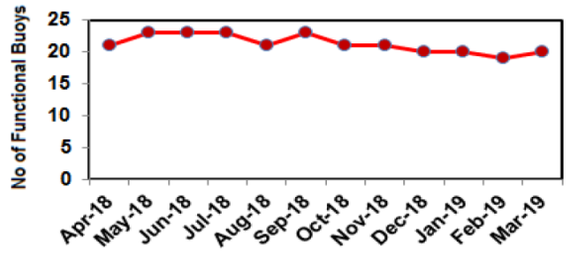
- Maintaining Moored Ocean Observation Network comprising of met-ocean and tsunami buoys for real time data transmission and to support RAMA program under the Indo-US collaboration and to disseminate data to INCOIS.
- Ocean observational tools prototype technology development.
- To carry out collaborative R&D projects, capacity building with National and International Institutes/ Organizations.

Establishment of Moored Buoy Network (Met-Ocean and Tsunami)

Ocean Observation Systems (OOS) group of NIOT has been systematically maintaining 12 deep ocean OMNI buoys, 4 coastal buoys, one CAL-VAL buoy system, one subsurface ADCP mooring, one Wave rider buoy (DWR), one Arctic mooring and 3 tsunami buoy systems. During the reporting period, 15 cruises have been taken up which took 199 days ship time and a sailing covering 17273 nautical miles to carryout 67 deployments/ retrievals. An additional buoy equipped with Integrated Marine Surveillance System (IMSS) was operational for 4 months since May 2018.



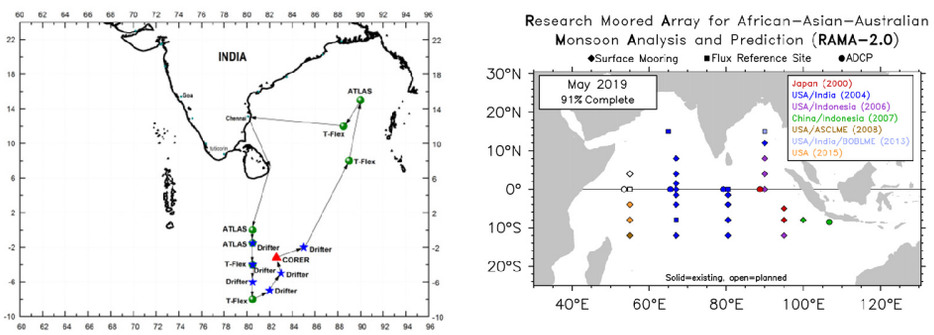
Moored Buoy Network in Northern Indian ocean



Functional Buoy Status

RAMA Buoy Network

The Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) has been designed to study the Indian Ocean's role on the monsoons. During the reporting period one RAMA cruise has been undertaken for 27 days (from 30th Oct to 26th Nov 2018) covering 3816 nm for the maintenance of RAMA buoy network and 32 RAMA buoy operations have been conducted,



Cruise tracks and present status of the RAMA array in the Indian Ocean

Indian Arctic Mooring (IndARC)

To understand various processes in the Arctic region, and its impact on Indian Monsoon, the country's first multi-sensor moored observatory IndARC has been installed in the Kongsfjorden fjord and maintained continuously since July 2014 with the support of ESSO-NCPOR. The last deployment of IndARC IV mooring was completed on 22nd July 2017 using the vessel RV Lance.

Cyclone Signals Captured by Buoy Systems in Real Time

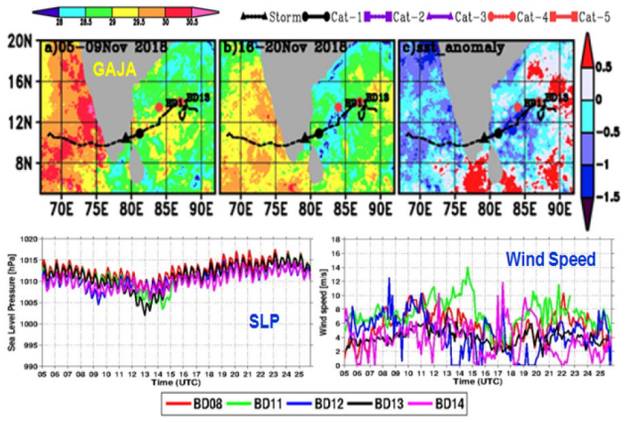
The NIOT moored buoy network has helped the society by providing real time data during cyclones and tsunamis. Following four cyclones were captured in real time by OMNI buoys.

a) **Cyclonic Storm Daye (19-22 September 2018):** Observed signatures during 15th to 21st September 2018 by OMNI buoys BD08, BD09, BD10, BD11, BD12, BD13 & BD14. The buoys BD08, BD09 and BD10 captured drop in sea level pressure (SLP) of ~ 10 hPa (from 1005 to 995 hPa). Wind speed increased from 2 m/s to 14 m/s at BD10 location.

b) **Very Severe Cyclonic Storm Luban (6-15 October 2018):** Observed signatures during 3rd - 13th October by OMNI buoys AD06, AD07, AD08, AD09, AD10. SLP dropped by ~ 5 hPa at the AD08. The response of other parameters was not prominent, since the buoys were located far away from the cyclone track.

c) **Very Severe Cyclonic Storm Titli (8-12 October 2018):** Observed signatures during 8th to 12th September 2018 by OMNI buoys BD08, BD09, BD10, BD11, BD13 & BD14. The signatures of SLP was observed in BD13 (~12 hPa) but the increase in wind speed from 2 m/s to 16 m/s was observed in BD10.

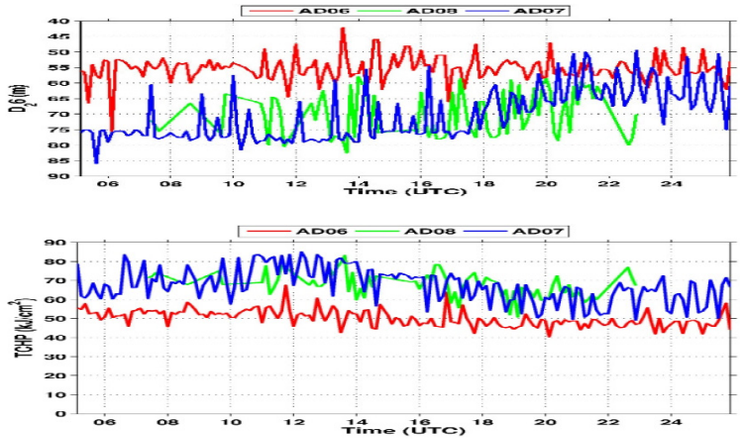
d) **Cyclonic Storm GAJA (10- 20 November 2018):** The GAJA cyclone made landfall on Tamil Nadu coast. OMNI buoys BD08, BD11, BD12, BD13 and BD14 provided continuous moored buoy observations during GAJA Cyclone, November 2018. Maximum sustained wind speeds are at 60 knots (3-min) and 75 knots (1-min), with gusts at 70 knots. Minimum central pressure is estimated at 992 hPa. BD13 recorded drop in SLP (~8 hpa) while BD11 recorded increase in wind speed from 7 to 14 m/s. However no significant response was observed in other parameters.



GAJA cyclone track overlaid on GHRSST (a) before (b) after the cyclone passage (c) anomalies in SST due to cyclone; (d) SLP, (e) Wind speed

Tropical Cyclone Heat Potential (TCHP) from OMNI buoys

TCHP plays a major influence on tropical cyclone (TC) intensification and maximum intensity. D26 are calculated for OMNI buoys in the Arabian Sea(AS) and Bay of Bengal(BoB) for one week i.e. from the initial phase till the availability of real time data during the occurrence of a TC and is disseminated to IMD. The D26 and TCHP estimated during cyclone GAJA is presented below.



D26 and TCHP estimated during cyclone GAJA from OMNI buoys in the Arabian Sea

Indigenious Products of OOS programme

The following indigenization efforts taken by OOS group under Make In India programme, not only signified the beginning of a new era of development of advanced ocean observational tools in the National Context but also could achieve a deserving place for India among the renowned International ocean observational bodies.

a) **Development of Indian Tsunami Buoy System Sagar Bhoomi:** Indian Tsunami Buoy Sagar Bhoomi-II surface buoy system was deployed in Arabian Sea at TB12A location (11°46.97'N, 68°36'E), in around 4300 m depth. It is configured with DART Message format, configurable

transmission interval and low power consumption. It is working satisfactorily since deployment and the demonstration was successful at field with real time data being shared with NDBC through INCOIS.

b) **Development of ROBO Coastal Observer (RCO) / Life saver:** The RCO is used for performing real time remote controlled data collection of parameters associated with oceanographic study in coastal waters, also in lakes and rivers as well as for coastal and deep sea surveillance purposes. It can also be used as coastal life saver to rescue a person who has fallen overboard. It can rapidly reach the target and can be launched from land, vessels or even from aircrafts and is highly durable. ROBO life saver was successfully tested in-house as well as in the open sea. An Indian patent has been filed. The Technology of RCO was transferred to M/s. CT Control Technology, India Pvt. Ltd. through NRDC at Hyderabad on 27th April 2018.

c) **Development of Robotic Boat:** An autonomous robotic boat for coastal and deep water surface observation was developed and tested off Chennai during September 2018 and was demonstrated at Muttukadu, Chennai on 11th February 2019. It can be controlled through wi-fi/4G and equipped with surface and sub-surface sensors and underwater camera. The real time video streaming from the robo boat provides clear details of underwater sensors.

d) **IMSS (Integrated Marine Surveillance System) Buoy & Industrial Version Field trials:** The first of its kind of a buoy which is equipped with IMSS-01 was deployed at Chennai port on 3rd May 2018 for four months. It has three cameras fixed above the surface and one camera fixed in underwater. This system has transmitted real time videos through GPRS communication. Special approval was obtained from Chennai port authorities to carry out the buoy operation from NQ jetty.

Support to International & National ocean observation programmes

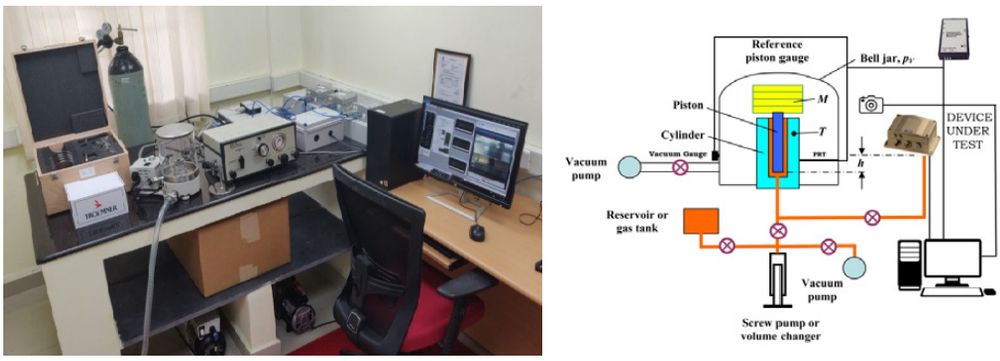
OOS-NIOT has joined OceanSITES which aims to collect multidisciplinary data worldwide from the full-depth water column as well as the overlying atmosphere. Two deep water locations are identified as OceanSITES; viz., AD07(15N/69E) in Arabian Sea and BD11(13N/84E) in Bay of Bengal respectively. OOS supported deployment of BIO-GEO-Chemical sensor integrated with AD06 (18N/67E)- OMNI buoy for INCOIS. Also supported deployment of ambient noise measurement system at AD09 (8N/73E) – for Ocean Acoustics group, NIOT.

Subsurface ADCP mooring design

To validate the current data measured by the OMNI buoys, a comparison exercise is being carried out with an upward looking subsurface ADCP mooring at AD09 location. The challenge was to make the ADCP buoy settle at around 250m subsurface. A combination of wire rope, chain and nylon rope was used. The estimated elastic and plastic elongation in the nylon rope was calculated based on the expected peak load and minimum load on the mooring. Post recovery, it was found that ADCP settled at 248m.

In house Calibration

OOS established state of art calibration test facility and maintaining the reference standard to calibrate the sensors which measure the parameters i.e. atmospheric pressure, atmospheric temperature, relative humidity, precipitation and DPU. All the reference standard are traceable with National



Digital gas piston gauge – Barometer calibrator

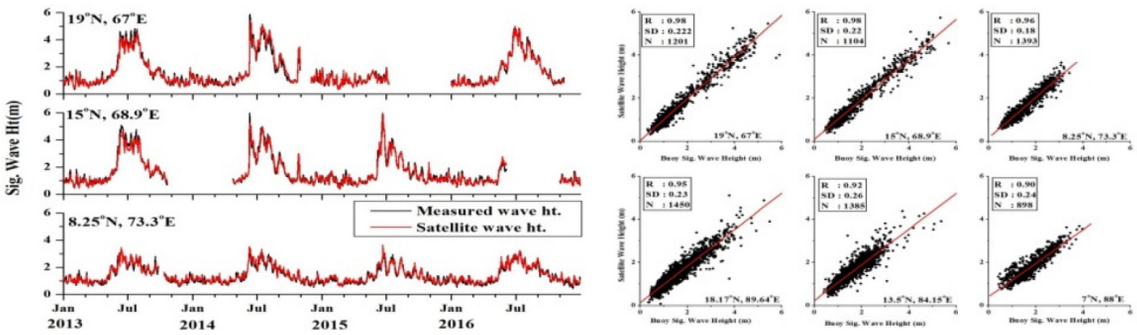
Standards. Sensors used in buoy systems are calibrated before deployment and after retrieval to ensure the quality of the data being collected.

Validation of Data

Apart from the efforts taken in ensuring continuity of data, the quality of the data is also ensured by comparing with other standard reference platform/systems.

The quality of the meteorological observations is ensured by comparing them with different data loggers, like Imported GENI, Indigenous IDAS, WHOI and Campbell buoy data loggers, at the reference station at OOS-NIOT.

- Calibration of CT sensors is the crucial factor and all the sensors are calibrated before deployment and after retrieval in the field with reference to a (already) calibrated sensor and the data are validated for drift analysis to ensure good quality measurements.
- Wave Measurement Validation (PPWET) which is an inter-comparison excersice between wave data measured by NIOT moored buoy and DWR off Chennai is continued during the reporting period.The data and report are submitted to JCOMM.
- An inter-comparison of wave measurements between an indigenous buoy of 2.2 m hull with 3.0m imported hull from Fugro-Oceanor was carried out at 15 m water depth Off Chennai for four months and the inter-comparison indicates good agreement between two buoy systems.
- The significant wave height (SWH) derived from AVISO is validated using the in-situ moored buoy measurements at six locations in Northern Indian Ocean and the correlation varied between 0.92 (RMSE=0.24) to 0.97 (RMSE=0.21) in the Bay of Bengal and Arabian Sea respectively.



SWH from Moored Buoy vs AVISO in the Arabian Sea

Data Audit

NIOT disseminates real time data to INCOIS through EMail, VSAT and FTP every three hours and on monthly basis. Further, as and when the buoys are retrieved from the location, high resolution data from the internal storage (Hard Disk) of the buoys system is also provided to INCOIS through FTP. NIOT and INCOIS jointly conducted the data verification about quality of the data and performance of sensors held on 3 & 4 May 2018 at NIOT, Chennai. The data is in order.

Reliability analysis

A study has been conducted on the reliability metrics achieved by NIOT-operated moored buoy networks, the healthiness monitoring interval implemented to achieve the highest level of on-demand reliability, the methodologies adopted to ensure highest possible system availability, and data returns and a paper has been published in peer reviewed journal.

Best Practices for the Ocean Moored Observatories

The best operational practices and quality control processes followed in the Indian moored buoy system design, sensor calibration, testing, integration, deployment, retrieval, and data quality control over the past two decades, has helped to achieve an average meteorological data return of 90%.

DBCP Guidelines for Oceanographic Instruments

Based on the request of the DBCP panel, an overview of the draft proposal for stipulating the guidelines for Oceanographic Observations and Instruments, such as CIMO (Commission for Instruments and Methods of. Observation) guide for the Meteorological Instruments was provided during 34th DBCP meeting held at Cape Town, South Africa during 23-26 October 2018.

Augmentation and Up gradation of Shore Station

The shore station setup was established in 1997 and was revamped in 2011. Owing to the growing computational, processing demands, storage requirements and to enhance the data reception and dissemination capabilities, as per the recommendations of the technical committee comprising experts from various organisations, the facility **CORNEA** – **C**entre for **O**cean **R**ealtime i**N**formation vi**E**w and **A**rchives was made operational from October 2018. It is manned 24 x 7 and acts as the

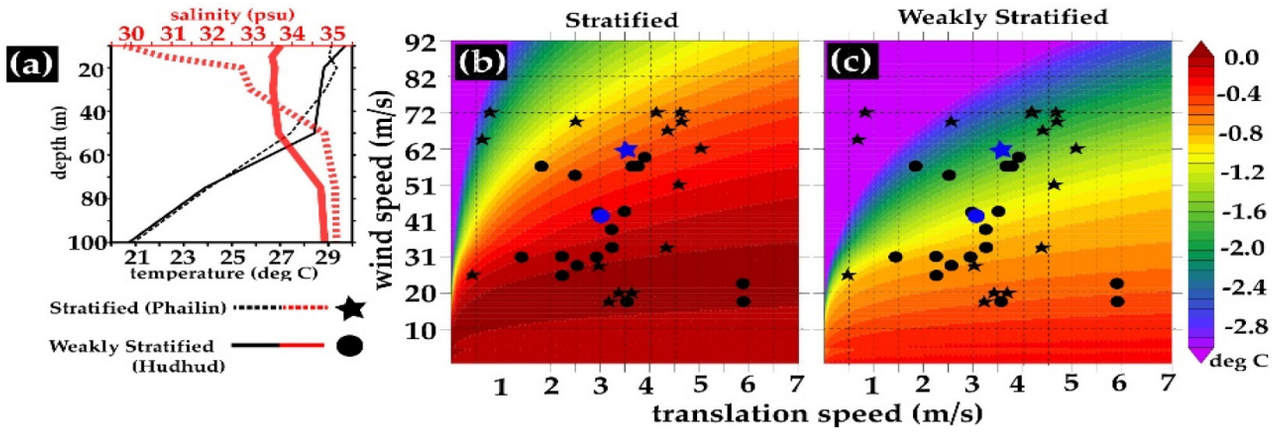
nodal point for dissemination of critical data like cyclone and Tsunami to INCOIS for promulgation of early alerts and warnings in India.

Challenges Faced during Field Operations

Challenging deployment/retrieval operations during rough and unsupportive weather. Nonavailability of much needed ship time which makes cruises during monsoon season inevitable. Vandalism of buoys in field on which a lot of time, effort and money is invested and still continuing even after many vigorous anti-vandalism efforts are taken. Biofouling, a continuous menace, has enforced lot of measures for field calibration to maintain quality mesurements.

Analysis and Research Based on the OOS-NIOT Observed Data

The contrasting upper ocean response of the Bay of Bengal to two intense cyclones: The upper ocean's response to cyclones Hudhud and Phailin (category 4 & 5 respectively), which traversed similar path and at nearly identical time of the year is analysed using observations from moored buoys, satellite and modelling. Hudhud though of less intensity, induced significant SST cooling and chl-a enhancement over an extensive area when compared to Phailin and the reasons for this contrasting response is addressed.

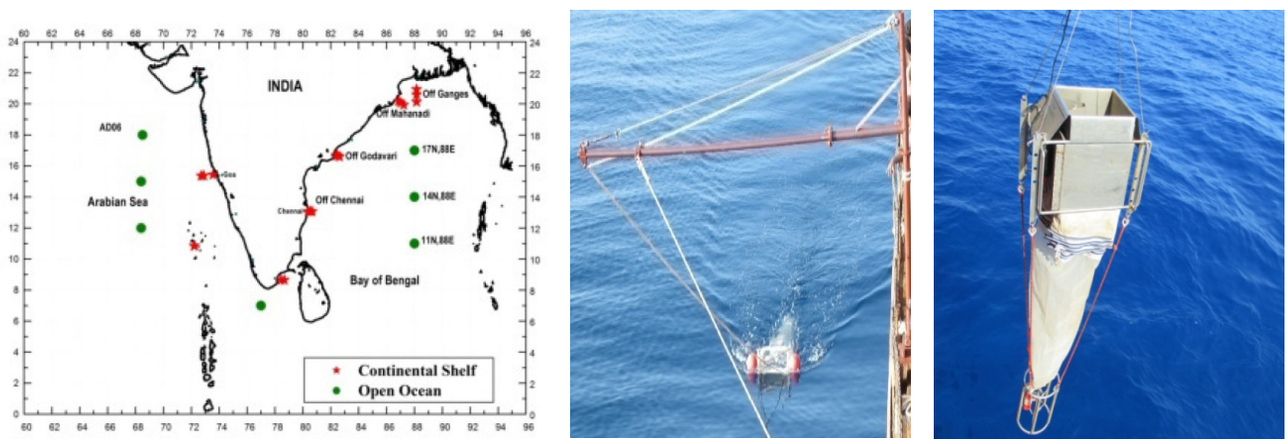


SST cooling for Stratified and Weakly Stratified Scenarios

- Offset correction in Long Wave Radiation measurement.
- Impact of East India Coastal Current (EICC) meandering on heat and salt budget and air-sea fluxes over the northern Bay of Bengal.
- Comparison of long-term thermohaline variability in North Indian Ocean.
- Model Dependent Wave Assimilation Characteristics using OMNI Buoy Data in BoB.
- Nonlinear Quadruplet Wave Energy Transfer in Shallow Waters during NE Monsoon.

Studies on Marine Plastics

Studies on Marine Plastics were initiated in Northern Indian Ocean to identify and analyse the characteristics and its variability in the North Indian Ocean. Samples are collected from various locations of deep sea and coastal regions to study the effect of oceanic process, riverine discharge and ship based disposal of micro plastics. Five cruises were carried out in which horizontal net trawl and vertical net haul are carried out to estimate the presence of micro-plastics in the surface waters and in the water column. Water samples from various depth levels and sediment samples were also collected and the analysis is under progress.



Samples collected using Manta Net, Zooplankton Net and CTD Rosette

Secretary MoES, Reviewed OOS Pre-Cruise & Field Activities Onboard Sagar Nidhi on 28-02-2019

Secretary MoES, Unveiled Mobile Apps Developed by OOS(left) MarPlasts for Marine Plastics Study (NIOT & NCCR) &(right) Real Time Buoy Data on Mobile

VESSEL MANAGEMENT CELL

CRV Sagar Tara successfully launched on 25th Dec, 2018

Unveiling of Launching Ceremony plaque by HMoES

Pre-Launching Ceremony of Sagar Tara

Indian Coast Guard Ships

Sahyog HOP TAC 2018

VESSEL MANAGEMENT CELL

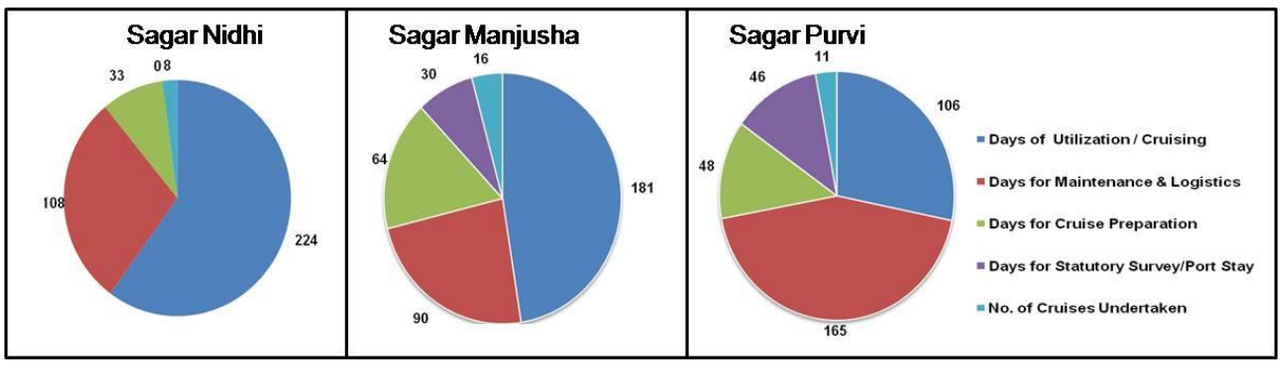
Research Ships of NIOT are versatile ocean observing platforms equipped with advanced scientific equipment and mechanical handling equipment for technology demonstration and oceanic observations, which are on par with International Standards. Vessel Management Cell of NIOT is responsible for operational management and maintenance of research ships and scientific equipments onboard. Currently there are three vessels under NIOT viz., Sagar Nidhi, Sagar Manjusha and Sagar Purvi.

As the existing Coastal Research Vessel (CRV) Sagar Purvi which is more than 22 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 we required slightly larger capacity vessels & hence NIOT has proposed to acquire two new Coastal Research Vessels which are sophisticated than the available similar category of the vessel. These two new CRVs are being built at M/s TWL, Kolkata.

VMC consists of a team of Engineers who support the research ships on a day to day basis, to ensure the vessels continue in the on time delivery of data collected. VMC collect scientific data and compile the data collected during the expedition. Operation and maintenance of scientific equipments is being done by VMC team in Sagar Nidhi [till Dec, 2018], Sagar Manjusha & Sagar Purvi without outsourcing. VMC team have implemented a number of innovative engineering solutions on research ships of NIOT, which is helping the scientific users and shipping industry widely.

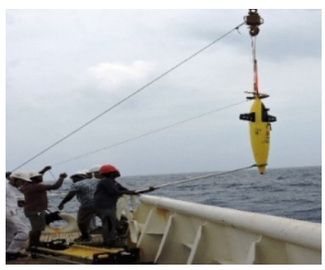
Vessel Utilization Report during 1st April 2018 to 31st March 2019

Vessel	Days of Utilization / Cruising	Days for Maintenance & Logistics	No. of Cruises Under-taken
Sagar Nidhi	224	108 (Dry Dock and afloat repairs, Major Overhauling of Engines, 60T A-Frame and Port Azimuth Thruster Maintenance)	8
Sagar Manjusha	181	90 (Anchor windlass repair, Sea water/Fresh water pipeline repair/replacement, Single beam Echosounder rectification, CTD winch davit boom replacement, New lab UPS fitment)	16
Sagar Purvi	106	165 (Engine and CPP overhauling for speed restoration,Rectification of steering gear control,Renewal of exhaust funnel pipe line and main engine seawater pipeline, Under water hull cleaning, Fumigation, Emergency fire pump overhauling, M/E turbocharger, AC condenser, Deep freezer, Fire alarm system, Anchor winch motor replacement)	11

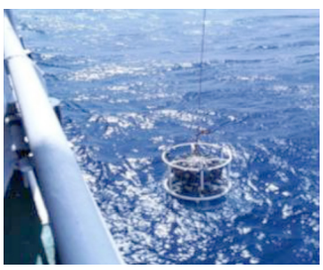
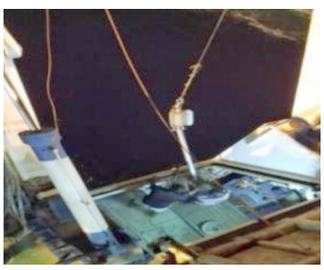


Major cruises undertaken by Sagar Nidhi

- INCOIS/PRL for Scientific Survey.
- OOS-NIOT for Buoy Deployment, Maintenance and Retrieval incland Micro-plastic survey
- OOS-NIOT (RAMA) for Buoy Deployment, Maintenance and Retrieval.
- DST-NIOT for New winch testing Trials and for ACS trials
- INCOIS & MBT-NIOT for OON Cruise
- SAIC-INCOIS for Buoy Deployment, Maintenance and Retrieval

Deployment of VMP and Sea glider (INCOIS / PRL cruise)

Deployment of CTD Rosette & Deep Sea Corer (INCOIS & MBT-NIOT cruise)

Secretary, MoES visited Sagar Nidhi on 28th Feb, 2019 at Chennai Port to review the scientific capabilities of Ship & interacted with VMC team, Ship crew & appreciated the efforts of VMC-NIOT

Secretary. MoES visited Sagar Nidhi at Chennai Port

& SCI in ensuring the up-keep of vessel & effective utilization of Ships.

Radiometer Operation

CTD Operation

Major cruises undertaken by Sagar Manjusha

- INCOIS/University for Scientific Survey and for Collection of Physical, Biological, Chemical and Geological data.
- NCCR for Sea Water Quality Monitoring Programme.
- IIT Madras for Underwater Optical Studies.
- Indian Coast Guard for SAHYOG-HOP 2018 Exercise.
- EFW-NIOT for Island Survey and Sampling.
- INCOIS for Retrieval of Glider & MOSAIC Coastal water and aerosol sampling in Bay of Bengal.
- OOS–NIOT buoy deployment at Goa port and water sample collection for microplastic studies in Bay of Bengal and Arabian sea
- OSS cruise for Bathymetry survey and sampling for setting up of 6 LTTD plants in UT Lakshadweep

Major Cruises undertaken by Sagar Purvi

- University/NIOT for Scientific Survey and Water Sampling
- NIO Kochi for Marine ecosystem Dynamics Study
- NCCR for Sea Water Quality Monitoring Programme

Acquisition of two new CRVs

Sagar Tara berthed alongside Pantoon Jetty

Laying & Fixing of insulation, Wall Panels & Floating Floors in accommodation areas

CRV Sagar Tara

Description (Outfitting)	Overall Completion (%)
Bollards	100
WT Doors & Hatches	100
Ducts (Machinery Space & Accommodation)	90
Chequerd Plating (Machinery Space & Store room)	80
Insulation & Panelling	Insulation Completed Panelling: 60
Windows	100

CRV Sagar Anveshika

- Complete hull fabrication and erection has been completed. Moonpool erected for dropkeel.
- Aluminium block fabrication and erection is in progress under cover shed.
- The quality of aluminium welding achieved by TIG & MIG is as per ship building practice.
- Major equipment such as diesel generator, oily water separator, bow thruster, HPP for BT, fresh water generator, calorifier, hydrophore tank, grey water discharge pump, sea water pump, AC, refrigeration and emergency fire pump have been installed onboard.Drop keel and rudder fabrication is in progress.

Block Erection status of Sagar Anveshika

The progress is being monitored closely and quality standards are being verified on a regular basis on every stage of the construction of CRVs through IRS (Class), NIOT overseeing team, Expert Committees & IRS (Overseeing team).The progress is satisfactory and well within the contractual dates and specifications.

Likely date of delivery of two new CRVs ahead of contractual schedule is tentatively by **July & October 2019** respectively.

Sagar Nidhi A-Frame piston refurbishment work using clad welding technique

Avoiding the conventional way of procuring new hydraulic cylinders, VMC team recommended for rectifying the same by welding the corroded area after de-chroming the shaft. Post chroming around 150µ, non-destructive testing confirmed the quality of welding. Accordingly, the shafts were pressure tested, synchronized and installed onboard and was approved by Statutory authority.

Hydraulic cylinders synchronized & tested

Sagar Nidhi-Deep Sea Winch base frame fabrication and installation

It was requested by DST team that existing winch base frame to be modified and new base frame to be fabricated and installed. VMC took up the challenge to carry out the work at port though it is a dry dock package. Critical points like deck strengthening, point load of winch & positioning of girders & carlings were identified by VMC team and proposed to class. The same was approved by IRS after due verification.

Sagar Purvi-Speed restoration

VMC took up the challenge of increasing the speed of Sagar Purvi and during inspection it was found that there is a reverse flow of exhaust gas from the manifold, choked inlet vent, erratic turbo-charger operations.CPP system was inspected & fine tuned the same. Similarly re-profiling of exhaust manifold, renewal of inlet vent and turbocharger filter was carried out. After modification, it was observed that the ship was attaining a speed of 6.5 knots in the same sea condition.

SEAFRONT FACILITY

Project Site office, Chittedu

Roof top Solar panel at project site, Chittedu

Rain harvesting system at project site, Chittedu

Drinking water supply system at project site, Chittedu

SEAFRONT FACILITY

The aim is to create world class Seafront Research Facility to enable activities in development and testing of prototype systems, validation of indigenously developed marine systems in the ocean environment and also to undertake programs connected with NIOT such as Deep Sea Technologies, Submersibles and Gas hydrates, Offshore Numerical studies, Marine Sensor Systems, Desalination Research, Coastal Engineering Research, Open Ocean Acoustics, Marine Biotechnology, Ocean Observation System and Ocean Electronics.

Master Plan for Seafront Research Facility (SRF) & Facility for Administrative, Computational and Training (FACT)

The master plan has been prepared by planning the immediate essential requirements as phase 1 and rest of the facilities as phase 2. The Master plan has been reviewed and approved by Project Review and Coordination Committee (PRCC). Detailed Project Report (DPR) comprising user group research facility requirements and budgetary estimates has been completed and approved by PRCC.

The DPR will be the base document for further process. The master plan for Seafront Research Facility (SRF) at Pamanji site shows the locations of the proposed testing facilities that are to be developed in long term perspective for user group of NIOT.

The master plan for FACT at Chittedu site shows the locations of proposed residential complex for NIOT staff, Guest houses, accommodation for trainees, social and service infrastructural facilities.

FACILITY 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	Acoustics 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.
16A	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	OFF Shore Numerical Tank
38	Computational Facility (Stilt + 2)
39 A	Centralized Office (Stilt + 4)
39 B	Centralized Office (Stilt + 4)
40	Admin (Stilt + 4)
41	Common Storage
42	Canteen and Guest House (G+2)
43	Pump Room
44	Labour Shed
45	Panel Room
46	Fire Station
47	STP
48	Building Transformer Yard
49	Desalination, RO Plant, UG Sump
50	Security
51	Existing Security
52	Solar Farm
53	Ballast Water Treatment Facility
54	Algal cultural facility
55	New Transformer
56	Boat Jetty
57	VMC Dock

PLOT COVERAGE	
TOTAL BUA	151080 SQ.M
PLOT AREA	621394.80 SQ.M
FSI	0.24
PLOT COVERAGE - MASTER PLAN	28.62 %
PLOT COVERAGE - PHASE 1	28.18 %
PLOT COVERAGE - PHASE 2	29.36 %

Master plan for SRF at Pamanji

FACILITY NO	NAME OF FACILITIES
1	Admin Building (G+2)
2	Fact Facility (G+1)
3	Auditorium
4	Creche
5	Canteen & Guest House (G+2)
6	Primary School (G+1)
7	Community Hall (G+1)
8	Health Centre / Commercial (G+1)
9	Indoor Sports and Gym (G+1)
10	Club and Meditation (G+1)
11	Site Maintenance (G+1)
12	Common Storage Yard (G+1)
13	Labour Shed (G+1)
14	RO Plant
15	Fire Station
16	Electrical Panel Room
17	Electrical / Civil Storage Yard
18	Electrical Substation (G+1)
19	Civil Engineering QC Lab
20	Pump and Sump room
21	Tele Exchange
22	STP
23	EB Yard
24	Security
PLOT COVERAGE	
TOTAL BUA	104370 SQ.M
PLOT AREA	212460 SQ.M

	UNIT TYPES	NO OF FLOORS	NO OF BLOCKS	NO OF UNITS
	TYPE II	G+2	08	96
	TYPE III	G+2	17	204
	TYPE IVB	G+2	17	102
	TYPE IVC	G+2	08	48
	TYPE V	DUPLEX - G+1	50	100
	TYPE VI	DUPLEX - G+1	07	07

Master plan for FACT at Chittedu

Facilities built and taken over at Pamanji and Chittedu

The civil works for the essential facilities like Project site office, Security building and Sentry posts are completed. Temporary katcha road has been laid as per norms to access the land purchased at Pamanji Site.

Sentry post at Chittedu

Security room at Chittedu

Security building at Pamanji

Systems installed in the building facilities

According to the building regulation norms, the project site office established at Chittedu is installed with systems such as solar panels, diesel generator, drinking water / drainage system, rainwater harvesting, underground sumps, fire fighting system and CCTV surveillance system.

Raceway Pond works at Pamanji Site

Testing facility for conducting algal culture which comprises of raceway ponds, store room and pump room has been completed. The work has been carried out in the remote place with a least approach route to the site location.

Security room at Chittedu

Facilities for raceway pond at Pamanji

Pump room for raceway pond at Pamanji

COMPUTER MAINTENANCE CELL

Computer Maintenance Cell (CMC) of the NIOT provides Computational and Infrastructure Managed Services for the research and administrative purposes. CMC administers, manages and caters to the needs of different projects, departments within the institute apart from in house software development and maintenance.

CMC services the campus-wide LAN which caters close to 500 users. LAN has been designed with single mode fibre OFC backbone offering aggregate bandwidth of 1 Gbps from NKN-NIC and a leased line of 30 Mbps capacity from Vodafone to ensure uninterrupted service to the user community. NKN established through NIC, has redundant connectivity's as a failsafe arrangement.

The CMC core infrastructure facilities include server farms, blade servers with wide variety of operating systems like Windows, Unix, Linux, Redhat for intranet portal, web & mail services, FTP Storage and Application servers running key applications 24 x 7. Two Storage facilities 20 TB and 4 TB capacities respectively support large volume of data.

CMC also maintains the telepresence facility for remote and virtual meeting requirements of the organisation. It also supports '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 maintains state of art 'IBM Lotus Notes v9' mailing system.

CMC has also developed Integrated Office Automation System (IOAS) to support activities of Stores & Purchase, Leave management, General Administration, Finance Applications and to make them online, enabling NIOT to move towards paperless office implementation as per Government of India guidelines.

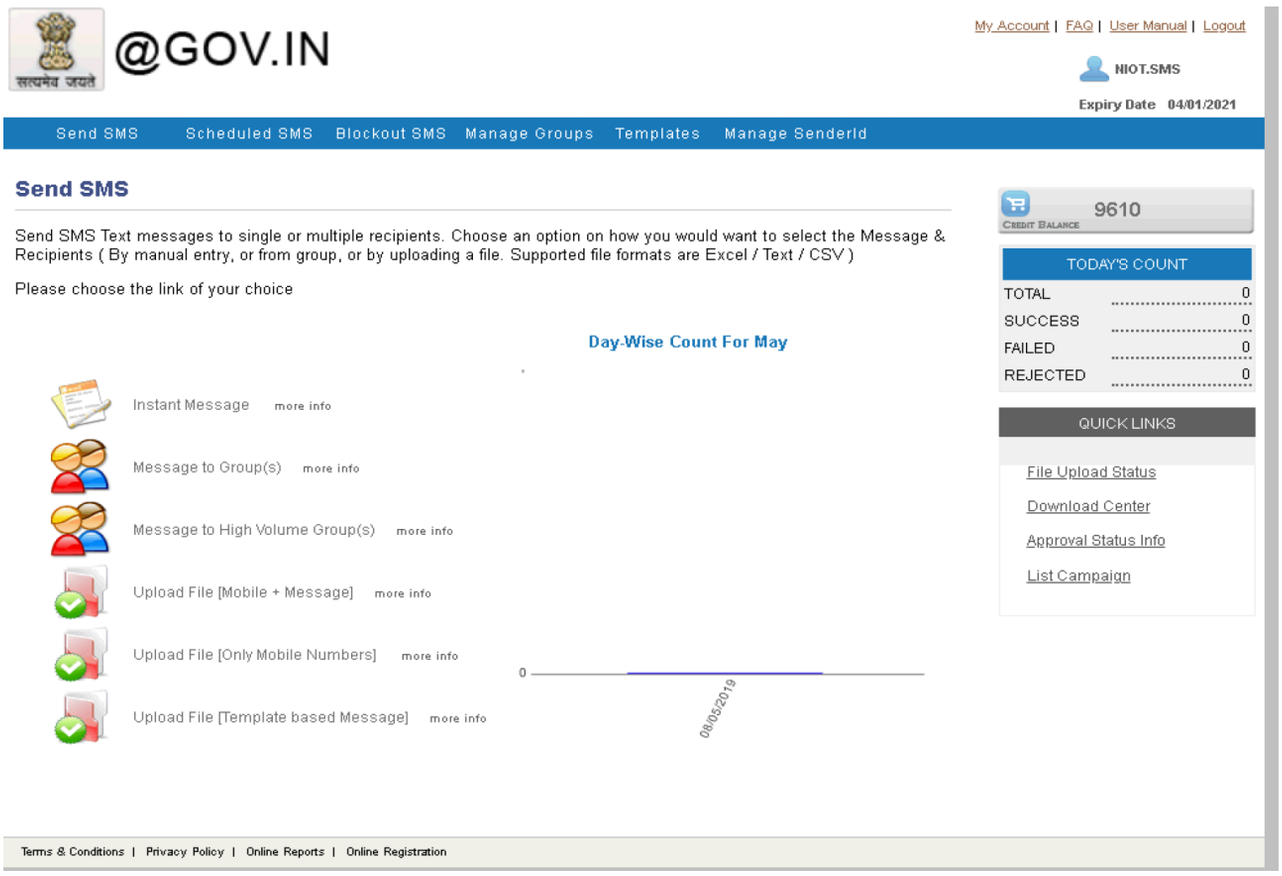
The online recruitment module was used for regular posts recruitment from online application submission to call letter generation.

CMC has been successful in piloting PFMS usage and now NIOT uses PFMS for regular employee payroll processing. CMC has also developed DAK management system for tracking file/postal and letter movements.

NIOT is also implementing NIC email, and SMS services as a part of MoES initiative for transparent communication and transactions.

Major Accomplishments during the year

- Implementation of NIC's SMS Services
- Implementation of PFMS for NIOT Employee's payroll



Following are some of the major softwares that are being used by various departments and supported by CMC.

Category	Name of the Software
For Drafting & Modelling	AutoCAD, Pro E, Mike 11 & 21, ITI Simulation
For Analysis	Ansys, Orcaflex, Shear 7, Hypack, Moses, Star ccm, Staad Pro, Arc GIS, HTRI
General Purpose Software	Mathcad, Matlab, Lab View
Project Monitoring Software	Primavera , SAP 2000

CAMPUS DEVELOPMENT AND MAINTENANCE

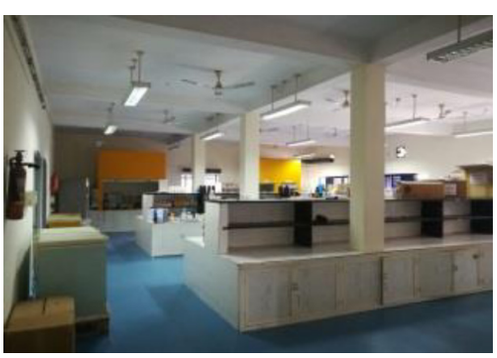
To cater the requirement of research activities of different groups at NIOT campus, the planning permit and building approval has been obtained from Chennai Corporation to construct the buildings as part of the campus development work.

As per the plan approval, vertical expansion of Hyperbaric Test Facility and Ecotoxic Building, expansion of Guest House, Endurance Test Facility, Security Building at North Gate and UPS room for Ocean Observation Services are carried out.

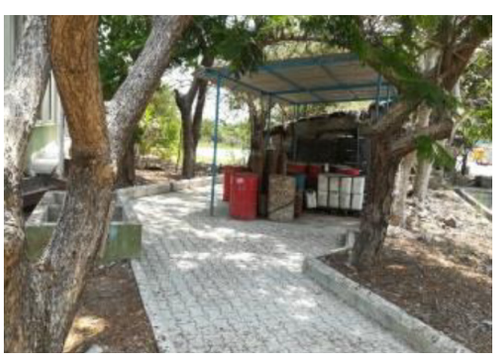
The compound wall at Northern side of NIOT campus is reconstructed to a length of 180 m to ensure the safety. Interior work for setting up the Gas Hydrates laboratory and seating arrangement in ground floor of Integration Bay (IB) has been completed.

Also interior work for submersible group and Ocean Acoustics were completed. Fabrication of 8ton capacity concrete dummy weight for testing the deep sea winch and umbilical cable and laying of paver block passage for oil barrel set for DST group was completed.

Modular toilets along with necessary plumbing works at terrace in Buoy Test Facility were installed. In view of the modernization and as green initiative, minimizing the plastic usage, the Video LED wall has been installed at Auditorium



Interior and civil work at Ecotoxicology Laboratory



Paver block passage for Submersible & Gas Hydrates

Modular Toilet at BTF terrace

LIBRARY

NIOT-library plays a key role in the research activities of NIOT. Besides holding an excellent print collection of over 5700 volumes of books, 23 online and print journals on Engineering and Science, it also holds CD-ROMs, Gratis materials, reprints, thesis, video cassettes, National Hydrographic Office (NHO) maps and Hindi publications. During the last twenty three years the Library made significant investment in acquiring research documents and monographs. It strives to keep pace with a dynamic and technology-enabled information environment to meet the expectations of Scientific and administrative staff.

Library also provides access to the e-journal facility, a customized web-based Library portal, for access to the full-text journals and databases being subscribed by the institute. It also provides a gateway to a collection of 117 Science Direct journals and Scopus database being subscribed through MoES consortium It provides a customized integrated (24hrs) access (browse; search; locate; download) facility. Library also provides access to Central Library, IIT-M, Chennai British Council library, Chennai and CUIC – Anna university library as additional resources to the staff.

The library offers a range of value added services including:

- Access to electronic resources through digital library portal
- Online issue / return
- Automatic reminder and renewal facility
- Document delivery service (Print & Electronic)
- Internet facility
- Reference assistance
- Inter Library loan facility

The Institutional Repository of NIOT is a scholarly archiving facility for NIOT scientific community established in 2010, where the institute's intellectual output is preserved, searched and shared, using an in-house software package. The service facilitates long-term preservation of the research output and provides easy access to these publications. Further, free availability of the research findings helps in the dissemination of the knowledge base in the global oceanic community.

IMPLEMENTATION OF OFFICIAL LANGUAGE

Hindi training

NIOT is working steadily in the completion of Hindi training of all the staff members. As per roster maintained, at present out of 164 staff members, 135 staff members are trained in Hindi as on 31-03-2019. Cash award and Personal pay is also granted as per norms on passing the Hindi Examination.

Hindi typewriting course

Out of 8 staff members who are eligible for Hindi typewriting course, 5 staff members have been trained and the result of one staff member is awaited. Staff members left for training would be nominated in the upcoming sessions. Cash award and Personal pay is granted as per norms to the eligible staff members.

Hindi Fortnight Celebrations

To promote the progressive use of Hindi and to encourage employees/ Officers to work in Hindi, NIOT celebrates Hindi Fortnight every year. This year Hindi Fortnight was celebrated during 14-27, Sep, 2018. Several competitions were organized and staff members actively participated in all of them with great enthusiasm. Staff members also extended their cooperation in the coordinating all the competition. The Valedictory Function was organized on 27.09.2018 and the staff members were given prizes for the competitions held. Shri Jawaharlal Sharma, Senior Hindi Officer, National Institute of Wind Energy was invited as the Chief Guest.

Hindi workshops

With a view to encourage staff members to use more and more Hindi in their daily routine work, Hindi workshops are being organized frequently. Two Hindi workshops were conducted during the year on various subjects to strengthen the knowledge of the staff members and to motivate them to work in Hindi.

Official Language Implementation Committee (OLIC) meetings

The increase in the use of Hindi and the valuation of the works being done in Hindi in the Institute is discussed in the OLIC meetings. The meetings are held under the Chairmanship of the Director, NIOT and members from each group and sections. Three meetings of Official Language Implementation Committee (OLIC) were conducted during the year.

Online Submission of Quarterly reports for progressive use of Hindi

The reports on the use of Hindi are regularly prepared in each quarter and sent to Regional Implementation Office, Cochin and MoES, New Delhi.

Submission of Half yearly reports for progressive use of Hindi

The half Yearly reports are being sent to the Town Official Language Implementation Committee as per the prescribed format.

Participation in Town Official Language Implementation Committee (TOLIC) meetings

The half yearly meetings of the Town Official Language Implementation Committee (TOLIC) meetings held on 29.05.2018 & 18.12.2018 was attended by the Director In-Charge and the staff members of Hindi cadre. Besides the TOLIC meeting held on 18.12.2018 was hosted by NIOT.

Apart from that staff members of NIOT lively participate in all the competitions that are being organized by TOLIC from time to time. Staff members also send articles to the magazine published by TOLIC.

Participation in All India Official Language Conference

NIOT was represented in the All India Rajbhasha special Hindi Workshop and Seminar organized by Parivartan Jan Kalyan Samiti, New Delhi held during 18-20, February, 2019 at Puri, Odissa.

Official Language Conference organized by Regional Implementation office, Kochi

NIOT was also represented in the One day Official language Conference on 14.02.2019 organised by Regional Implementation Office (South-West), Kochi.

MEETINGS

Parliamentary Standing Committee

- Study visit of the Rajya Sabha Committee on Papers laid on the table, to discuss 'Constraints being faced by organizations/institutions in laying their Annual Report /Audited Accounts timely', took place on February 24, 2019 in Taj Coramandel, Chennai. NIOT presented the technological activities and achievements and timely submission of Annual report/audited accounts every year. The committee appreciated very much, the achievements as well as timeliness of NIOT.

CONFERENCES / WORKSHOPS

- MoES-NIOT conducted workshop on "Puducherry Beach Restoration" at Puducherry on 11.10.2018 in the presence of Dr. Kiran Bedi, IPS, (Retd.) Hon'ble Lt. Governor of Puducherry and Shri. V. Narayanasamy, Hon'ble Chief Minister of Puducherry.

- NIOT in association with Marine Technology Society (MTS) India Section and Bay of Bengal Programme - Inter-governmental Organisation (BoBP-IGO) organized the 2nd Techsurge 2018 on the theme of Technologies and Innovation for Sustainable Fishing (TISF), at Hotel Crowne Plaza, Chennai, India on 10th August 2018.

TechSurge

- National Workshop on Marine Biotechnology (NWMB-2018) was held on 26th June 2018 at NIOT Chennai. A total of 5 invited lectures including one key note address and plenary talk by eminent scientist from biotechnology field were organized. Approximately 120 participant including scientist, research scholars and students participate in the workshop.
- Workshop on Marine Biotechnology, Biodiversity and Fisheries (WMBBF-2018) was conducted on 28th June 2018 at ANCOST Port Blair. A total of 8 invited lectures including one key note address and 2 plenary talk by eminent scientist from biotechnology field were organized. Approximately 70 participant including scientist, research scholars and students participate in the workshop.
- An International conference on Ocean Renewable Energy and Water (INDACON 2019) was organized during 7-8 March 2019 at NIOT, Chennai in association with IEEE-OES & Indian Desalination Association. Dr. V.K. Saraswat, Member, NITI Aayog presided in presence of Secretary, MoES and other eminent guests.
- A workshop on HF radar network along Indian coasts was conducted during 24-25, January, 2019. The workshop was attended by nearly 120 participants from academia, research organizations and Industry (OEMs). A manual for the QA/QC of HF Radar data and proceedings of the workshop were unveiled by the secretary, MoES.

STAFF RECREATION CLUB

Staff Recreation Club (SRC) has conducted various events for children and family members of NIOT and NCCR staff members. The SRC conducted blood donation camp at NIOT campus with Voluntary Health Services (VHS) on January 18, 2019.

70th Republic Day Celebration

The 70th Republic Day was celebrated at NIOT on January 26, 2019. Dr.M.A.Atmanand, Director, NIOT and Dr.M.V.Ramanamurthy, Director, NCCR hoisted the national flag in front of the main building and addressed the gathering of family of the staff members.The staff recreation club organized tree plantation by the scientists and staff and organized indoor games for children and staff of NIOT. Prizes were distributed for the winners.

A tour to the NIOT project implementation site at Kadalur Villages near Kalpakkam was arranged for the staff members and their families by the SRC




72nd Independence Day Celebration

The 72nd Independence Day was celebrated at NIOT on August 15, 2018. Dr.M.A.Atmanand, Director, NIOT and Dr.M.V.Ramanamurthy, Director, NCCR hoisted the national flag and delivered the Independence day address to the audience comprising NIOT staff and their families.

The staff recreation club organized tree plantation by the scientists and staff and organized indoor games for children and staff of NIOT. Prizes were distributed for the winners.

International Women's day Celebration

International Women's day was celebrated on 8th March 2019 at NIOT Chennai. Dr.Premeela Gurumurthy, Vice Chancellor, Tamilnadu Music and Fine Arts University delivered the Presidential address as Chief Guest. Secretary, MoES graced the occasion and delivered special address.

Competitions such as Poster presentation on 'NIOT – Vision 2040', General quiz and Cooking without fire were conducted for NIOT staff and prizes were distributed.

Student Autonomous Underwater Vehicle (SAVe)

IEEE Oceanic Engineering Society (OES) India Jointly with National Institute of Ocean Technology (NIOT), Ministry of Earth Sciences, Government of India and Marine Technology Society (MTS) India Section is organizing the National Competition on Students Autonomous underwater Vehicle (SAVe).

This innovative initiative which was launched in 2011 had so far received 302 registrations and 166 teams had submitted their Preliminary Design Reports (PDR) and 96 teams had made oral presentations on Conceptual Design Reports (CDR). The success of this competition has resulted development of fifteen AUVs by Indian students with different configurations from various educational institutions.

The 6th National Competition on Student Autonomous underwater Vehicle SAVe 2019 was announced on 23rd February 2018. Out of 22 teams registered, 15 teams got selected in the Conceptual Design level competition held at NIOT on 1st August 2018. Eleven teams totalling to 90 students participated in the final phase of 6th National Competition held at the Swimming Pool of IIT Madras during 23-24 January 2019. The committee announced the result that "Indian Institute of Technology Bombay & National Institute of Technology Rourkela" jointly won and shared the First position in the Competition. Indian Institute of Technology Kanpur received the Second position and MIT-World Peace University, Pune took the Third position in the Competition.

Dr. M.Rajeevan, Secretary, MoES interacting with students during the Final competition

ISO Certification

The change over from ISO 9001:2008 to ISO 9001:2015 version has been made and related ISO documents such as Quality Manual for NIOT and compilation of Quality Procedures of administrative sections have been made. Successfully completed the recertification audit during July 2018 and obtained ISO 9001: 2015 certification from the accrediting body TÜV SÜD South Asia Pvt Ltd., Chennai for NIOT and is valid till 2021.

CERTIFICATE

The Certification Body
of TÜV SÜD Management Service GmbH
Trading as TÜV SÜD South Asia Private Limited
certifies that

National Institute of Ocean Technology
(Ministry of Earth Sciences, Gov. of India)
NIOT Campus, Velachery - Tambaram Road, Narayanapuram,
Pallikaranai, Chennai – 600 100, Tamil Nadu, INDIA

has established and applies
a Quality Management System for

Providing Supporting services like Strategic Planning and Management, Finance and Accounts, Stores and Purchase, Establishment and Personnel, Estate and Maintenance, Library, Director's Secretariat, Computer Maintenance Cell, Security, Transport and Logistics, Human Resource Development.

An audit was performed, Report No. 4153139190.
Proof has been furnished that the requirements
according to

ISO 9001:2015

are fulfilled.
The certificate is valid from 2018-08-27 until 2021-11-08.
Certificate Registration No.: 12 100 30057 TMS.

Product Compliance Management
Munich, 2018-08-29

TÜV SÜD Management Service GmbH • Zertifizierungsstelle • Ridlerstrasse 65 • 80339 München • Germany
www.tuev-sued.de/certificate-validity-check

Visit of Dignitaries and Technical Talks

- Andaman and Nicobar Centre for Ocean Science and Technology (ANCOST) was renamed as "Atal Centre for Ocean Science and Technology for Islands" (ACOSTI), and dedicated to the nation, by Hon'ble Minister Dr. Harsh Vardhan on 15th September 2018.
- Dr. Tomas Farrar, Scientist from WHOI visited NIOT between 25-27 July, 2018.
- Dr. Mc Phaden Senior Scientist from NOAA visited NIOT between 30-31 July, 2018.
- Dr. Beenabalan Sarojini, Scientist at European Center for Medium- Range Weather Forecasts (ECMWF), UK visited OOS on 23rd October 2018 to have a collaboration to utilize moored buoy observations to validate the ECMWF numerical model results. She also delivered a Guest lecture titled "Impact of ocean observations on initialization and seasonal forecasting".

- Prof. Eric D'Asaro, an Oceanographer from College of Environment, University of Washington visited for an interaction on research carried out at OOS on 28th Feb 2019.
- Prof. Amit Tandon, University of Massachusetts visited OOS to have discussions on Air – Sea fluxes on 15th March 2019.
- Dr. Jinwhan Kim, Technical Lead of Marine Robotics & Intelligence Laboratory and Professor from Korea Advanced Institute of Science & Technology (KAIST) visited NIOT on 18th July 2018 delivered a lecture titled "Development of Field Autonomy for Marine Robotic Vehicles" at NIOT, Chennai.

- Dr. Tomonari Akamatsu, Senior Researcher, National Research Institute of Fisheries Science, Japan delivered a lecture on "Ocean sound as an Essential Ocean Variable (EOV) for oceanography and wildlife monitoring" on 16th November 2018 and visited NIOT facilities.
- Prof. Gopu Potty, Professor in the University of Rhode Island, USA delivered a lecture on "Source localization using a compact tetrahedral array" on 19th November 2018.
- Prof. Andy Cundy, Director of Internationalization School of Ocean and Earth Science and Research, UK, visited NIOT and delivered a technical lecture on "Marine plastics: processes, monitoring and management" on 13th February 2019.
- Dr. Holger Klinck, Director of the Bioacoustics Research Program, Cornell University, USA, delivered a technical lecture on "Recent advances in passive acoustic monitoring of marine mammals" held on 11th March 2019 and visited NIOT facilities.
- Dr. Christophe Proisy, Head of Laboratory of Applied Informatics and Geomatics (LIAG) in French Institute of Pondicherry, delivered a technical lecture on "Status and connectivity of mangroves forests using fine-scale multi spectral remote sensing and spatial oceanography modelling" on 7th December 2018.
- Dr. Malcolm L. Heron, CEO of Port Map Remote Ocean Sensing Ltd. Queensland, delivered a technical lecture as part of IEEE-OES distinguished lecture on "HF Radar for next decades" on 23rd January 2019.

Silver Jubilee Celebration

- The Silver Jubilee Celebration of NIOT commenced on 5th November 2018 and Dr. V.Balamurugan, Director, CVRDE delivered a special lecture as the Chief Guest. Dr. M.K.Surappa, Vice Chancellor, Anna University graced the occasion as Guest of Honour.

Technology day celebration

- Technology Day was celebrated in NIOT on 11th May 2018 and Dr. A.K. Bhaduri, Director, IGCAR delivered the special lecture as the Chief Guest. Shri B. Anand, IAS., AS & FA, MoES addressed the gathering as Guest of Honour.

World Ocean Day

- World Ocean Day was celebrated at NIOT, on 8th June 2018 and Dr.R.Ramesh, Director, National Centre for Sustainable Coastal Management, Chennai delivered the special lecture on "Preventing plastic pollution and encouraging solutions for a healthy ocean", as Chief Guest. Students and teachers from 23 schools who were part of Guinness world record during IISF 2017 participated and Guinness certificate was issued to them during the meeting.

Swachhta Pakhwada

- Swachhta Pakhwada was held during July 1-15, 2018 at NIOT and cleanliness campaign inside and outside the campus were conducted. Cleanlin4ess awareness programme was conducted for the village community including school children in Thupilipalem and Pamanji, demonstrating method of waste segregation. Also at NIOT, various competitions were held. The valedictory function was held on 13th July 2018 at NIOT and the Chief Guest Mrs. Shobha Menon, Founder Trustee, Nizhal, delivered a talk on "Caring for life and Green Cities" and distributed prizes.

Senior Scientist, NIOT giving lecture in Telugu for school children

- Swachhta Pakhwada Award 2018 - NIOT won the third place for the activities as part of Swachh Bharath.

Awards

- Deep sea technologies team of NIOT received **NRDC National Societal Innovation Award - 2018** for the invention of "Underwater Remotely Operated Vehicle for Polar and Shallow Water Research". Award was

received from Dr. V.K.Saraswat, Hon'ble Member Niti Ayog, Government of India at Innovate India meet 2019 held at Ahmedabad on 30th March 2019.

- In a token of recognition of the outstanding research contributions in the field of Ocean Science and Technology, the Ministry of Earth Sciences, honoured Dr.R.Venkatesan with the **"National Award in the field of Ocean Science and Technology"** for the year 2018 during the Foundation Day held at Ministry on 27th July 2018.

- Shri D.Rajasekhar, Scientist – G, and Head, VMC received the **'Green Technology Innovative Award'** from the **"National Environmental Science Academy"**, during December, 2018 in recognition of his outstanding contribution in the field of Sustainable Environmental Technology.
- Shri D.Rajasekhar, Scientist – G, Group Head, VMC received the **'Excellence and Innovation Award'** from **"Combined Society for Educational Research & Development"**, during February, 2019 in recognition of his outstanding contribution in the field of Science and Technology.

Best Paper Award

- M. Kalyani, K. Jossia Joseph, G. Latha and R. Venkatesan (2018) *"Model Dependent Wave Assimilation Characteristics Using OMNI Buoy Data in Bay of Bengal"*, presented by Dr. M. Kalyani has won **Best Paper Award** in the **National Conference (INCHOE2018)**, Pune, India, Sep, 2018.
- NIOT's research publication titled "Impact of artificial coastal protection structures on Ascidian settlement along the Tamil Nadu coast" published in the Journal Oceanologia, fetched **Outstanding Scientist Award** to all the authors of the paper Prince Prakash Jeba Kumar J, Ragumaran S, Nandagopal G, Rajan Babu B, Vijaya Ravichandran, by RULA innovation & betterment excellence award committee. The award consists of a medal, shield, and certificate.

MoES Award

- The following staff of NIOT have received the MoES awards for the year 2017-18 during the Foundation Day of Ministry of Earth Sciences (MoES), held on July 27, 2018 at New Delhi.
  - Dr.G.Dhinesh, Scientist-D - **Certificate of Merit** in the field of Ocean Science and Technology
  - Mrs.P.M.Rajeshwari, Scientific Assistant Gr. 'C'
  - Shri B.O.Vishwanath, Scientific Assistant, Gr. 'C'
  - Smt. Vatchala Kuppuraman, Senior Executive

  } Best Employee Award

Patents

Patents Granted

Inventors	Title	Awarded Ref. No.	Country
Venkatesan G Purnima Jalihal	An apparatus for the production of drinking water and Industrial Quality water using Renewable Energy Sources and its method thereof.	299064 dated 20.7.2018	India

Patents Filed

Inventors	Title	Awarded Ref. No.	Country
R. Kirubagaran A. Josephine T.S. Kumar R. Vijaya Raghavan G. Dharani N.V.Vinithkumar J. Mary Leema Thilagam D. Magesh Peter	Pharmacoactive nutrient and a process of production thereof from marine algae	Appl.no.18168608.0 dated 20.4.2018 EP 3 403 662 A1	Europe
K.K.Tejaswini Dr.Boby George Dr.Jegadeesh kumar R.Srinivasan Tata Sudhakar M.A.Atmanand	Devices and methods for conductivity measurement of liquids	201841031272 dated 21.08.2018	India
Ashwani Vishwanath Purnima Jalihal	A system for tapping sea wave energy	TEMP/E-1/42439/2018-CHE dated 15.10.2018	India

Inventors	Title	Awarded Ref. No.	Country
AN. Subramanian G. Harikrishnan E. Chandrasekaran G.A. Ramadass M.A. Atmanand	Electro Thermal Ice Coring Apparatus	201841043532 dated 19.11.2018	India
G A Ramadass S Ramesh N Vedachalam AN Subramanian D Sathinarayanan R Ramesh G.Harirkrishnan A.Vadivelan E. Chandrasekaran D. Muthukumaran M. Murugesan S. Elangovan.	A Polar Remotely Operated Underwater Vehicle	201841045387 dated 30.11.2018	India

PUBLICATIONS

International Journals

1. N. Vedachalam, R. Ramesh, V. Bala Naga Jyothi, V. Doss Prakash & G, *"Autonomous underwater vehicles, challenging developments and technological maturity towards strategic swarm robotics systems"*, **Marine Georesources and Geotechnology,** Vol.37(5), pp.525-538, April 2018.
2. Simi Mathew, Usha Natesan, G.Latha, R.Venkatesan, Rokkam R.Rao and M.Ravichandran, *"Observed warming of sea surface temperature in response to tropical cyclone Thane in the Bay of Bengal"*, **Current Science,** Vol.114 (7), pp.1407-1413, April 2018.
3. Simi Mathew, Usha Natesan, G.Latha, Ramasamy Venkatesan, *"Dynamics behind warming of the southeastern Arabian Sea and its interruption based on in situ measurements"*, **Ocean Dynamics,** Vol.68(4–5), pp.457–467, May 2018.
4. D. Menaka, G. Murugesan, M. Arul Muthiah, R.Venkatesan, *"Zigbee based wireless sensor interface for Data Buoy System"*, **International Journal of Science and Innovative Engineering &Technology (IJSIET)** Vol. I, pp.3-7, ISBN No.978-81-923607-3-7, May 2018.
5. Venkatesan, R., Vedachalam, N., Arul Muthiah, M., Sundar, R., Kesavakumar, B., Ramasundaram, S., *"Reliability Metrics from Two Decades of Indian Ocean Moored Buoy Observation Network"*, **Marine Technology Society Journal,** Vol.52 (3), pp.71-90, DOI: 10.4031/MTSJ.52.3.14, May/June 2018.
6. R.Srinivasan, V.Rajendran, Shijo Zacharia, Tata Sudhakar, *"Advances in sea surface layer temperature measurements with fast responding thermistor arrays on drifting buoys"*, **Current Science,** Vol.115(2), pp.325-330, July 2018.
7. M.Ashokan, Latha G and Raghuraman G, *"Ocean ambient noise off Chennai due to very severe cyclonic storm Vardah"*, **Applied Acoustics,** Vol.140, pp.256-262, September 2018.
8. Madan M.Mahanty, Latha G, Raguraman G, *"Soundscapes in shallow water of the eastern Arabian Sea"*, **Progress in Oceanography**, Vol.165, pp.158-167, September 2018.
9. M.C.Sanjana, Latha G, Thirunavukkarasu A, R.Venkatesan, *"Ambient noise field and propagation in an Arctic fjord Kongsfjorden, Svalbard"*, **Polar Science,** Vol. 17, pp.40-49, September 2018.
10. M. A. Atmanand, R.Venkatesan, M. V.Ramanamurthy, G. A. Ramadass, R. Kirubagaran, N. Vedachalam, *"Blue Economy of India and Technology Initiatives II"*, **Marine Technology Society Journal,** Vol.52(5), September/October 2018.
11. M. C. Sanjana, G. Raguraman, and G. Latha, *"Ambient Noise Vertical Directionality and Reflection Loss Estimates for a Shallow Tropical Site with a Fast Sound Speed Bottom"*, **Marine Geodesy** Vol. 41(5), pp.427–438, November 2018.
12. Nanda Kishore Reddy Busireddy, Krishna K. Osuri Sanikommu Sivareddy, Ramasamy Venkatesan., *"An observational analysis of the evolution of a meso-scale anti-cyclonic eddy over the Northern Bay of Bengal during May–July 2014"*, **Ocean Dynamics,** Vol.68(11), pp.1431-1441, https:// doi.org/10.1007/s10236-018-1202-4., November 2018.

13. P.Muthuvel, Boby George, G.A. Ramadass *"Magnetic-Capacitive Wear Debris Sensor Plug for Condition Monitoring of Hydraulic Systems"*, **IEEE Sensor J**, Vol.18(22), pp.9120 –9127, November 2018, DOI:10.1109/JSEN.2018.2869675.

14. Samiran Mandal, Sourav Sil, Abhijit Shee, Venkatesan, R., *"Upper Ocean and Sub-Surface Variability in the Bay of Bengal during Cyclone ROANU: A Synergistic view using In-situ and Satellite Observations"*, **Pure Appl. Geophys.** Vol.175(12), pp.4605–4624, https://doi.org/10.1007/s00024-018-1932-8, December 2018.

15. R.Venkatesan, K. Ramesh, Anand Kishor, N.Vedachalam, M.A.Atmanand, *"Best Practices for the Ocean Moored Observatories"*, **Frontiers in Marine Science,** Vol.5(469), doi: 10.3389/fmars.2018.00469, December 2018.

16. Balaji, D., Velraj, R., Ramana Murthy, M.V., *"A Review of the Role of Passive Techniques on Heat Transfer Enhancement of Horizontal Tube Falling Film and Flooded Evaporators"*, **Journal of Enhanced Heat Transfer,** Vol.25(3), pp.239-282, 2018.

17. Venkatesan, R., Sannasiraj, S. A., Ramana Murthy, M.V., Senthil Kumar P., Dhinesh, G., *"Development and Performance Validation of a Cylindrical Buoy for Deep-Ocean Tsunami Monitoring"*, **IEEE Journal of Oceanic Engineering,** Vol.44(2), pp.415-423, 2018.

18. Jebarathnam Prince Prakash Jebakumar, Shunmugavel Ragumaran, *"A Conceptual Approach towards Utilization of Technological Advancement for Coral Reef Conservation at India"*, **Examines Mar BiolOceanogr**, Vol.1(4), 1-28, EIMBO.000519.2018. DOI: 10.31031/EIMBO.2018.01.000519, 2018.

19. Anburajan, L., Meena, B., Vinithkumar, N. V., Dharani, G., and Kirubagaran, R, *"Molecular characterization and insilico analysis of ectoine biosynthesis genes from the deep sea halophilic eubacteria, NIOT- Bacillus clausii DSB04"*, **Gene Reports,** Vol.12, pp.235–242, 2018.

20. Neelu Singh, S. Rajan, Shabnam Choudhary, Magesh Peter, C. Krishnaiah, *"Diisopropyl naphthalene in the surface sediments of an Arctic fjord: Environmental significance"*, **Polar Science,** Vol.18, pp.142-146, 2018.

21. Satheesh Kumar Palanisamy, Velusamy Arumugam, Magesh D. Peter, Umamaheswari Sundaresan, *"Patterns of chemical diversity in the marine ascidian Phallusia spp.: anti-tumor activity and metabolic pathway inhibiting steroid biosynthesis"*, **Biotechnology,** Vol.8, pp.251, 2018.

22. Rangamaran VR, Uppili B, Gopal D, Ramalingam K. Easy QC, *"Tool with Interactive User Interface for Efficient Next-Generation Sequencing Data Quality Control"*, **Journal Computational Biology,** Vol.25, pp.12, 2018.

23. Jena, K.S. Arunraj, V. Suseentharan, Kukadiya Tushar, T. Karthikeyan, *"Indian Coastal Ocean Radar Network"*, **Current Science,** Vol.116, pp.372–378, https://doi.org/10.1029/2018JC014041, 2018.

24. Magesh Peter. D, Kirubagaran R, Dhinesh Kumar R, J Mary Leema Thilakam and Dharani G, *"Implications of Nitrogen Limitation and Sufficiency on the Acetyl Co-A Carboxylase Activity and Biodiesel Production from Marine Chlorella Vulgaris (JF894250)"*, **Journal of Chemical and Pharmaceutical Research,** Vol.9(10), pp.80-88, 2018.

25. Anburajan, L., B. Meena, N. V. Vinithkumar, G. Dharani, R. Kirubagaran, *"Molecular characterization and insilico analysis of ectoine biosynthesis genes from the halophilic eubacteria, Bacillus clausii NIOT-04"*, **Gene Reports,** Vol.12, pp.235-242, 2018.
26. Anburajan, L., Meena Balakrishnan, Rajaprabhu Gunasekaran, Rajaguru Srinivasan, Vinithkumar Nambali Valsalan, Dharani, Gopal, Kirubagaran Ramalingam, *"Unexplored deep sea habitats in active volcanic Barren Island, Andaman and Nicobar Islands are sources of novel halophilic eubacteria"*, **Infection, Genetics and Evolution,** Vol.65, pp.1-5, 2018.
27. Benjamin Franklin, Sathish Thadikamala, Vinithkumar Nambali Valsalan, Kirubagaran Ramalingam, Madeswaran Perumal, *"Seawater Quality Conditions of the Andaman Sea (Bay of Bengal, Indian Ocean) in lustrum during 2010 decade. Marine Pollution Bulletin"*, **Marine Pollution Bulletin,** Vol.136, pp.424-434, 2018.
28. Nalini Sathiyamurthi, Dhinakarasamy Inbakandan, Venkatnarayanan Srinivas, S.U.Mohammed Riyaz, Dheenan, P.S, N.V.Vinithkumar, Sriyutha Murthy, Parthasarathi Rengasamy, Ramalingam Kirubagaran, *"PYRROLO isolated from Marine sponge associated bacterium Halobacillus kuroshimensis SNSAB01 – antifouling study based on molecular docking, diatom adhesion and mussel byssal thread inhibition"*, **Colloids and surfaces B. Biointerfaces**, Vol.173, pp.9-17, 2018.
29. Josephine A, Kumar TS, Sreelatha T, Vijaya Raghavan R, Dharani G, Kirubagaran, *"An efficient method for the sequential production of lipid and carotenoids from the Chlorella Growth Factor-extracted biomass of Chlorella vulgaris"*, **Journal of Applied Phycology,** Vol.30(4), pp.2325-2335, 2018.
30. Aravind George, R. Anandanarayanan, R. Suchithra, B. Pattnaik, Prasad Dudhgaonkar, Purnima Jalihal, *"Experimental analysis of turbine chamber coupling for wave energy conversion"*, **International Journal of Energy Research,** Vol.42(15), pp.4770-4782, 2018.
31. Shyam Kumar Madhusudhana, Bishwajit Chakraborty & G. Latha, *"Humpback whale singing activity off the Goan coast in the Eastern Arabian Sea"*, **Bioacoustics,** Vol.28(4), pp.329-344, 2018.
32. Dilip Kumar Jha, R. Kirubagaran, N.V. Vinithkumar, Dharani G., P. Madeswaran, *"The Andaman and Nicobar Islands. World Seas: An Environmental Evaluation,"*, **Marine Pollution Bulletin,** Vol.3. pp.146, 2018.
33. P.Yuvaraj, T. Satheeswaran, P. Damotharan, V. Karthikeyan, Dilip Kumar Jha, G. Dharani, T. Balasubramanian, R. Kirubagaran, *"Evaluation of the environmental quality of Parangipettai, Southeast Coast of India, by using multivariate and geospatial tool"*, **Marine Pollution Bulletin,** Vol.131, pp.239-247, 2018.
34. Arunraj, K., Jena, B. K., Suseentharan, V., Rajkumar, J. *"Variability in eddy distribution associated with East India Coastal Current from high-frequency radar observations along southeast coast of India"*, **Journal of Geophysical Research: Oceans,** Vol.123(12), pp.9101-9118, 2018.
35. Jebarathnam Prince Prakash Jebakumar, Ganesan Nandhagopal, Bose Rajan Babu, Shunmugavel Ragumaran, Vijaya Ravichandran, *"Impact of coastal power plant cooling system on planktonic diversity of a polluted creek system"*, **Marine Pollution Bulletin,** Vol.133, pp.378–391, 2018.

36. Tejaswini.K.K. Boby George, Jagadeesh kumar, R.Srinivasan, Tata Sudhakar, *"A capacitive coupled non-contact probe for the measurement of conductivity of liquids"*, **IEEE Transaction on Instrumentation and Measurements,** Vol.99, pp.1-9, January 2019, DOI:10 .1109/TIM.2019.2890921.
37. V. Doss Prakash, N.Vedachalam, R Ramesh, *"Assessment of the effectiveness of the subsea optical wireless communication system in the Arabian sea using field data"*, **Marine Technology Society Journal,** Vol. 53(1), pp.9-19, January 2019.
38. R.Venkatesan, K. Ramesh, M. Arul Muthiah, K. Thirumurugan, M A Atmanand, *"Analysis of Drift characteristic in Conductivity and Temperature Sensors used in Moored Buoy System"*, **Ocean Engineering,** Vol.171, 151-156, https:// doi.org/ 10.1016 /j. ocean eng.2018.10.033., January 2019.
39. R.A.Weller, J.T.Farrar, Hyodae Seo, Channing Prend, Debasis Sengupta, J. SreeLekha, M. Ravichandran, R. Venkatesan, *"Moored Observations of the Surface Meteorology and Air–Sea Fluxes in the Northern Bay of Bengal in 2015"*, *Journal of American Meteorological Society"*, **Journal of Climate,** Vol.32, pp.549-573, https://doi.org/10.1175/JCLI-D-18-0413.1, January 2019.
40. A.Umapathy, S. Muthukrishna Babu, N.Vedachalam, K.Venkatesan, N. Suresh Kumar, K. Gopakumar, G.A. Ramadass, and M.A.Atmanand, *"Influence of Deep sea Ambient conditions in the Performance of Pressure compensated Induction Motors"*, **The Marine Technology Society Journal,** Washington DC, Vol.53(1), pp.67-73, January/February 2019.
41. S.Ramesh, K.N.V.V.Murthy, S. M. Hussain, S.Ramasamy and G.A. Ramadass, *"Occurrence of Nummulitic coralline limestone from Offshore Palar Basin, Bay of Bengal, India"*, **Marine Georesources and Geotechnology,** 1-7, February 2019.
42. N.Vedachalam, A.Umapathy, S.Muthukrishna Babu, K.Venkatesan, N. Suresh Kumar and M. A. Atmanand, *"Performance of Electro-magnetic Oil Circuit Breakers under Hyperbaric conditions"*, **The Marine Technology Society Journal**, Washington DC, Vol. 53(1), pp.74-82, January/ February 2019.
43. Ganesh Kumar, K. Balamurugan, R. Vijaya Raghavan, G. Dharani & R. Kirubagaran, *"Studies on the antifungal and serotonin receptor agonist activities of the secondary metabolites from piezotolerant deep-sea fungus Ascotricha sp"*, **Mycology,** Vol.10(2), pp.92-108, 2019.
44. Palanisamy SK, Arumugam V, Rajendran S, Ramadoss A, Nachimuthu S, Peter D M, Sundaresan U, *"Chemical diversity and anti-proliferative activity of marine algae"*, **Natural Product Research,** Vol.33(14), pp.2120-2124 2019.
45. Madan M.Mahanty, G.Latha, P.Edwards Durai, *"Impact of tropical cyclone Vardah on the fish chorus in shallow waters of Southwest Bay of Bengal"*, **Ecological Indicators,** Vol.96, pp.288-292, 2019.
46. Uma Kumari.C.R, Dhanalakshmi Samiappan, Kumar. R, Tata Sudhakar, *"Fiber optic sensors in ocean observation: A comprehensive review"*, **Optik-International Journal for Light and Electron Optics,** Elsevier, Vol.179, pp.551–560, 2019.
47. C. V. Chachin Vishal, G. Venkatesan, L. S. S. Prakash Kumar, Balaji, Chandrakanth, A. Karthikeyan, Purnima Jalihal, *"Impact of thermosiphon on nocturnal yield of conventional solar still"*, **International Journal of Ambient Energy,** 1-7, 2019, DOI:10.1080/01430750.2019.1587719.

48. Aditya Chaudhary, Neeraj Agarwal, Rashmi Sharma, B. K. Jena and Raj Kumar, *"Coastal currents from Jason-2 and SARAL/AltiKa in the Indianregion"*, **International Journal of Remote Sensing,** 10.1080/01431161.2019.1602793, 1-17, 2019.
49. Jebarathnam Prince Prakash Jebakumar, Ganesan Nandhagopal, Bose Rajan Babu, Shunmugavel Ragumaran, Chokalingam Muthiah Ramakritinan, Abdul Jaffar Ali, Mohammed Kaleem Arshan, Vijaya Ravichandran, *"Impact of artificial coastal protection structures on Ascidians settlement along the Tamil Nadu coast, India"*, **Oceanologia,** Vol.61, pp.60 – 67, 2019.
50. Dipanjan Chaudhuri; Debasis Sengupta; Eric D Asaro, R. Venkatesan; M. Ravichandran. *"Response of the salinity-stratified Bay of Bengal to cyclone Phailin"* JPO-D-18-0051. **The Journal of Physical Oceanography,** 2019.
51. Biplab Sadhukhan, Arun Chakraborty, K. Jossia Joseph, and R Venkatesan. *"Long-Term Estimation of Wave Climate Variability in the Western Bay of Bengal"*, **The Journal of Physical Oceanography,** DOI: 10.1109/ JOE.2019.2905733; 2019.
52. K.N. Navaneeth, M.V. Martin, K. Jossia Joseph and R. Venkatesan (2019), *"Contrasting Upper Ocean Response of Two Intense Cyclones in Bay of Bengal"*, **Deep Sea Research-Part.1,** Vol.147, pp.65-78, 2019.

National Journals

1. T. Karthikeyan, Abdus Samad, A. Salam, D. Baruah, Prasad Dudhgaonkar, *"Performance analysis of an air turbine for ocean energy extraction using CFD technique"*, **Journal of The Institution of Engineers (India): Series C,** July 2018.
2. K.Chithra, Tata Sudhakar & M.A.Atmanand, *"Performance analysis of coding techniques in Underwater Acoustic communication"*, **Journal of Acoustical Society of India (JASI),** Vol.45(3), pp.150-158, 2018.
3. D S Sreedev, Dhilsha Rajapan, Shibu Jacob, Shijo Zacharia, K Arumugam, P M Rajeshwari and M .A .Atmanand, *"Compact FPGA based instrumentation for a buried object detection sonar"*, **Journal of Acoustical Society of India (JASI),** Vol.45(3), pp.111-120, 2018.
4. Sayanti Bardhan, Mahimol eldhose, Shibu Jacob, Shijo Zacharia, P.M.Rajeshwari and M.A.Atmanand, *"Signal Processing aspects of an indigenous buried object detection sonar"*, **Journal of Acoustical Society of India (JASI),** Vol 45(3), pp.121-130, 2018.
5. P.M.Rajeshwari, Dhilsha Rajapan, Mahimol Eldhose, A.Karthikeyan, *"Target detection of Buried object scanning SONAR images using artificial Bee colony based Tsallis entropy method"*, **Journal of Acoustical Society of India (JASI),** Vol.45(3), pp.131-140, 2018.
6. Malarkodi A, Latha G, Jothi B, *"Sound wave propagation analysis in acoustic tank"*, **Journal of Acoustical Society of India,** Vol.45(3), pp.159-164, 2018.

Book Chapter

1. M A Atmanand, M Ravichandran, D Rajasekhar, *"Designing Polar Research Vessels"*, **Deep Sea Exploration' in Geography and You**, Vol.18(4) (115), pp.21-26, August 2018.
2. Purnima Jalihal, *"Quarter Century of Ocean Technology"*, **Geography and You,** Vol.19(13), January 2019.
3. Rajapan.D, G.Latha, M.C.Sanjana, *"The Significance of Acoustics, Sensors & Electronics in Ocean Technology"*, **Geography and You,** Vol.19(13), pp.31-35, January 2019.
4. R. Venkatesan, M. Kalyani, K J Jossia, K Ramesh, M Arul Muttiah, S. Rama Sundaram, P. Murugesh, *"Observing the Oceans"*, **Geography and You,** Vol.19(13) (124), pp.1-15, January 2019.
5. M. V. Ramanamurthy, B. K. Jena, and R.Vijaya *"Recent Developments in shore protection for India's coasts"*, **Geography and You,** Vol:19(13) (124), pp.1-15 January 2019.
6. G Venkatesan G, L S S Prakash Kumar, V Samson Packiaraj Raphael, S Srinivasa Rao, Ashwani Vishwanath, Purnima Jalihal & M A Atmanand. *"Low Temperature Thermal Desalination–A novel approach"*, **Geography and You,** Vol.19 (13), pp.44-48, January 2019.
7. Kamalakannan M., Kalyani M., Prabhakar V., Jena B.K., Venkatesan R. (2019) Assessment of Nonlinear Quadruplet Interactions for Measured Spectra in Deep Waters on the East Coast of India Through Gauss–Legendre Quadrature Method. In: Murali K., Sriram V., Samad A., Saha N. (eds) Proceedings of the Fourth International Conference in Ocean Engineering (ICOE2018). **Lecture Notes in Civil Engineering, Springer, Singapore.** DOI: https://doi.org/10.1007/978-981-13-3119-0_53. Vol.22, pp.795-812, January, 2019.
8. Purnima Jalihal, Purvaja.R, Subba Reddy Bonth, R.Ramesh *"Renewable Energy Technologies for mitigating climate change"*, **Climate change and the vulnerable Indian Coast,** MoEF, December 2018.
9. Purnima Jalihal, *"Ocean thermal desalination- A climate change perspective"*, **Climate change and the vulnerable Indian Coast,** MoEF, December 2018.
10. Kalyani M., Kiran A.S., Ravichandran V., Suseentharan V., Jena B.K., Ramana Murthy M.V., "Wave Transformation Around Submerged Breakwaters Made of Rubble Mound and Those Made of Geosynthetic Tubes—A Comparison Study for Kadalur Periyakuppam Coast. In: Murali K., Sriram V., Samad A., Saha N. (eds) Proceedings of the Fourth International Conference in Ocean Engineering (ICOE2018). **Lecture Notes in Civil Engineering, Springer,** Singapore. DOI: https:// doi.org/10.1007/978-981-13-3134-3_25. Vol 23. pp.327-336, December 2018.
11. Vinithkumar, N.V., Sathish, T., Apurba Kumar Das, Raghunathan, C., Sivaperuman, C., Dharani, D., Kirubagaran, R., and Sujathkumar, N.V., *"Marine Ecosystems of Andaman and Nicobar Islands – Species abundance and Distribution"*, **Biodiversity and Climate Change Adaptations in Tropical Islands,** pp.217-256, 2018.
12. Venkatesan R., Tandon A., Sengupta D., Navaneeth K.N. Recent Trends in Ocean Observations.


In Observing the Oceans in Real Time. **Springer Oceanography.** Springer, ChamDOIhttps://doi.org/10.1007/978-3-319-66493-4_1. 3 – 13, 2018.

13. **Science,** the premier global science weekly, has published a summary highlight titled "USE THE BEACH" referring NIOT's paper in the "Editor's Choice" section of the issue of 27th July 2018.
14. **Geography and You,** has re-published the paper with a summary highlight titled "Planktonic diversity of a polluted creek system" in the Economy/Industry section of the GEOGRAPHY and YOU website on 17th December 2018.
15. D Rajasekhar, P S Deepak Sankar, B Bhavana Singh, D Narendrakumar, Anantha Krishna, K Ramasundaram, D Bernardin Marina, V Chandana Deepthi, *"Minimizing Shipborne Emissions along the Indian Coast"*, **Geography and You,** Vol.19(13) (124), pp.20-25, January 2019.

Papers Presented in Conferences

International Conferences

1 Tejaswini.K.K. Boby George, Jagadeesh kumar, R.Srinivasan & Tata Sudhakar, *"An Auto-balancing signal conditioning scheme for non-contact measurement of conductivity of water"*, **IEEE International Instrumentation & Measurement Technology Conference organised by IEEE Instrumentation & Measurement society at Houston,** Texas, USA, pp.591-595, 14-17 May 2018.

2 Muthuvel.P, Tata Sudhakar, Niteshvarma, Thangavel.C, Sarojani Mourya, Arumugam.P, M.A.Atmanand *"Development of deep sea profiling float Challenges and Technology demand"*, **OCEANS-MTS/IEEE Kobe Techno-Ocean (OTO),** DOI:10.1109/OCEAN SKOBE.8558832, May 2018.

3 D S Sreedev, Dhilsha Rajapan, Shibu Jacob, Sayanti Bardhan, P M Rajeshwari, Shijo Zacharia and M A Atmanand, *"Effectiveness of indigenously developed Chirp imaging SONAR in ship wreck detection"*, in Proc. **OCEANS - MTS/IEEE Kobe Techno-Oceans (OTO),** May 2018.

4 C.Janarthanan, V.Chandran, V.Sundaramoorthi, B.O.Viswanath, D.Dineshkumar, P.Muthuvel, S.Rajesh, A.A.Gnanaraj, K.Venkatesan, S.MuthukrishnanBabu, Gopkumar K, N.R.Ramesh, G.A.Ramadass, *"Development and Testing of Locomotion Trials on Soft Sea Bed Soil and System Performance Checks of Experimental Undercarriage system"*, **The 28th International Ocean and Polar Engineering Conference(ISOPE)**, Sapporo, Japan June 10-15, 2018.

5 A.A. Gnanaraj, T. Sasikala, K. Venkatesan, N.R. Ramesh, P. Muthuvel, S. Muthukrishna Babu, Gopkumar. K, G.A. Ramadass, *"Testing of Umbilical Cable for Reliable and Safe Operation"*, **The 28th International Ocean and Polar Engineering Conference (ISOPE),** Sapporo, Japan, June 10-15, 2018.

6 C.Janarthanan, M.Shyam sunder, V.Sundaramoorthi, B.O.Vishwanath, V.Chandran, S.Rajesh, P.Muthuvel, N.R.Ramesh, Gopkumar K, G.A.Ramadass, M.A.Atmanand, *"Design and Qualification of a Latching System for Experimental Undercarriage System for 6000 m depth"*, **OCEANS 2018 Charleston,** USA, October 22-25, 2018.

7 R.Venkatesan,M. A. Atmanand, G. Latha, B. Kesavakumar, *"Indian Ocean Observation Progam-Two decades of service to the society"*, **Oceans 2018 Conference held at Charleston,** South Carolina, USA, October 22-25, 2018.

8 Abhishek Tavva, Sankar S, Lokesh T, Shanmugapriyaa S, Rajkumar J, VijayaRavichandran, Ramanamurthy M V, Atmanand M A, *"Development of shoreline response assessment system for planning sustainable shore protection measures"*, **Oceans 2018, Charleston,** USA, organized by IEEE - OES and MTS, October 22-25, 2018.

9 Kiran A S, Vijaya R, Abhishek T, Ramanamurthy M V and Atmanand M A., *"Environmentally friendly shore protection using Geosynthetic tubes: A case study from East coast of India"*, **Oceans 2018, Charleston,** USA, organized by IEEE - OES and MTS, October 22-25, 2018.

10 K.Chithra and Tata Sudhakar, *"Realising Underwater acoustic communication with less power consumption"*, **WESPAC 2018,** New Delhi, November 11-15, 2018.

11 D.S.Sreedev, Dhilsha Rajapan, P.M.Rajeshwari and M.A.Atmanand, *"Performance of Indigenous wideband sub bottom profiler in seabed layer imaging"*, **WESPAC 2018,** New Delhi, November 11-15, 2018.

12 P.M.Rajeshwari, Dhilsha Rajapan, D.S.Sreedev and M.A.Atmanand, *"Acoustic signature analysis of a ship wreck in shallow water environment using a wide band sonar"*, **WESPAC 2018,** New Delhi, November 11-15, 2018.

13 Distinguished talk delivered by Dr.G.Latha on *"Passive acoustic monitoring in the open ocean – Current scenario, Challenges and Future needs"*, **WESPAC 2018,** New Delhi, November 11-15, 2018

14 A.Malarkodi, Latha G, Srinivasan S, *"Characterization of Underwater Acoustic Communication Channel from an Open Ocean Experiment Off Chennai"*, **WESPAC 2018,** New Delhi, November 11-15, 2018

15 M.Ashokan, Latha G, Thirunavukkarasu A, *"Underwater noise in the Kongsfjorden fjord, Arctic during summer 2016"*, **WESPAC 2018,** New Delhi, November 11-15, 2018

16 Mahanty M.M., G.Latha, and A.Thirunavukkarasu, *"Variability of under-ice ambient noise due to the environmental conditions in the Kongsfjorden, Arctic Ocean"*, **WESPAC 2018,** New Delhi, November 11-15, 2018

17 K.K.Noufal, Latha G, Ramesh R, *"Shallow water Acoustic Propagation loss modeling in Bay of Bengal"*, **WESPAC 2018,** New Delhi, November 11-15, 2018.

18 Biren Pattanaik, Y.V.N Rao D. Leo, Purnima Jalihal, *"Experiential Studies on Development of Power Take Off System for Wave Powered Navigational Buoy"* **13th International Conference on Industrial and Information Systems (ICIIS 2018),** December 1-2, 2018.

19 Biren Pattanaik, Y.V.N Rao D. Leo, Purnima Jalihal, *"Experiential Studies on Development of Power Take Off System for Wave Powered Navigational Buoy"*, **In proceedings of 13th International Conference on Industrial and Information Systems (ICIIS 2018),** December 1-2, 2018.

20 Suresh R, Mullai Vendhan K, Anbhazhagan A, Ramana Murthy, M.V., Vijaya Kumar G, *"Challenges in launching unusual structure at off shore"*, **Hydro 2018, Patna,** December 19-21, 2018.

21 AN Subramanian, Krishna Vasudevan, M.A. Atmanand,G.A. Ramadass, *"Novel Methodology for Sensorless Control of Three Phase Variable Inductance BLDC Motor Driven Thruster for Underwater Application"*, **IEEE Power Electronics, Drives, and Energy Systems Conference (IEEE-PEDES 2018),** December 2018.

22 Ashwani Vishwanath, Nitinesh Awasthi, Purnima Jalihal, Prasad Dudhgaonkar, *"Performance simulation of wave powered navigational buoy using CFD and experimental study"*, **In Proceedings of the Fourth International Conference in Ocean Engineering (ICOE2018)** (pp. 869-882). Springer, Singapore, ISBN 978-981-13-3133-6, December 2018.

23 Biren Pattanaik, Nagasamy D, YVN Rao, Balaji Chandrakanth, Nitinesh Awasthi, Abhijeet Sajjan, D Leo, Prasad Dudhgaonkar, Purnima Jalihal, *"Ocean Current measurements and energy potential in the islands of Andaman"*, **In Proceedings of the Fourth International Conference in Ocean Engineering (ICOE2018)** (pp. 725-736). Springer, Singapore. ISBN 978-981-13-3133-6, December 2018.

24 Biren Pattanaik, Nagasamy D, Karthikeyan A, D Leo, YVN Rao, Sajeev K, Prasad Dudhgaonkar, Purnima Jalihal, *"Open Sea trials on floating wave energy device backward bent ducted buoy and its performance optimization"*, **In Proceedings of the Fourth International Conference in Ocean Engineering (ICOE2018)** (pp. 775-791). Springer, Singapore, ISBN 978-981-13-3133-6, December 2018.

25 Kalyani M, Kiran A S, Vijaya R, Suseentharan V, Jena B K and Ramanamurthy M V, *"Wave Transformation around Submerged Breakwaters made of Rubble Mound and those made of Geosynthetic Tubes- A Comparison Study for Kadalur Periyakuppam Coast"*, **ICOE 2018,** 4th International Conference in Ocean Engineering, IIT Madras, 2018.

26 S.Muthukumaravel, Tata Sudhakar, Dr J. Santhanakumar, Dr D. Dharani, Dr N.V Vinithkumar, *"Design and Development of automatic open sea hybrid submerged fish cage system"*, **BRAQCON-2019 world brackish water aqua culture conference,** CIBA, Chennai, India, January 23-25, 2019

27 Martin V Mathew, R. Venkatesan, S. Sundararajan, K. Jossia Joseph and G. Nandagopal, *"Assessment of Microplastics Distribution in the North Indian Ocean"*, **International conference on Advancements on Polymeric Materials (APM-2019),** CIPET, Chennai, January 23-25, 2019.

28 K. V. Reshma, C. Janarthanan, V. Sundaramoorthi, K. Jayanthi, B. O. Vishwanath, P. Muthuvel, K. Gopkumar, G. A. Ramadass, *"Testing of Soft Clays Using Bevameter for Deep-Sea Mining Machine"*, **4th International Conference in Ocean Engineering (ICOE2018),** Springer edition, pp.913-928, January 2019.

29 C. Janarthanan, K. Gopkumar, V. Sundaramoorthi, N. R. Ramesh, G. A. Ramadass, *"Influence of Grouser Geometrical Parameters of Deep-Sea Crawler Vehicle on Soft Clays"*, **4th International Conference in Ocean Engineering (ICOE2018),** Springer edition, , pp.899-912, January 2019.

30 बरिन पट्टनायक, अश्वनी वशिवनाथ, पूरणमिा जलहिाल, 'समुद्र नवीकरणीय ऊर्जा की अनुसंधान में रा. स. प्रौ. सं की गतविधियिां', Hindi Scientific Seminar held at IGCAR, Kalpakkam on 10th January 2018.

31 Venkatesan G, *"A study on Desalination plants using Energy from Waste heat and Ocean thermal gradient"* **International conference on renewable energy & water (INDACON-19),** organized at NIOT with joint collaboration from Indian Desalination Association (InDA) and IEEE-OES, March 7-8, 2019.

32 Balaji D, Phani Kumar S.V.S, Ramana Murthy. M.V, *"Enhancing deaeration in Low Temperature Thermal Desalination Plant: An Experimental study"*, **InDA & IEEE-(OES) Conference on Technologies for Renewable Energy and Water (INDACON 2019),** Kattankulathur, Chennai, March 7-9, 2019.

33 Susmitha Thankachan, A S Kiran, Vijaya R, Suriyakala C D, *"Coastal sediment transport studies along Kalpakkam using sediment trend analysis and numerical modelling"*, **International conference on recent innovations in Civil Engineering (RICE 2019),** 2019.

34 Blessan K Varghese, A S Kiran, Vijaya R, Suriyakala C D., *"Sand bypassing methodology for sustainable river mouth opening"*, **International conference on recent innovations in Civil Engineering (RICE 2019),** 2019.

National Conferences

1. Vinithkumar, N.V., KarunaKumari, R., Delivered a lecture on *"Seaweed Ecosystems of Andaman and Nicobar Islands"* **Workshop for the school teacher on organized by Andaman and Nicobar Regional Centre, Zoological Survey of India,** Port Blair, 11th September, 2018.
2. Ramana Murthy, M.V., *"Recent trends in Shoreline Management"*, **6th Conference on Coastal, Harbour and Ocean Engineering (INCHOE-2018), Central Water & Power Research Station (CWPRS),** Pune, September 26-28, 2018.
3. M. Kalyani, K. Jossia Joseph, G. Latha, R. Venkatesan, *"Model Dependent Wave Assimilation Characteristics Using OMNI Buoy Data in Bay of Bengal"*, **INCHOE2018,** Pune, September 26-28, 2018.
4. M. Kamalakannan, M. Kalyani, V. Prabhakar, Basantakumar Jena, R.Venkatesan, *"Nonlinear Quadruplet Wave Energy Transfer in Coastal Waters of Cuddalore during NE Monsoon using Gauss Legendre Quadrature Method"*, **6th National Conference on coastal, harbour and ocean engineering, INCHOE2018,** Pune, September 26-28, 2018.
5. Grisilda M, K. Jossia Joseph, R. Venkatesan and K. Srinivasan, *"Validation of significant wave height using moored buoy observations in Northern Indian Ocean"*, **6th National Conference on coastal, harbour and ocean engineering, INCHOE2018,** Pune, September 26-28, 2018.
6. Aswathy Pulickal, A S Kiran, M. Kalyani, T. Lokesh, R. Vijaya, C.D. Suriya Kala, *"A Numerical Model Study using Delft3D on the Feasibility of Sustainable River Mouth Opening for Fishing Activities at Kadalur Villages on the SE Coast of India"*, **6th National Conference on Coastal, Harbour and Ocean Engineering, INCHOE2018** Pune, India, September 26-28, 2018.
7. Praveen Kumar, A. S. Kiran, M. Kalyani, S. Sankar, R. Vijaya, C.D. Suriyakala, *"Performance Evaluation of Sustainable Green Solution for Erosion Control at Bommayarpalayam on the South East Coast of India using DELFT3D"*, **6th National Conference on Coastal, Harbour and Ocean Engineering,** Pune, India, September 26-28, 2018.
8. Ashwani Vishwanath, Purnima Jalihal, Sreekumar Pokuddi, *"Investigation on Flexible Interconnection System between two Floating Structures"*, **INCHOE-2018,** Indian Society for Hydraulics and Central Water & Power Research Station, Pune, September 26-28, 2018.

9. Biren Pattanaik, Ashwani Vishwanath, Purnima Jalihal, D Leo, A Kathikeyan, Y V N Rao, K S Sajeev, *"Field Demonstration of Wave Powered Navigational Buoy for usage in Ports"*, **In Proceedings of INCHOE-2018,** Indian Society for Hydraulics and Central Water & Power Research Station, Pune, September 26-28, 2018.
10. AswathyPulickal, A S Kiran, Kalyani.M, Lokesh T, R Vijaya, Suriya Kala C.D, *"A numerical model study using DELFT 3D on the feasibility of sustainable river mouth opening for fishing activities at Kadalur villages on the southeast coast of India"*, **6th National Conference on coastal, harbour and ocean engineering, INCHOE 2018,** CWPRS Pune, India, Vol.2, pp.929-938, September 2018.
11. Praveen Kumar, Kiran AS, M. Kalyani, Sankar Sellamuthu, Vijaya Ravichandran, Suriyakala C.D *"Performance Evaluation of Sustainable Green Solution for Erosion Control at Bommayarpalayam on the South East Coast of India using DELFT3D"* **6th National Conference on coastal, harbour and ocean engineering, INCHOE 2018,** Pune, India Vol.2, pp.635, September 2018.
12. Ashly KU, A S Kiran, Lokesh T, Sankar S, R Vijaya, R Sajeev, *"Analysis of Shoreline Change Behavior of Coastal Fishing Villages in Kadalur, Tamilnadu"* **6th National Conference on coastal, harbour and ocean engineering, INCHOE 2018,** Pune, India, Vol.2, pp.667, September 2018.
13. Andrea Linus Pereira, K. Jossia Joseph, R. Venkatesan, R. Sajeev, *"Validation of WAVEWATCH III Model Results in Northern Arabian Sea"*, **TROPMET 2018,** Varanasi, Uttar Pradesh, India, October 24–27, 2018.
14. K.N. Navaneeth, Martin V Mathew, K. Jossia Joseph and R. Venkatesan (2018), *"Upper Ocean Dynamics in the wake of intense cyclones in Bay of Bengal"*, **TROPMET 2018,** Varanasi, Uttar Pradesh, India, October 24-27, 2018.
15. M. Kalyani, C. Anoopa Prasad, K.N. Navaneeth, Martin V Mathew, K. Jossia Joseph, R. Venkatesan, *"Validation of Sea Surface Temperature from Different Global Reanalysis Products in Indian Waters Using In-Situ OMNI Buoy Observations"*, **TROPMET 2018,** Varanasi, Uttar Pradesh, India, October 24-27, 2018.
16. Anoopa Prasad C., P V Hareesh Kumar and K. Jossia Joseph (2018), *"Salinity variability in the Bay of Bengal during Indian Ocean Dipole and El Niño/La Niña"*, **TROPMET 2018,** Varanasi, Uttar Pradesh, India, October 24-27, 2018.
17. Vinithkumar, N.V., KarunaKumari, R, NidaQuraishi, Dharani, G., *"Seaweed and Open Sea Cage Fish Culture Prospects in Andaman and Nicobar Islands. Future India Science andTechnology: Regional Science Congress Meet, Port Blair"* organised by **Indian Science Congress Association, Pondicherry Chapter and Department of Ocean Studies & Marine Biology, Pondicherry University** at Regional Medical Research Institute, ICMR, Port Blair, October 26-28, 2018.
18. Vinithkumar, N.V., KarunaKumari, R, Srividyalakshmi, V and NidaQuraishi, *"Seaweed Technology Development and Commercial Prospects for Andaman and Nicobar Islands"* **National workshop Mariculture Technologies for Andaman and Nicobar Islands: Potential, Prospect and Strategies towards seaweed Culture,** Atal Center for Ocean Science and Technology for Islands, NIOT, Port Blair, on 10th October, 2018.

19. Vinithkumar, N.V., G. Dharani, *"Open Sea Cage Development and deployment"* **National Workshop on Mariculture Technologies for Andaman and Nicobar Islands: Potential, Prospects and Strategies towards Open Sea Cage Culture,** Atal Centre for Ocean Science and Technology for Islands, National Institute of Ocean Technolgy, Port Blair, on 11th October 2018.
20. Vinithkumar, N.V., G. Dharani, *"Mariculture and Fisheries Accomplishment of ESSO-NIOT"* **National Workshop on Mariculture Technologies for Andaman and Nicobar Islands: Potential, Prospects and Strategies towards Open Sea Cage Culture,** held at Atal Centre for Ocean Science and Technology for Islands, National Institute of Ocean Technolgy, Port Blair, on 11th October 2018.
21. Venkatesan G, *"A study on Desalination plants using Renewable Energy and Ocean thermal gradient"* workshop on **'Desalination: Status and Trends in the Indian Context'** organized by the Center for Sustainable Development at IIT Gandhinagar on November 16, 2018.
22. Prince Prakash Jeba Kumar. J, Kiran A.S., VijayaRavichandran, Ramanamurthy M.V., Rajagopal K., *"Preliminary studies on the impact of marine growth on tensile strength of submerged geosynthetics"*, **Proceedings of National Conference on Application of Geo-synthetics in Ports, waterways and Coasts,** IITM, Chennai. 24th November 2018.
23. Kiran A S, Abhishek T, Vijaya R, Ramanamurthy M V., *"Long term mitigation and engineering design for coast prone to erosion from high energy waves"*, **Proceedings of National Conference on Application of Geo-synthetics in Ports, waterways and Coasts,** IITM, Chennai, 24th November 2018.
24. Ramana Murthy, M.V., *"Coastal Protection Geosynthetics"*, **National Conference Application of Geosynthetics in Ports, Waterways and Coasts,** IIT Madras, Chennai, November, 2018.
25. Prince Prakash Jebakumar. J, Nandhagopal. G, RajanBabu. B, Ragumaran. S, C.M.Ramakritinan, *"Epibiota associated with Artificial Coastal Defence Structures- an alternative niche to enhance Marine Biodiversity"*, **National Conference: Future Trends in Marine Biotechnology, FTMBT 2019,** Tamil Nadu, India, 2019.

INVITED TALKS

Dr. M.A.Atmanand

- Delivered a talk on "Technology in Aid of Blue Economy" at Second ASEAN - India Workshop on Blue Economy held in New Delhi on July 18, 2018.
- Chaired the session on Ocean and Atmosphere and also delivered the talk on 'Ice Class Research Vessels its cost benefit studies and its need in Indian Polar Programme' at Fifth International Conference on Science and Geopolitics of Himalaya, Arctic & Antarctic with a focus on Technological Innovations and Research Expeditions (SaGHAA 2019) held at India International Centre, New Delhi, on February 26, 2019.
- Delivered an invited talk on "Deep Ocean Mission" at 106th Indian Science Congress, Jalandhar on January 5, 2019.
- Delivered an invited talk on "Renewable Energy Development in Ocean and Opportunities in India in Indian - Norwegian solutions for sustainable growth - summit 2019" inaugurated by Prime Minister Norway, January 7-8, 2019.

Dr. Purnima Jalihal

- "Ocean Energy and Desalination – Possible Solutions to the Energy and Water Crises?", IGCAR, April 3, 2018.
- "New Technologies for Additional Water Availability", InDA, NIT Trichy, April 21, 2018.
- International Symposium on State of the Art Technologies and Market in Waste water Treatment in India, Talk on "Desalination Methods – Merits, Demerits and the Energy Nexus", Hindustan University, September 5, 2018.
- Recent Advances in Industrial Pollution Control, Talk on "Reducing Thermal Pollution Through Low Temperature Desalination Technique", SRM University, November 12, 2018.
- Conference on Renewable Energy - Challenges and Way Forward, Talk on "Ocean Renewable Energy", PHD Chambers New Delhi, February 7, 2019
- "Can the Oceans help to Solve the Water Crisis", WATMAN Conference, February 22, 2019.
- Keynote address - "Can the oceans play a role in the water stress?", KPR University, Coimbatore, March 21, 2019.

Dr.R.Venkatesan

- Delivered an award recipient lecture (National Award of Excellence in Ocean Science & Technology of MoES) on technological achievements in ocean observations in Vigyan Bhavan Delhi on July 27, 2018.

- Chaired and delivered a talk during the student symposium during CORCON, 2018 held in Jaipur on October 1, 2018.
- Delivered lecture during the National Oceanography Workshop (NOW) 2018, held at INCOIS on November 15, 2018.
- Delivered keynote address during Diploma Distribution function (Diploma in Fisheries Engineering) for the youths of Fishermen Community of Kanathur Village held at AMET University on November 19, 2018.

Dr.M.V.Ramana Murthy

- "Regional workshop to strengthen capacity for Marine Litter Management in the South Asian Seas (SAS) region", "Technical Official on coastal & Marine Litter Pollution Monitoring issues", South Asia Co-operative Environment Programme (SACEP), Mumbai, April 5-6, 2018.
- "Workshop on Recycling of land based Marine Litter: Challenges and Opportunities in South Asia Seas Region", South Asia Co-operative Environment Programme (SACEP), Mumbai, April 10, 2018.
- "Modeling of Coastal Flooding" Brain Storming on Kerala Floods, NCESS, Trivandrum, September 7, 2018.
- "Flood Modelling and Forecasting": Workshop on "Assessment of Floods in Kerala", Ocean Society of India (OSI), CMLRE, October 5, 2018.
- "Demonstration of Coastal Protection and Wave Structure Interaction". Invited talk in AICTE (QIP) Sponsored Short term Course on Research Avenues in Coastal Engineering, TKM College of Engineering, Kollam, January 14-19, 2019.
- "Resent Trends in Coastal Research", Workshop on "Coastal and Ocean Management" IIRS Dehradun January 28 - February 1, 2019.
- Talk on "Cleaner Oceans", in"World Sustainable Development Summit (WSDS)" India Habitat Centre, New Delhi, February 11-13, 2019.

Dr.Dhilsha Rajapan

- Delivered an invited talk in the National Symposium "Advances in Scientific and Industrial Instrumentation" (ASCII – 2019) by CUSAT, Kochi on February 15, 2019.

Mr.D.Rajasekhar

- Delivered a technical talk on "Research Ship Management Strategy & Innovative Engineering Solutions" in Science & Geopolitics of HIMALAYA-ARCTIC-ANTARCTIC [SaGHAA 5] held at India International Centre, New Delhi on February 26, 2019.

Dr.G.Latha

- Delivered a talk on 'Real time monitoring of ocean ambient noise in Indian seas' in Woodshole Oceanographic Institute WHOI, USA organized by IEEE-OES on June 25, 2018.
- Chaired the Plenary lecture and as a 'Distinguished Speaker' delivered a talk on "Passive acoustic monitoring in the open ocean – Current scenario, Challenges and Future needs", WESPAC 2018, New Delhi, November 11-15, 2018.
- Delivered a talk on "Role of women in transforming India", Women Scientist & Entrepreneur conclave as part of IISF 2018, Lucknow, on October 7, 2018.

Mr.Tata Sudhakar

- "Technology Contributions by NIOT at SRM Vadapalani.
- "Underwater Vehicles" at Sai Ram Engineering College
- "Introduction to Ocean Electronics" and "Indian Tsunami warning system", Indian Maritime University (IMU) for African dignitaries training program.
- "Development of AUPD at NIOT", at INCOIS, Hyderabad.

Dr. Vijaya Ravichandran

- Delivered a lecture on 'Preparation of Detailed Project Report and Environmental Impact Assessment for Marine Infrastructure Projects' for an African Delegation in the Indian Maritime University (IMU), June 11-28, 2018.

Dr. Basanta Kumar Jena

- Delivered a lecture on "Oceanography and Surveying in Coastal Engineering" for an African Delegation in the Indian Maritime University (IMU), June 11-28, 2018.

Dr.G.Dharani

- Delivered a lecture on Production of nutraceutical from marine microalgae, National level technical symposium" Biotechcellence 2018, Department of Biotechnology, Anna University, Chennai, March 13-14, 2018.
- Delivered a lecture on "Offshore cage culture an innovative way for fish protein production in India", 8th International Food Convention (IFCoN-2018), CFTRI, Mysore, December 12-15, 2018.

Dr.S.V.S.Phani Kumar

- "Low Temperature Thermal Desalination Plants for Remote Islands" Indo-Japan International Symposium on Water Treatment held at Anna University, May 22, 2018.

Dr. G.Venkatesan

- "Water Issues related to thermal power plants" in VIT, Chennai, February 6, 2019.
- "Challenges and Research opportunities in Ocean Technology" during the "Design and Fabrication Expo" in MNM Jain Engineering college, Thoraipakkam – Chennai, April 13, 2018.
- "Challenges in Design of large scale desalination system", at IMU Chennai on as part of Indian Technical and Economic Cooperation Programme (ITEC) for Ocean Engineers, November 1, 2018.

BILATERAL COLLABORATION

- A Memorandum of Understanding (MOU) was signed with Virgenia Institute of Technology (VIT)for undertaking joint collaborative work for Ocean Technology related activities on 8th March 2019.
- INDO-US collaboration under OMM (Ocean Mixing and Monsoon) project: Under the Indo-US collaboration, OOS staff member has undergone training on moored buoys at Woods Hole Oceanographic Institute (WHOI), USA during November 2018. OOS Scientist has also participated in the cruise onboard ORV Thomas G Thompson during June 2018. NIOT has organized a review meeting of the principal Investigators under the project OMM during December 2018.
- An MoU was signed between ESSO-NIOT and ICAR-CIBA on 25th September 2018, for technical partnership in supporting for marine finfish seeds for open sea cage culture demonstration.

MoU signing between MoES-NIOT and ICAR-CIBA in presence of Secretary, MoES

- MoU was signed with Andaman Administration for technical support on open sea cage culture, artificial reef and fish aggregation devices and EIA studies at Andaman and Nicobar Islands.
- **IIT Madras** - Studies on Bidirectional Impulse turbine for wave energy
- **Edinburg University** - In this joint collaboration, NIOT is carrying out CFD studies to estimate performance of an axial flow marine hydrokinetic turbine under different operating conditions. NIOT along with project partners participated in a meeting held on 19-20 April 2018 at University of Edinburgh to discuss the progress of the project. NIOT also participated in a video conference meeting held on 5 Nov 2018 at University of Edinburgh to discuss the progress of the project.
- **IEA-OES** - India along with Japan is coordinating a sub task for OTEC under the Technology Collaboration Program (TCP) of International Energy Agency-Ocean Energy Systems (IEA-OES). Webinars were organized by NIOT for member countries of the OTEC sub group for roadmap for collaboration. NIOT represented India at Ex-Co meetings of IEA-OES at Cherbourg, France during 11-15, June, 2018 and at Cancun, Mexico during 26-27, March, 2019.

DEPUTATION ABROAD

S. No	Name of the official	Place of Visit	Purpose	Period
1	Shri. D.Rajasekhar	United States of America	Factory Acceptance Test for thrusters	9th – 12th April 2018
2	Shri. Ashwani Vishwanath	United Kingdom	Steering group and management committee meeting for flowturb	18th – 20th April 2018
3	Dr. Jossia Joseph	United States of America	International visitor leadership programme for Indian Scientists	30th April - 18th May 2018
4	Shri. V.Pandurangan,	Colombo, Srilanka	Sagar Nidhi Dry Docking	5th – 11th May 2018
5	Shri. N. Ravi Alias Gurusamy	Colombo, Srilanka	Sagar Nidhi Dry Docking	13th – 19th May 2018
6	Shri. D.Rajasekhar	Colombo, Srilanka	ORV Sagar Nidhi Dry Docking activities	17th – 19th May 2018
7	Shri. K.Ramasundaram	Colombo, Srilanka	Sagar Nidhi Dry Docking	25th – 31st May 2018
8	Shri. P. Muthuvel Shri. D.S.Sreedev	Kobe, Japan	IEEE/MTS Oceans' 18 conference	26th -31st May 2018
9	Dr. Purnima Jalihal	Cherbourg, France	To attend 34th IEA-OES meeting	10th – 16th June 2018
10	Shri K Gopkumar Shri A.A.Gnanaraj	Japan	Sapporo conference 3 ISOPE 2018	10th – 15th June 2018
11	Dr. R. Venkatesan	Colombia	GOOS SC 7	11th – 17th June 2018

S. No	Name of the official	Place of Visit	Purpose	Period
12	Shri N.R.Ramesh	Kualalumpur, Malaysia	Deep Sea Mining Best Practices Cultural Development and Future Possibilities	13th & 14th June 2018
13	Shri R Sridharan Shri N Sundaravadivelu Shri C Muthukumar	Darwin, Australia	African – Asian – Australian Monsoon analysis and Prediction (RAMA)	14th June – 7th July 2018
14	Dr.G.Latha	United States of America	19th meeting of UN open ended informal consultative process on low of the sea and visit to Woods Hole Oceanographic Institution and the University of Rhode Island.	18th – 29th June 2018
15	Dr M A Atmanand	Paris, France	51st session of IOC Execution Council UNESCO Headquarters	3rd – 6th July 2018
16	Shri N.R.Ramesh Shri S.Rajesh	Norway	Factory Acceptance test on Deep Sea Cable and AHC winch 700m	4th & 5th July 2018
17	Shri G Raguraman Shri A Thirunavukkarasu	NyAsleund, Norway	Scientific Expedition to Arctic for Ambient noise Mooring system deployment.	12th – 19th July 2018
18	Shri A AGnanaraj Shri V Chandran	Denmark	Factory Acceptance Test on Deep Sea Cable and AHC winch 700m	16th – 20th July 2018
19	Dr. G.A.Ramadass Cdr K.Gopakumar	Netherlands and Norway	To attend Underwater Mining Conference – 2018	10th - 16th September 2018

S. No	Name of the official	Place of Visit	Purpose	Period
20	Shri. S.Muthukrishna Babu Shri. A Umapathy	Brazil	Factory Acceptance Test and training on Medium Voltage Variable Frequency Drives at M/s. Siemens Ltd.	11th - 14th September 2018
21	Shri. D.Rajasekhar	France	Factory Acceptance Test for the two Coastal Research Vessel at Kley France	1st – 6th October 2018
22	Dr. G.Venkatesan	Italy	Technical discussion with Water Edge Technologies team, Italy regarding design, finalization of LTTD Plant at TTPS	23rd – 25th October 2018
23	Shri. Kiran AS Shri. B.Kesavkumar	USA	To attend OCEANS 2018 Conference and present papers	22nd -25th October 2018
24	Dr. R.Venkatesan	South Africa	To attend 34th session of the joint World Meteorological Organisation-Intergovernmental Oceanographic Commission DBCP	23rd -26th October 2018
25	Dr. G.Dharani,	Australia	Working Committee Member of the Indian Delegation to attend the Commissions for the Conservation of Antarctic Marine Living Resources	21st October - 2nd November 2018
26	Shri. D.Rajasekhar	Norway	Factory Acceptance Test at Kongsberg, Norway - Multi Beam and Single Beam Echo Sounder w.r.t to two CRVs	29th October - 2nd November 2018

S. No	Name of the official	Place of Visit	Purpose	Period
27	Shri R.Sridharan	USA	To attend the training on Mooring system.	12th - 23rd November 2018
28	Smt. K.Amudha Shri.V.Sundarmoorthy	Norway	Factory Acceptance Test on submersible lay flat hose at M/s. MandalsAS, Norway	19th - 23rd November 2018
29	Dr. R.Venkatesan	Paris, France	To attend Evolving and Sustaining Ocean Best Practices Meeting-II at International Ocean Conference (UNESCO)	4th – 6th December 2018
30	Dr. M.A. Atmanand	Paris, France	To attend the meeting Executive Planning group to support the development of the UN decade of Ocean Science for Sustainable Development	17th – 19th December 2018
31	Dr. G.A.Ramadass	Jamaica	To attend 1st part of the 25th Session of International Sea Bed Authority	23rd February - 4th March 2019
32	Dr. Purnima Jalihal	Mexico	To attend 36th IEA OES Executive Committee Meeting	24th – 27th March 2019
33	Shri. Trishanu Shit	Mexico	To attend 36th IEA OES Executive Committee Meeting	26th – 28th March 2019
34	Dr. M A Atmanand	Port Elizabeth, South Africa	To attend the Steering Committee of IIOE-2, IOCINDIO meetings	12th – 13th March 2019

MEMBER OF COMMITTEES

Dr.M.A.Atmanand

- Elected as the first Indian from India for the Administrative Committee (AdCom) of IEEE Oceanic Engineering Society (OES) from 2019 to 2021.
- Member of the Executive Planning Group (EPG) to support the development of the UN Decade of Ocean Science for Sustainable Development by Intergovernmental Oceanographic Commission (IOC) of UNESCO.
- Indian Representative in the Executive Committee for the Ocean Energy Systems under the International Energy Agency.
- Member of National Biodiversity Authority, representing MoES.

Dr.Purnima Jalihal

- Member, Programme Advisory Committee - Water Technology Initiative, Department of Science and Technology (DST).
- Expert Member of RD&D Project Appraisal Committees (RDPACs) for Appraisal of RDD&D proposals for the Development of Ocean Energy in India at Ministry of New and Renewable Energy, New Delhi.
- Indian Representative in the Executive Committee for the Ocean Energy Systems under the International Energy Agency.
- Chairperson of Indian Desalination Association (South Zone) Executive Committee
- Member of committee on Water Sector for the Global Technology Watch Group, TIFAC.

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; WG Vandalism of Ocean Platforms
- National Consultant SACEP-NORAD-International Maritime Organization by Govt, of India
- Country focal Point Belmont forum Arctic
- Member of Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM)

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. G.A. Ramadass

- Member, IEEE Oceanic Engineering Society

Dr. Dhilsha Rajapan

- Doctoral Committee member, VIT, Vellore
- Doctoral Committee member, Anna University, Chennai
- Guest Editor, Journal of Acoustic Society of India

Shri. D.Rajasekhar

- Member of Marine Engineering and Safety Aids Sectional Committee TED 19 under Bureau of Indian Standards [BIS].
- Member of Expert committee constituted by DG Shipping on the fixation of port limits.
- Expert 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 .
- Member, Peer Review Committee 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 of Expert Committee on Earth and Atmospheric Sciences, Science and Engineering Research Board (SERB) Gov. of India
- Member of Expert Committee for preparation of RFP for DSS for cyclone warning, IMD, Delhi
- Doctoral Committee Member, Anna University

Mr. Tata Sudhakar

- Chairman, Institution of Electronics and Telecommunication Engineers (IETE) Chennai centre and Council member in IETE, New Delhi.
- Member Board of studies in Sai Ram engineering Collage
- Member board of studies in Saveetha Engineering Collage

Dr.Basanta Kumar Jena

- Associate member at ASCE, USA, American Society of Civil Engineers since 2003
- Society member for Coastal Education & Research Foundation, Inc. (CERF)

Dr.Vijaya Ravichandran

- Member in the Environmental Appraisal Committee for Nuclear, Defense and Strategic Projects in the Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India
- Member in the Committee for prevention of sexual harassment of women, National Institute of Wind energy

Dr.G.Dharani

- Member, Coastal Aquaculture Authority, Ministry of Agriculture and Farmers Welfare, Government of India.
- Member, Technical Advisory Committee for Gujarat State Biotechnology Mission.

Dr. S.Ramesh

- Executive Council Member, Tamil Nadu Geologists Association

Cdr. Gopkumar Kuttikrishnan

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

Dr. N. Vedachalam

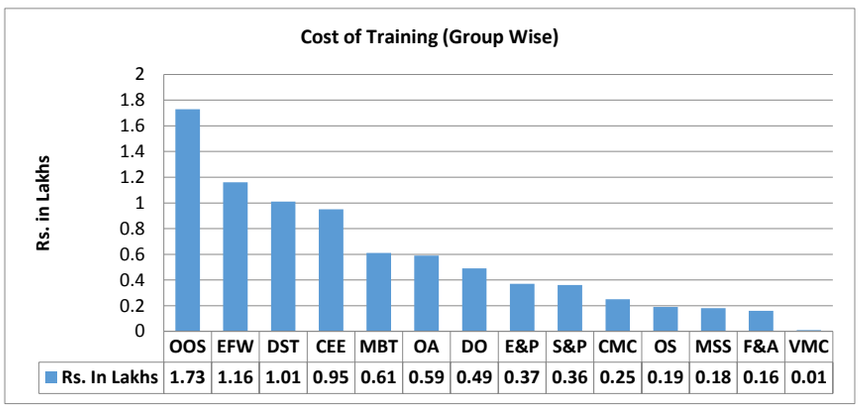
- Member, Marine Technology Society
- Member, Society for Underwater Technology
- Member, International Society of Offshore and Polar Engineers,
- Member, IEEE OES

HUMAN RESOURCE DEVELOPMENT

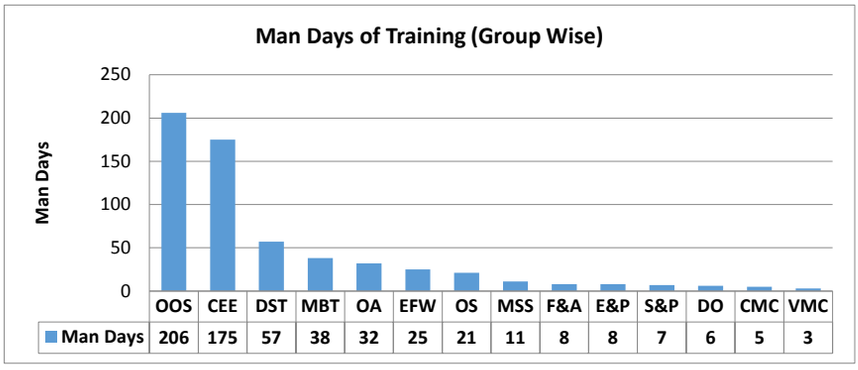
The HRD division organizes training courses in the areas of engineering, software, project management, personality development, product trainings etc. Besides the external training courses, efforts are also made to conduct extra mural lectures by eminent personalities in the other fields which are beneficial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

The division also provides both short term (4 weeks to 6 months) and long term (one year) project training to students pursuing B.Tech / 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. Around 89 students completed the project work in various departments of NIOT. About 89 students carried out their short term internships (minimum 2 weeks maximum 4 weeks) and 62 students carried out their inplant training (minimum 5 days maximum 2 weeks) during the college summer and winter vacation.

With regards to the external training for staff, the section has coordinated trainings cumulating about 602 man-days costing about Rs.8 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.



	OOS	EFW	DST	CEE	MBT	OA	DO	E&P	S&P	CMC	OS	MSS	F&A	VMC
Rs. In Lakhs	1.73	1.16	1.01	0.95	0.61	0.59	0.49	0.37	0.36	0.25	0.19	0.18	0.16	0.01



	OOS	CEE	DST	MBT	OA	EFW	OS	MSS	F&A	E&P	S&P	DO	CMC	VMC
Man Days	206	175	57	38	32	25	21	11	8	8	7	6	5	3

Training Undergone by NIOT Staff

Sl. No	Name of the Staff	Training Program	Duration
1	Mrs. A. Malarkodi Scientist - D	Training Programme on "One day laboratory course on Changes in ISO/IEC 17025:2005 to ISO/IEC 17025:2017" at NABL, Chennai	07.05.2018
2	Mr. Trishanu Shit Scientist -C	Training Programme on " Short Course on Tunnelling" at Hotel Le meridien, Bengaluru	16.05.2018 to 19.05.2018
3	Mr. Abhijeet Sajjan Scientist - C		
4	Ms. G.V. Ahalya Executive	Training Programme on "General Financial Rules 2017 & DFPR" at Institute of Government Accounts & Finance, Chennai	18.05.2018
5	Mrs. L. Vaidehi Junior Executive		
6	Mr. H. Junaid Ahmed Technician B	Seminar on "E-way bill implementation under GST Law" at Hotel Abu Sarovar, Kilpauk, Chennai	18.05.2018
7	Mr. S. Krishna Mohan Joint Manager	3rd National Conference on "Arbitration in India-Current Issues & Trends" at Hotel Eastend, Munnar, Kerala	24.05.2018 to 26.05.2018
8	Mrs. K. Chithra Scientist - E	One day Awareness programme on "Transition of ISO/IEC 17025:2005 to ISO/IEC 17025:2017" at NABL, Chennai	18.06.2018
9	Mr. R. Sundar Scientist – C		
10	Mr. Peddinti SSR Sridhar Project Scientist - I		
11	Dr. R. Venkatesan Scientist – G	Workshop for "CVOs and Vigilance Functionaries" at Indian Bank Staff College, MRC Nagar, Chennai	05.07.2018 to 06.07.2018

Sl. No	Name of the Staff	Training Program	Duration
12	Mr. Martin V Mathew Project Scientist –I	Training Programme on "STCW course Package" at Indian Maritime University, Uthandi, Chennai	09.07.2018 to 21.07.2018
13	Mr. K.N. Navaneeth Project Scientist – I		
14	Ms. Anoopa Prasad C Project Scientist-I		
15	Mr. Jay Kumar Project Scientific Assistant		
16	Mr. Kritharth Krishnan Project Scientific Assistant		
17	Mr. Abhishek Tandon Project Scientist – I		
18	Mr. Abhijeet Sajjan Scientist – C	Training Programme on " Advanced Course on Fatigue and Fracture Behaviour structures and Structural Components" CSIR, Campus, Taramani, Chennai	18.07.2018 to 20.07.2018
19	Mr. Trishanu Shit Scientist – C		
20	Ms. Anulekha Majumdar Scientist – B		
21	Mr. D. Rajasekhar Scientist – G	32nd National convention of Marine Engineers and National Seminar on " Indian Maritime Sector - A Ocean of Opportunities" at hotel Savera, Chennai	16.08.2018 to 18.08.2018
22	Mrs. K. Vasanthi Executive	Training Programme on "PFMS EAT Module" at MoES, New Delhi	21.08.2018 to 22.08.2018
23	Mrs. G. Hemavathi Senior Executive		

Sl. No	Name of the Staff	Training Program	Duration
24	Mr. S.M. Gopalakrishnaa Coordinator Gr-IV	One day programme on “Right to Information Act 2005”, NIWE, Chennai	24.08.2018
25	Mr. V. Sankara Ramasubramanian Senior Administrative Officer		
26	Mr. S. Guruprasad Rao Junior Executive		
27	Mrs. M. Vansi Philomena Project Junior Assistant		
28	Mr. Y.P.C.V.S. Manikanta, Project Scientific Assistant	Training Programme on "Annual Hypack Training Seminar" at Bogmallo Beach Resort, Goa	27.08.2018 to 29.08.2018
29	Mr. M. Sivanathan Project Scientific Assistant		
30	Mr. Yograj Sharma Project Scientist – I		
31	Mr. Jarpula Laxman Scientific Assistant – A		
32	Mr. M. RadhaKrishnan Scientific Officer Gr. –I	Training Programme on “Practice for Trouble Free Drilling”, IDT, Dehradun	27.08.2018 to 31.08.2018
33	Mr. C. Jothi Technician Grade – B		
34	Mr. R. Sridharan Scientific Officer Gr.-II	Short Time Training for “Survival Swimming” at Velachery Aquatic, Complex	31.08.2018 to 14.09.2018
35	Mr. M. Murugesan Scientific Officer Gr – II		
36	Ms. A. Anjusha Project Scientist – I	Training Programme on "Live feed production for finfish and shellfish" at Visakhapatnam regional Centre of CMFRI, Visakhapatnam	24.09.2018 to 29.09.2018
37	Mrs. A. Malarkodi Scientist – E	Assessor's Training Course on “ISO/IEC 17025:2017” at Kolkata	26.09.2018 to 30.09.2018

Sl. No	Name of the Staff	Training Program	Duration
38	Mrs. Vatchala Kuppuraman Senior Executive	Workshop on "A1CTE Internship Policy 2018,Rahman Crescent Institute of Science and Technology" at Vandalur, Chennai	09.10.2018
39	Mrs. K.R. Anuradha Assistant Manager		
40	Ms. Preethi Sekar Project Scientist – I	Training Programme on Plaxis standard course on "Computational Geotechnics", at IIT, Chennai	24.10.2018 to 26.10.2018
41	Dr. M. Kalyani Scientist – C	Workshop on National Oceanography (NOW 2018) at INCOIS, Hyderabad	14.11.2018 to 16.11.2018
42	Mr. Y.V. Narashima Rao Scientific Officer Grade – II	13th IEEE International Conference on "Industrial and Information System 2018 (ICIIS 2018)" at IIT Ropar, Punjab	01.12.2018 to 02.12.2018
43	Dr. G. Dharani Scientist – F	8th International Food convention IFCoN 2018,CSIR-CFTRI, Mysore	12.12.2018 to 15.12.2018
44	Dr. J. Mary Leema Thilakam Scientific Officer Grade – I		
45	Ms. Nida Quraishi Project Scientific Assistant	Training Programme on "Asian Seabass Aquaculture" at Sirkali, Nagapattinam, TN	17.12.2018 to 20.12.2018
46	Mr. A.N. Subramanian Scientist – E	International Conference on "IEEE Power Electronics, Drives, and Energy Systems Conference- 2018 (IEEE-PEDES -2018) at IIT Madras, Chennai	18.12.2018 to 21.12.2018
47	Ms. S. Shanmuga priyaa Project Scientist – I	HYDRO-2018, International(Hydraulics, Water Resources and Coastal Engineering) Conference, at, NIT Patna	19.12.2018 to 21.12.2018
48	Mr. S. Guruprasad Rao Junior Executive	Training Programme on "Development programme for Office secretaries, Personal Assistant and Office Staff" at Hotel Lapaz garden, Vasco-da-gama, Goa	07.01.2019 to 11.01.2019

Sl. No	Name of the Staff	Training Program	Duration
49	Mr. Vikas Pandey Project Scientist – I	Training on "Laboratory Management system and Internal Auditing" at Brainwave consultant, Chennai	10.01.2019 to 13.01.2019
50	Mr. S. Venkat Narayanan Project Scientist – I		
51	Mr. Sathis Kumar Project Scientist – I		
52	Mr. A.N. Subramanian Scientist – E	NIAS-DST Training Programme on "Science & Technology : Global Developments & Perspectives" at NIAS campus, Bengaluru	21.01.2019 to 01.02.2019
53	Dr. J. Santhanakumar Scientific officer Grade – I	World Brackish water Aquaculture conference (BRAQCON 2019) at CIBA, Chennai	22.01.2019 to 25.01.2019
54	Mr. G. Rajaprabhu Project Scientist – I		
55	Mrs. N.N. Lavanya Junior Assistant	Training Programme on "Management Development Programme on Direct Tax" at Hotel, Deccan plaza, Chennai	23.01.2019 to 24.01.2019
56	Mrs. K. Vijayalakshmi Junior Assistant		
57	Dr. G. Dhinesh Scientist – D	Training Programme on "Offshore wind resource modelling" at NIWE, Chennai	29.01.2019 to 31.01.2019
58	Mr. Satya Kiran Raju Alluri Scientist - D		
59	Mr. Bolem Srinivas Scientist – D	Training Programme on "Cyber Security & Ethical Hacking" at CDAC, Bengaluru	04.02.2019 to 08.02.2019
60	Mr. S. Ramasundaram Scientist – D		
61	Mr. R. Sundar Scientist - D		

Sl. No	Name of the Staff	Training Program	Duration
62	Mr. Biswajit Haldar Scientist – C	Training Programme on "STCW Course Package", at IMU, Uthandi, Chennai	04.02.2019 to 19.02.2019
63	Mr. Anand Kishor Scientist – C		
64	Mr. K. Ramesh Scientific Officer Gr. II		
65	Mr. Subash Kumar Project Scientific Assistant		
66	Mr. R. Keerthivasan Senior Research Fellow		
67	Ms. R. Janani Senior Research Fellow		
68	Ms. S. Anuvinda Project Scientist – I		
69	Mr. R. Thennavan Project Scientist – I		

Sl. No	Name of the Staff	Training Program	Duration
70	Mr. K. S. Arunraj Project Scientist – I	Training Programme on "STCW Course Package", at IMU, Uthandi, Chennai	04.02.2019 to 19.02.2019
71	Mr. Amol Anil Dhole Project Scientific Assistant		
72	Mr. M.J.M. Pavan Kumar Project Scientific Assistant		
73	Mr. Vishal Pawan Jain Project Scientist- I		
74	Mr. T. Lokesh Project Scientist – I		
75	Mr. Tirtha Ghosh Project Scientific Assistant		
76	Mr. Gummadi Anil Kumar Project Scientist – I		
77	Mr. Y. Manikanta Project Scientific Assistant		
78	Ms.Sonitha S Saraf Junior Hindi Translator	Official Language Conference, Kochi	14.02.2019
79	Mrs. K. R. Anuradha Assistant Manager	"Developing Management Skill for Secretaries Administrative staff – Assistant", Abu Sarovar, Chennai	15.02.2019
80	Mrs. Vatchala Kuppuraman Senior Executive		
81	Mr. Manoj Vasudevan, Scientist – D	"All India Rajbhasha Special Hindi workshop and seminar", Vijay International Hotel Puri, Odissa	18.02.2019 to 20.02.2019
82	Mr. Sulabh Srivatsav Hindi Typist		

Sl. No	Name of the Staff	Training Program	Duration
83	Dr. K. Jossia Joseph Scientist – D	Workshop on "air-Sea Interactions in the Bay of Bengal from Monsoons to Mixing at ICTS", Bengaluru	18.02.2019 to 23.02.2019
84	Mr. K.N.Navaneeth Project scientist – I		18.02.2019 to 21.02.2019
85	Mr. Martin Mathew Project Scientist – II		
86	Mr. K. Mullaivendhan Scientist – D	Workshop on "FOWPI's Offshore wind Met Ocean data and analysis", at NIWE, Chennai	18.03.2019 to 20.03.2019
87	Mr. Lakku Naresh Kumar Goud Project Scientist - I		

Students / Faculty/ Officers visit to NIOT

Sl.no.	Name of the University/Institution	Student/ Faculty	Total nos. visited	Period of visit
1.	KC College of Technology	Students	90	03.07.2018 to 04.07.2018
2.	Dept. of Electrical & Electronics, Hindustan University	Professors & Lecturers	35	05.07.2018
3.	Dept. of Electronic & Instrumentation Engg., St.Josephs College of Engineering.	Students	120	10.07.2018 to 11.07.2018
4.	Chennai schools and colleges (as part of IISF-18)	Students	1000	25.09.2018
5.	Rajalakshmi Engineering College	Students	50	21.08.2018
6.	Alpha College of Engineering	Students	33	04.09.2018
7.	Dept. of Marine Science Integrated, Manonmaniam Sundaranar University	Students	26	31.10.2018
8.	IMU, Vizag	African Nationals	16	13.11.2018
9.	College of Fisheries Engineering, Nagapattinam	Students	30	07.12.2018
10.	RMK College of Engineering & Technology	Students	178	04.01.2019
11.	Prince Venkateshwara Padmavathy Engineering College	Students	65	22.02.2019
12.	Mechanical Dept., Anna University	Students	45	22.02.2019
13.	Velammal Engineering College	Students	100	15.03.2019
14.	SRM Institute of Science & Technology	Students	44	29.03.2019
15.	Dept. of Naval Architecture and Offshore Engineering of AMET University	Students	75	29.03.2019

Extra Mural Lectures Delivered by Eminent Personalities

Mr. Sivashankar, M/s. Multi Organ Harvesting Aid Network (MOHAN) foundation delivered a lecture on "Organ donation" on 14th August 2018.

Dr Y Sreenivasa Varma, Medical Director, Bala Gangadhara Varma Medical Research Centre delivered an awareness talk on "Seasonal fever" on 20th November 2018.

Prof. A.G.A. Gopichand, M/s. SKY Yoga delivered a lecture on "Benefits of Yoga" on 26th December 2018.

A Yoga session by Ms. Roshini Moravineni, Clinical Research Coordinator, from Sri Sri school of Yoga is scheduled on 13th August 2018 at NIOT, Chennai. The session covered Asanas, Pranayaam, Meditation and Health tips.

ADMINISTRATION

Following are the details of the manpower position during the period from 01.04.2018 to 31.03.2019 at NIOT.

a. Staff Strength

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

Sl.No.	Category	No. of Posts Sanctioned	No. of Posts Filled	No. of Posts Vacant
1.	Director	01	01	NIL
2.	Scientific	89 + (2)*	83 + (2)*	06
3.	Technical	54	53	01
4.	Administrative	18	17	01
5.	Official Language Hindi	03	02	01
6.	Multi- Tasking Staff	06	06	NIL
	Total	**171+ (2)***	162+(2)*	09

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

b. Appointments

Sl.No	Name	Post	Date of Appointment
1.	Shri V Sankara Ramasubramanian	Administrative Officer	26.7.2018

c. Superannuation

Sl.No	Name	Post	Date of superannuation
1.	Shri T P Rangamaran	Joint Manager	31.5.2018
2	Dr R Kirubagaran	Scientist – G	30.6.2018

d. Promotions Under Modified Flexible Complementing Scheme

Sl.No	Name	Post	With effect from
1	Dr G Dharani	Scientist-F	1.7.2018
2	Dr S Sundararajan	Scientist-E	1.7.2018
3	Shri N Ravi alias Gurusamy	Scientist-E	1.7.2018
4	Smt A Malarkodi	Scientist-E	1.7.2018

Sl.No	Name	Post	With effect from
5	Shri S Rajesh	Scientist-E	1.7.2018
6	Dr G Venkatesan	Scientist-F	1.1.2019
7	Shri R Ramesh	Scientist-E	1.1.2019
8	Shri Aruna.Avula	Scientist-E	1.1.2019
9	Smt K Amudha	Scientist-E	1.1.2019
10	Shri G Harikrishnan	Scientist-E	1.1.2019
11	Shri S Srinivasa Rao	Scientist-D	1.1.2019
12	Shri R Sundar	Scientist-D	1.1.2019
13	Shri Ashwani Vishwanath	Scientist-D	1.1.2019
14	Smt D Shyamala Varthini	Scientist-D	1.1.2019
15	Shri B Kesava Kumar	Scientist-D	1.1.2019
16	Shri Satya Kiran.Alluri	Scientist-D	1.1.2019
17	Shri Anand Kishor	Scientist-C	1.1.2019
18	Shri Biswajit Haldar	Scientist-C	1.1.2019
19	Ms Anulekha Majumdar	Scientist-C	1.1.2019

e. Resignations

Sl.No	Name	Post	Date of Resignation
1.	Ms Puja Dutta	Junior Hindi Translator	27.9.2018 (F.N.)

f. Ph.D / M.Tech

Sl.No	Name		
2.	Shri R.Sundar	M.Tech	Ocean Technology, IIT Madras
3.	Shri G.Vengatesan	M.Tech	Ocean Technology, IIT Madras

g. Re-Designation

In pursuance to letter No.MoES/25/17/2010-Estt(Pt.) dated 31.10.2018 of MoES, GoI, New Delhi, the following posts were re-designated and will not entail any financial implications whatsoever.

Sl.No.	Earlier designation	Pay Level in the 7th CPC	Re-designated as
1	Scientific Assistant – Grade A	Level 6	Scientific Assistant
2	Scientific Assistant – Grade B	Level 7	Scientific Officer Grade – I
3	Scientific Assistant – Grade C	Level 8	Scientific Officer Grade – II

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
2	2018	-	-	1	-

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 2018 – 2019

Ministry / Department / Organization	:	National Institute of Ocean Technology, Chennai Ministry of Earth Sciences
Year	:	2018 – 19 (April 2018 to March 2019)

Progress in 2018 – 19						
	Opening Balance as on 01.04.2018	**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	6	15	26	0	0	35
First Appeals	1	0	1	0	0	2

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**
270	20	-

RTI Annual Return Information System (2018 - 2019) 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 (2018 - 2019) National Institute of Ocean Technology, Chennai Ministry of Earth Sciences (Please note that field 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

A J Deora & Associates

CHARTERED ACCOUNTANTS

INDEPENDENT AUDITOR'S REPORT

TO
THE CHAIRMAN & MEMBERS
GOVERNING BODY OF NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

Report on the Audit of the Standalone Financial Statements

Opinion

We have audited the financial statements of **NATIONAL INSTITUTE OF OCEAN TECHNOLOGY (NIOT) CHENNAI**, which comprise the Balance Sheet as on 31st March 2019, and the Income & Expenditure Account and Receipts & Payments Account for the year then ended and notes to the financial statements, including a 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 the Institute as at March 31, 2019, and excess of income over expenditure for the year ended on that date subject to
Non-accounting of Gratuity and Leave Encashment and Gratuity on accrual basis in accordance with Accounting Standards 15 issued by The Institute of Chartered Accountants of India. The Impact of the same could not be quantified in the absence of Actuarial valuation of Retirement Benefits.

Basis for Opinion

We conducted 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 Auditor's Responsibilities for the Audit of the Financial Statementssection 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.

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 other irregularities; selection and application of appropriate accounting policies; making judgments 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

No. 68, Adarsh Apartments Ground Floor, Vepery High Road, Chennai – 600 007 India
Cell No: 80560 63340 Email: ajdeoraca@gmail.com

A J Deora & Associates
CHARTERED ACCOUNTANTS

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.

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 except the non-compliance stated above.

A J Deora& Associates
Chartered Accountants
Firm No. 000711S

P. Jainendra

CA. Jainendar P
Partner
M.No. 239804

UDIN: 19239804AAAAAG4063

Place: Chennai
Date : 21/08/2019

A.J. DEORA & ASSOCIATES * CHENNAI - 07 * CHARTERED ACCOUNTANTS

No. 68, Adarsh Apartments Ground Floor, Vepery High Road, Chennai – 600 007 India
Cell No: 80560 63340 Email: ajdeoraca@gmail.com

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

BALANCE SHEET AS AT 31ST MARCH 2019

(Amount in Rupees)

LIABILITIES	**Schedule**	**31.03.2019**	**31.03.2018**
CAPITAL FUND	1	3,593,712,413	3,158,974,873
RESERVES AND SURPLUS	2	375,749,372	347,158,184
EARMARKED / SPONSORED PROJECT FUNDS	3	1,189,554,429	217,080,705
CURRENT LIABILITIES AND PROVISIONS	4	1,366,283,193	1,362,846,787
TOTAL		**6,525,299,407**	**5,086,060,549**
ASSETS			
FIXED ASSETS	5	3,318,310,673	3,018,533,725
INVESTMENTS - OCEAN TECHNOLOGY AND EARMARKED / SPONSORED PROJECT FUNDS	6	1,399,661,818	264,320,254
INVESTMENTS - OTHERS	7	1,284,512,286	1,310,947,048
CURRENT ASSETS, LOANS, ADVANCES, ETC.	8	522,814,630	492,259,522
TOTAL		**6,525,299,407**	**5,086,060,549**
Significant Accounting Policies	14		
Contingent Liabilities and Notes to Accounts	15		

For National Institute of Ocean Technology, Chennai

DIRECTOR

As per our Report of even date
For A J DEORA & ASSOCIATES
Chartered Accountants
FIRM REGN.NO.000711S

CA.JAINENDAR.P
PARTNER
Memb No: 239804

Date: August 21, 2019
Place: Chennai 600 100

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31ST MARCH 2019

(Amount in Rupees)

INCOME	***Schedule***	**2018-19**	**2017-18**
Scientific and Technical Consultancy Services		2,475,000	67,286,914
Grants-in-aid - Core Grant	9	310,071,839	272,559,527
Interest Earned	10	5,519,970	5,844,700
Other Income	11	2,950,973	2,107,760
TOTAL (A)		**321,017,782**	**347,798,901**
EXPENDITURE			
Expenditure on Scientific and Technical Consultancy Services		621,000	39,287,538
Establishment Expenses	12	256,721,818	258,139,792
Administrative Expenses	13	59,510,199	58,216,842
Depreciation on assets created out of Core Grants		26,001,582	27,258,602
TOTAL (B)		**342,854,599**	**382,902,774**
Interest & Other Incomes Earned during the Year 2018-19 under the programme "Ocean Technology" refundable to Ministry of Earth Sciences, Government of India transferred to Schedule 4 - Current Liabilities & Provisions		8,470,943	7,952,460
Balance being excess of Income over Expenditure transferred to Schedule 1- Capital Fund		-32,161,760	-71,055,709
Appropriations on Scientific and Technical Consultancy Services			
General Reserve Fund		1,781,550	26,604,408
Staff Welfare Fund		72,450	1,394,969
		321,017,782	**347,798,901**
Significant Accounting Policies	14		
Contingent Liabilities and Notes to Accounts	15		

For National Institute of Ocean Technology, Chennai

DIRECTOR

Date: August 21, 2019
Place: Chennai 600 100

As per our Report of even date
For A J DEORA & ASSOCIATES
Chartered Accountants
FIRM REGN.NO.000711S

CA.JAINENDAR.P
PARTNER
Memb No: 239804

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2019

(Amount in Rupees)

SCHEDULE 1 - CAPITAL FUND	31.03.19		31.03.18	
BALANCE AS AT THE BEGINNING OF THE YEAR		3,158,974,873		3,396,128,581
Add: Additions during the year	711,976,105		810,722,411	
Less: Transfer/Adjustment	-		747,046,072	
Less: Excess of Expenditure over income	32,161,760		71,055,709	
Less: Provision for depreciation	245,076,805	434,737,540	229,774,338	-237,153,708
BALANCE AT THE YEAR END		**3,593,712,413**		**3,158,974,873**

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

Schedule -1

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2019

(Amount in Rupees)

SCHEDULE 2 - RESERVES AND SURPLUS		31.03.19		31.03.18	
	Reserves created out of Technical / Consultancy Projects				
i.	**General Reserve Fund**				
	As per last Account	306,297,829		294,509,453	
	Additions during the year	32,605,726		51,229,110	
	Deductions during the year	519,840	338,383,715	39,440,734	306,297,829
	Sub - Total		338,383,715		306,297,829
ii.	**Staff Welfare Fund**				
	As per last Account	4,401,122		2,800,691	
	Additions during the year	966,666		1,643,181	
	Deductions during the year	182,936	5,184,852	42,750	4,401,122
	Sub - Total		5,184,852		4,401,122
iii.	**Scientific & Technical Consultancy Project Equipment Fund**				
	As per last Account	36,459,233		34,583,901	
	Additions during the year	1,698,307		8,878,732	
	Less: Depreciation on the assets created	5,976,736	32,180,805	7,003,400	36,459,233
	Sub - Total		32,180,805		36,459,233
	GRAND TOTAL (i+ii+iii)		**375,749,372**		**347,158,184**

Schedule -2

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J. DEORA & ASSOCIATES CHENNAI-07 CHARTERED ACCOUNTANTS

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2019

SCHEDULE-3 EARMARKED / SPONSORED PROJECT FUNDS

Details / Grants pertaining to	Balance as on 1.4.2018	Add: Receipts		Less: Expenditure			Balance as on 31.03.19
		Grants Received	Other Receipts and Interest	Expenditure Revenue	Project Equipment/WIP	Surrender of Grants	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. SCHEME-O-SMART							
Energy and fresh water	-43,539,056	90,000,000	-	39,102,675	4,977,974	-	2,380,296
Marine Sensors & Systems	-7,641,851	25,950,000	171,230	11,015,823	2,908,771	-	4,554,785
Ocean Acoustics	-1,269,998	44,375,000	1,090,019	29,850,189	541,184	-	13,803,648
Ocean Electronics	-1,253,814	25,000,000	77,318	13,846,527	9,570,152	-	406,825
Ocean Sciences & Technology for Islands	32,449,831	90,000,000	3,226,963	70,517,321	33,182,012	-	21,977,461
Development of Technologies for Offshore Structural component	-93,905,326	390,000,000	1,196,502	72,098,302	206,166,184	-	19,026,690
Sea Front Facility	136,273,699	-	1,135,353	10,240,020	86,074	-	127,082,958
Integrated Deep Sea Mining System for Mining of Polymetallic Nodules upto 6000m Depth	318,717,146	-	13,681,199	47,208,959	159,072,868	-	126,116,518
Technology Development of Manned and Unmanned Underwater Vehicles	45,072,276	206,000,000	8,428,010	15,897,385	8,973,443	-	234,629,458
Pre-investment activity of the two proposed National Oceanarium @ Puduchery and Diu	4,406,537	-	305,267	529,279	-	-	4,182,525
Establishment of Ballast Water Treatment Technologies Testing Facility	155,153,666	-	7,142,001	2,229,354	5,319,987	-	154,746,326
Operation and Maintenance of CRV Sagar Purvi	-81,388,060	88,000,500	-	61,768,148	-	-	-55,155,708
Operation and Maintenance of BTV Sagar Manjusha	-78,536,990	102,302,000	94,027	4,459,016	-	-	19,400,021
Operation & Maintenance of Research Vessel 'Sagar Nidhi'	-119,975,850	436,800,000	-	349,659,230	-	-	-32,835,080
Acquisition of two Coastal Research Vessels	3,023,800	586,996,667	7,262,817	7,729,032	103,092,501	-	486,461,751
Moored Ocean Observation Network / HF Radar	-88,521,892	328,750,000	2,109,252	217,304,734	-4,303,103	-	29,335,729
Scientific studies and technology development for exploration and extraction of Gas Hydrates	3,702,988	42,500,000	1,772,443	20,610,697	2,682,218	-	24,682,516
Extension of continental shelf & Geoscientific studies of the Exclusive Economic zone	1,438,450	-	-	451,350	25,219	-	961,881
Seawater Quality Monitoring	191,775	1,400,000	-	446,690	-	-	1,145,085
Information Technology and E-Governance activities	3,479,080	-	-	1,003,974	-	-	2,475,106
SUB-TOTAL - A	**187,876,412**	**2,458,074,167**	**47,692,401**	**975,968,705**	**532,295,484**	**-**	**1,185,378,791**
B. OTHER GOVERNMENT GRANTS							
Southern Ocean Expedition Cruise	17,538,343	-	-	-	-	17,538,343	-
National Post- Doctoral Fellowship	285,068	5,168,680	10,120	4,913,394	-	-	550,474
India International Science Festival 2017	11,375,987	7,900,000	220,151	16,834,342	-	-	2,661,796
Indo- French Workshop - Thematic School of Microbial Ecology	4,896	242,116	1,348	248,360	-	-	-
NIOT-Indacon '2019	-	649,746	-	586,377	-	-	63,369
Protection of beach from sea erosion at selected locations along the coast of Odisha	-	400,000	-	-	-	-	400,000
"Digital Poompuhar" network project	-	500,000	-	-	-	-	500,000
SUB-TOTAL - B	**29,204,294**	**14,860,542**	**231,619**	**22,582,473**	**-**	**17,538,343**	**4,175,639**
TOTAL-A+B	**217,080,705**	**2,472,934,709**	**47,924,020**	**998,551,178**	**532,295,484**	**17,538,343**	**1,189,554,430**
PREVIOUS YEAR	**613,770,779**	**1,630,949,519**	**62,808,608**	**1,296,227,789**	**793,722,411**	**498,000**	**217,080,705**

Schedule-3

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A. VEERA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2019

(Amount in Rupees)

SCHEDULE 4 - CURRENT LIABILITIES & PROVISIONS	31.03.19		31.03.18	
A. STATUTORY LIABILITIES				
Tax Dues	10,489,573		8,925,741	
CPF Contribution	9,642,142		7,740,475	
NPS Contribution	801,423	20,933,138	768,929	17,435,145
B.OTHER CURRENT LIABILITIES				
Pay & allowances for the month of March 2019	28,184,337		25,102,608	
Outstanding Liabilities	181,971,065		298,966,059	
Earnest Money & Retention money	75,193,485		73,306,821	
Interest & Other Incomes Earned during the Year 2018-19 under the programme "Ocean Technology" refundable to Ministry of Earth Sciences, Government of India transferred to Schedule 4 - Current Liabilities & Provisions	8,470,943	293,819,830	7,952,460	405,327,948
Project Advances *(Vide Sub-Schedule:B)*		1,051,530,225		940,083,693
TOTAL (A+B)		**1,366,283,193**		**1,362,846,786**

Schedule-4

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SUB-SCHEDULE:B FORMING PART OF SCHEDULE-4 OF THE BALANCE SHEET AS AT 31ST MARCH 2019

Details / Grants pertaining to	Balance as on 1.4.2018	Add: Receipts		Less: Expenditure			Balance as on 31.03.19
		Received	Other Receipts & Interest	Revenue	Capital/WIP	Transfer/Adjustments	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PROJECT ADVANCES							
Scientific and Technical Consultancy Services	99,328,234	82,320,525	7,588,429	21,243,989	1,698,307	2,070,000	164,224,892
On Deposit : Installation of 1 lakh litres per day capacity Seawater Low Temperature Thermal Desalination Plants at Agatti, Andrott, Minicoy, Amini, Kiltan & Chetlat Islands	840,755,459	107,500,000	52,872,560	-	113,822,686	-	887,305,333
TOTAL - B	**940,083,693**	**189,820,525**	**60,460,989**	**21,243,989**	**115,520,993**	**2,070,000**	**1,051,530,225**
PREVIOUS YEAR	**912,782,265**	**65,021,104**	**28,525,136**	**13,835,207**	**8,878,732**	**43,530,873**	**940,083,693**

Sub-Schedule: B

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J. DEORA & ASSOCIATES CHARTERED ACCOUNTANTS CHENNAI - 07

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2019

SCHEDULE 5 - FIXED ASSETS

(Amount in Rupees)

S.No	DESCRIPTION	GROSS BLOCK				DEPRECIATION				Provision for loss / unserviceable assets			NET BLOCK	
		Cost/Valuation as on 01.04.18	Additions during the year	Deletions	Cost/Valuation as on 31.03.19	Upto 01.04.18	Additions during the year	Deletion during the year	Total upto 31.03.19	Upto 01.04.18	Additions during the year	Total upto 31.03.19	As on 31.03.19	As on 31.03.18
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	108,150,055	13,831,193	-	121,981,248	-	-	-	-	-	-	-	121,981,248	108,150,055
2	**Buildings**	-			-	-			-	-	-	-	-	-
	Buildings & Infrastructure at NIOT Campus	516,714,862	31,974,897	-	548,689,759	335,850,356	18,960,229	-	354,810,585	-	-	-	193,879,174	180,864,506
	Building at ACOSTI, Port Blair	27,893,543	-	-	27,893,543	20,405,263	753,968	-	21,159,230	-	-	-	6,734,313	7,488,281
3	**Equipment**	-			-	-	-		-	-	-	-	-	-
	General Equipment	152,841,444	2,953,370	-	155,794,814	96,792,985	7,041,354	-	103,834,338	-	-	-	51,960,476	56,048,459
	Project Equipment under O-SMART scheme	6,009,704,083	246,312,202	-	6,256,016,285	4,211,697,772	244,322,838	-	4,456,020,610	60,952,724	-	60,952,724	1,739,042,952	1,737,053,587
	TOTAL UNDER (A)	**6,854,400,884**	**295,071,662**	**-**	**7,149,472,546**	**4,664,746,375**	**271,078,388**	**-**	**4,935,824,763**	**60,952,724**	**-**	**60,952,724**	**2,152,695,060**	**2,128,701,785**
B	**Capital work in progress**	**853,372,707**	**280,062,102**	**-**	**1,133,434,809**	**-**	**-**	**-**	-	-	-	-	**1,133,434,809**	**853,372,707**
C	**Fixed Assets created out of Scientific & Technical Consultancy Projects**													
1	Scientific & Technical Equipment	136,797,537	1,698,307	-	138,495,844	100,338,304	5,976,736	-	106,315,039	-	-	-	32,180,805	36,459,233
	GRAND TOTAL (A+B+C)	**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**
	PREVIOUS YEAR	**6,945,922,571**	**898,771,910**	**123,353**	**7,844,571,128**	**4,501,124,862**	**264,036,340**	**76,523**	**4,765,084,679**	**60,952,724**	**-**	**60,952,724**	**3,018,533,725**	**2,383,844,985**

Schedule-5

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2019

(Amount in Rupees)

SCHEDULE 6 - INVESTMENTS -MoES Grants		31.03.19	31.03.18
a.	Deposits with Banks	1,399,661,818	264,320,254
	TOTAL	**1,399,661,818**	**264,320,254**

(Amount in Rupees)

SCHEDULE 7 - INVESTMENTS - OTHERS		31.03.19	31.03.18
a.	Funds received for rendering Scientific and Technical Consultancy Services	134,644,225	103,572,169
b.	General Reserve Fund	338,309,632	306,627,543
c.	Staff Welfare Fund	4,241,249	4,013,057
d.	Deposits from other Agencies	807,317,180	896,734,279
	TOTAL	**1,284,512,286**	**1,310,947,048**

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

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

Schedule-6 & 7

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2019

(Amount in Rupees)

SCHEDULE 8 - CURRENTS ASSETS, LOANS & ADVANCES		31.03.19	31.03.18
A.	**CURRENT ASSETS**		
	Balance with Banks in Savings Accounts	291,610,305	197,559,578
B.	**LOANS AND ADVANCES**		
i	***Capital Advances***		
	Land Acquisition for Sea Front Facility at Nellore, Andhra Pradesh	58,483,793	72,779,945
	Advance to CPWD for Infrastructure	26,911,360	101,153,189
ii	**Staff Advances**		
	Non-Interest bearing Advances to employees	333,977	417,643
	Interest bearing Advances to employees	175,673	216,807
iii	***Advances and other amounts recoverable in cash or in kind for for value to be received***		
	Recoverable from Revenue Authorities	23,120,896	22,027,976
	Prepaid Expenses	8,130,195	8,810,224
	Project Advances	46,153,971	29,227,400
	Advance Payment to Suppliers	9,626,409	18,707,563
	Other Receivables	2,445,020	5,734,004
iv	***Interest accrued but not due***	55,823,031	35,625,193
	TOTAL	**522,814,630**	**492,259,522**

Schedule-8

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31ST MARCH 2019

(Amount in Rupees)

SCHEDULE 9 - GRANTS	**2018-19**		**2017-18**	
Grants-in-aid received from MoES	481,800,000		281,000,000	-
Add: Amount of Interest & Other Incomes earned during the year 2017-18	7,952,460	489,752,460	8,559,527	289,559,527
Less: Amount allocated for Capital Expenditure and transferred to Capital Fund				
(1) Building & Infrastructure Activities at NIOT, Chennai	2,500,000		10,000,000	
(2) General Equipment	7,500,000		7,000,000	
(3) Excess Expenditure incurred during 2017-18	129,680,621		-	
(4) Terminal Benefits to Employees	40,000,000	179,680,621	-	17,000,000
TOTAL		**310,071,839**		**272,559,527**

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

Schedule-9

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31ST MARCH 2019

(Amount in Rupees)

SCHEDULE 10 - INTEREST EARNED	2018-19	2017-18
On Savings Account	3,532,439	4,670,051
On Term Deposits	1,987,531	1,174,649
TOTAL	**5,519,970**	**5,844,700**

(Amount in Rupees)

SCHEDULE 11 - OTHER INCOME	2018-19	2017-18
Rent Received	1,145,789	927,457
Sundry Receipts	1,805,184	1,172,133
Profit on sale of Fixed Assets	-	8,170
TOTAL	**2,950,973**	**2,107,760**

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

Schedule-10 & 11

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31ST MARCH 2019

(Amount in Rupees)

SCHEDULE 12 - ESTABLISHMENT EXPENSES	2018-19	2017-18
Pay & Allowances	230,171,379	230,005,983
CPF Contribution	9,642,142	11,465,380
NPS Contribution	8,955,347	9,208,749
Medical Reimbursements	2,459,228	1,599,337
Children's Education Allowance	1,281,770	3,655,349
Leave Travel Concession	4,211,952	2,204,994
TOTAL	**256,721,818**	**258,139,792**

SCHEDULE 13 - ADMINISTRATIVE EXPENSES	2018-19	2017-18
Computer Maintenance/LAN/Software / Maintenance of Plant & Machinery	12,174,230	9,881,991
Electricity & Water Charges	10,271,749	8,411,259
Campus Maintenance Expenses	20,524,106	20,135,049
Vehicles Running and Maintenance	1,167,542	1,335,011
Conveyance Expenses	808,696	1,221,834
Travel Expenses	3,329,142	4,884,466
Subscriptions to Journals & Bulletins	1,187,114	1,118,199
Expenses on Seminars & Workshops	249,551	174,145
Communication Expenses	993,344	1,052,571
Printing and Stationery	1,788,130	1,436,734
Advertisement & Publicity	607,245	170,582
Rent, Rates and Taxes	2,648,106	1,602,158
Hospitality Expenses	1,329,162	1,644,552
Professional charges	1,161,015	1,660,134
Auditor's Remuneration	88,500	81,420
Other Administrative Expenses	1,182,567	3,406,737
TOTAL	**59,510,199**	**58,216,842**

Schedule-12 & 13

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI
RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH 2019

(Amount in Rupees)

RECEIPTS	2018-19	2017-18	PAYMENTS	2018-19	2017-18
I. Opening Bank Balances	197,559,578	33,257,025	**I. Expenses- Assistance to Autonomous Bodies**		
			a) Establishment Expenses	221,549,828	227,506,426
			b) Administrative Expenses	54,788,041	52,724,067
II. Grants Received			**II. Payments made against funds for various projects**		
a) Assistance to Autonomous Bodies	481,800,000	281,000,000	a) Scheme - O-SMART	601,726,245	1,004,150,836
b) Scheme - O-SMART	2,458,074,167	1,519,160,000	b) Sponsored Projects from other sources	32,538,478	125,558,022
c) Sponsored Project Grants from other sources	124,561,142	132,738,919	c) Deposit from other agencies	27,490,927	5,215,619
III. Scientific & Technical Consultancy Services	85,254,019	64,782,013	**III. Scientific & Technical Consultancy Services**	38,980,553	46,405,240
IV. Deposits Matured	1,963,021,553	2,164,834,452	**IV. Deposits Made**	3,012,379,883	1,448,274,595
V. Interest Received			**V. Purchase of Fixed Assets**	476,422,054	819,438,854
a) Assistance to Autonomous Bodies	3,655,402	4,670,051			
b) Scheme - O-SMART	10,253,049	11,625,133			
VI. Other Incomes	2,359,940	24,740,784	**VI. Other Payments**	649,199,253	361,740,032
VII. Any Other Receipts	80,146,717	51,764,892	**VII. Closing Bank Balances**	291,610,305	197,559,578
TOTAL	**5,406,685,567**	**4,288,573,269**	**TOTAL**	**5,406,685,567**	**4,288,573,269**

Date: August 21, 2019
Place: Chennai 600 100

For National Institute of Ocean Technology, Chennai

21/8/19

DIRECTOR

As per our Report of even date
For A J DEORA & ASSOCIATES
Chartered Accountants
FIRM REGN.NO.000711S

P. Jainendar

CA.JAINENDAR.P
Partner
M.No.239804

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.

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

(vii) The Institute has been notified as Scientific Research Institution under Section 35(1)(ii) of the Income Tax Act 1961 read with Rules-5C and 5E of the Income Tax Rules, 1962 vide Notification No.45/2012 (F.No.203/51/2011/ITA-II) dated 29th October 2012 from Assessment year 2011-12.

(viii) The enterprise is a level II entity as defined in preface to Accounting Standards issued by the Institute of Chartered Accountants of India. Accordingly, the enterprise has complied with all the accounting standards applicable to small and medium size entities unless otherwise stated.

2. ACCOUNTING CONVENTION:

The accompanying financial statements have been prepared under the historical cost convention basis in accordance with the Generally Accepted Accounting 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.

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

(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 expenditure is 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 presented as per the Uniform Format of Accounts for Central Autonomous Bodies.

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

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

As per our Report of even date
For A.J.DEORA & ASSOCIATES
Chartered Accountants
Firm Reg. No: 000711S

CA.JAINENDAR.P
Partner
M. No: 239804

Date: ***August 21, 2019***
Place: ***Chennai 600 100***

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY, CHENNAI

SCHEDULE- 15 : NOTES ON ACCOUNTS

1. Pending Capital commitments:

Autonomous Coring System was procured from M/s.Williamson & Associates, USA at a cost of US$ 57,40,950/-. Out of the above, as per terms & conditions, NIOT had paid Rs.23,41,74,645/- (US$ 48,43,959.75/- – 84.38% of the contract value) and capitalised the payments made as per the Accounting Standards-10 issued by Institute of Chartered Accountants of India. Pending capital commitment on account of the above contract is Rs.6,27,26,528/- (US$ 8,96,990.25 – 15.62% of the contract value).

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. The accrued liability in respect of NIOT regular employees as on 31st March 2019 are as follows:

			2018-19	2017-18
a.	Liability in respect of Gratuity	:	Rs.9,37,70,668/-	Rs. 8,17,79,226/-
b.	Liability in respect of Leave Encashment	:	Rs.12,81,39,461/-	Rs.11,30,45,465/-
	TOTAL	**:**	**Rs.22,19,10,129 /-**	**Rs.19,48,24,691 /-**
c.	Less: Grants received towards Terminal Benefits during the financial year 2018-19	:	Rs.4,00,00,000/-	Rs.0/-
	Balance Liability Receivable	**:**	**Rs.18,19,10,129 /-**	**Rs.19,48,24,691 /-**

3. Insurance claim

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

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

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

4. Loss of assets during sea trials

During the sea trials of Deep Sea Mining for testing the in-situ soil tester on 25th November 2016, due to dynamic load on the cable caused due to unforeseen weather-sea conditions at Central Indian Ocean Basin, the in-situ soil tester with associated accessories / equipments were lost in the sea. The committee constituted by the Director submitted its report that the loss of equipments is not due to negligence of the individuals and recommended that the loss be written off and duly accounted as per procedure. NIOT is in the process of writing off losses as per GFR 223(3)(v). Pending receipt of the approval of the competent authority to write off the loss in the books, NIOT had already provided for the loss of assets amounting to Rs.1,26,05,410/-.

5. Scheme – Ocean Services, Modelling, Application, Resources & Technology (O-SMART)

Ministry of Earth Sciences (MoES) sanctioned the following projects to NIOT under the Scheme – O-SMART viz., Energy and Fresh water and Development of Technologies for Offshore Structural component, Integrated Deep Sea Mining System for Mining of Polymetallic Nodules upto 6000m Depth, Technology Development of Manned and Unmanned Underwater Vehicles, Marine Sensors & Systems, Ocean Electronics and Ocean Acoustics, Ocean Sciences & Technology for Islands, Operation & Maintenance of Vessels (Sagar Purvi, Manjusha & Nidhi), Acquisition of two Coastal Research Vessels, Moored Ocean Observation Network, HF Radar, Gas Hydrates, Extension of continental shelf & Geo-scientific studies of the Exclusive Economic zone. During the financial year 2018-19, the Society received an amount of Rs.245,80,74,167/- (Previous Financial Year 2017-18:Rs.151,91,60,000/-) as Grants-in-aid under the Scheme – O-SMART from Ministry of Earth Sciences, Government of India.

The projects relating to the Scheme – O-SMART, have been transferred from Schedule -14 forming part of Income & Expenditure Account to Schedule - 3 - EARMARKED / SPONSORED PROJECT FUNDS and the previous year's figures (2017-18) has been re-grouped accordingly.

In the Schedule -5 – Fixed Assets forming part of Balance Sheet – Equipment of Ocean Technology Programmes and Equipment of Earmarked / Sponsored Projects have been re-named as Project Equipment under O-SMART Scheme and the figures have been merged and the previous year's figures (2017-18) has been re-grouped accordingly.

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY * CHENNAI *

A.J DEORA & ASSOCIATES * CHENNAI - 07 * CHARTERED ACCOUNTANTS

In the Schedule - A – Capital Fund forming part of Balance Sheet – Ocean Technology Equipment Fund and Earmarked Projects Capital Fund have been renamed as Project Equipment Fund under O-SMART Scheme and the figures have been merged and the previous year's figures (2017-18) has been re-grouped accordingly.

6. The Society during the financial year 2018-19 received an amount of Rs.48,18,00,000/- (Previous Financial Year 2017-18 : Rs.28,10,00,000/-) 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.

7. Depreciation charged in Income & Expenditure Account

During the financial year 2018-19 Depreciation on Assets created out of Core Grant amounting to Rs.2,60,01,582/- is charged to Income & Expenditure Account and also shown in Schedule -5 – Fixed Assets forming part of Balance Sheet.

8. Interest Earned

During the Financial Year 2018-19, the Interest Earned under the MoES Projects for the Scheme : O-SMART and Core Grant is Rs.5,23,48,935/- (Actual Interest Earned is Rs.3,56,35,775/- and Interest Accrued is Rs.1,67,13,160/-) out of which Rs.3,56,35,775/- has been remitted to Ministry of Earth Sciences during the financial year 2019-20 as per GFR Rule 230(8).

An amount of Rs.79,52,460/- being Interest and Other Income earned during the year 2017-18, shown under Current Liabilities is being accounted as Grants Received and this has been adjusted while releasing Grants by Ministry of Earth Sciences, Government of India during the year 2018-19.

9. Projects and Utilisation Certificates

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

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

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY NIOT CHENNAI

A.J DEORA & ASSOCIATES CHENNAI - 07 CHARTERED ACCOUNTANTS

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

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

11. Previous year figures have been regrouped / merged wherever necessary.

12. Schedules 1 to 15 are annexed to and form an integral part of the Balance Sheet as at 31st March 2019, 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

As per our Report of even date
For A.J.DEORA & ASSOCIATES
Chartered Accountants
Firm Reg. No: 000711S

CA.JAINENDAR.P
Partner
M. No: 239804

Date: August 21, 2019
Place: Chennai 600 100

A workshop on Indian Coastal Ocean Radar Network (ICORN) along Indian coast, was conducted during 24-25 January 2019. The proceeding of the workshop along with a manual for the QA/QC of HF Radar data, was released by Dr. M. Rajeevan, Secretary, MoES.

An International conference on Ocean Renewable Energy and Water (INDACON 2019) was organized during 7-8 March 2019 at NIOT, Chennai in association with IEEE-OES & Indian Desalination Association. Dr. V. K. Saraswat, Member, NITI Aayog presided in the presence of Dr. M. Rajeevan, Secretary, MoES and other eminent guests.

"Surging from the silver year in the oceans

International Women's day was celebrated on 8th March 2019 at NIOT Chennai. Dr. Premeela Gurumurthy, Vice Chancellor, Tamilnadu Music and Fine Arts University, delivered the Presidential Address. Dr. M. Rajeevan, Secretary, MoES graced the occasion and delivered special address.

Deployment of Passive Acoustic System in the Arctic

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