Indian Institute of Science
Centre for Atmospheric and Oceanic Sciences
BANGALORE 560 012, INDIA
Ph: +91 80 2293 3065; Mobile: +91 98457 40257; Fax: +91 80 2360 0865
http://caos.iisc.ernet.in e-mail: vinay@caos.iisc.ernet.in

Dr P.N.Vinayachandran,
Professor

11.02.2016

Dear Sir,

Subject: Enquiry for Fabrication & Supply of Drifting Buoy with Thermistor Chain rated for 100m water depth.

Bid Notification Number: CAOS/Tender/IITM02-3/2016

QUOTATIONS SHOULD BE SUBMITTED IN SEALED COVERS AND SUPERSCRIBED THE ENQUIRY NUMBER AND SHOULD BE SUBMITTED WITHIN DUE DATE.

INTRODUCTION:

Indian Institute of Science (IISc) is located in the city limits of Bengaluru City Corporation. There are about 45 departments and centres in IISc that work on a wide range of scientific and technological areas of research. Centre for Atmospheric and Oceanic Sciences (CAOS) is one of the centres in IISc and our research addresses a wide variety of topics within the broad realm of atmosphere-ocean-climate science. CAOS has served as leader in planning and execution of several Indian National oceanographic experiments and multinational ocean observation programs. One of the research themes of CAOS understands the dynamics of Indian Ocean by way of both observations and simulations using numerical models.

The instrument intended in this tender is meant for making underway measurement of vertical profiles of temperature and salinity in the ocean as a function of depth on board Indian research vessels.

Important Dates:

Date of release of the enquiry	:	11 February 2016
Last date for submission of quotes	:	29 February 2016

For any clarifications, contact: Prof. P. N. Vinayachandran, Centre for Atmospheric and Oceanic Sciences, Indian Institute of Science, Bangalore 560 012. Tel: +91 80-22933065; Email: vinay@caos.iisc.ernet.in

Thermistor chain description

The temperature chain (T-Chain) consists of a single polyurethane sheathed cable with a Kevlar core. This cable carries digital-format data from the various sensors. Temperature sensors and pressure sensor are moulded to ensure its functionality in underwater applications. The number and type of sensors, length of cable, and other parameters are fabricated as per the temperature chainspecification

Scope of work

Fabrication& Supply of drifter buoy with thermistor chain rated up to the depth of 100m.

Drifting buoy with Barometric pressure sensor, SST and Thermistor chain rated for 100m water depth with the detailed sensor configuration should be fabricated and supplied to Indian Institute of Science. The drifter buoy with Thermistor string will be useful for the scientific community to understand and monitor the high-frequency and vigorous internal wave and overturning processes in the ocean. The thermistor chain should support its custom designed electronics to collect temperature measurements at an estimated resolution of about 0.01°C with a response time faster than 30 second down to depths of 100m. The presented schematic of temperature chain is designed to interface 20sensor capsules at designated depths in the drifter buoy tether mooring line, which are all read-out within 60s using RS485 communication protocol.

Specification of Drifting buoy with thermistor chain rated for 100m water depth.

It should consists of mechanical section containing Surface float hull (Diameter: 400mm), Drogue (Length : 6m and Diameter : 600mm, should be made of Cordura Nylon) , Tether (Length of 15m and up to the drogue bottom end) mechanism and Electronic section has the sub systems like DAQ, suitable alkaline power pack to ensure endurance of 1 year minimum, Air pressure sensor, SST, GPS, INSAT UHF transmitter with Quadrifilar antenna and Internal cables & connectors as designed and proposed for mass production by NIOT as against the

tender ref :NIOT/S&P/OE/22176/2013-14 dated 19/12/2013 & NIOT contract order ref: NIOT/S&P/OE/22176/2014-15 dated 23/09/2014 and a thermistor chain rated for 100m depth with designated sensors as detailed respectively.

SPECIFICATION

Requirement of Sensor Configuration in a cable of 100m length.

Sl.No	***Description***	***Depth***	***Remarks***	***Compliance Yes/No***
1.	Temperature sensor capsule	0.5m,1m,2m,5m,10m,15m, 20m,25m,30m,35m,40m,45m,50 m,60m,70m,80m,90m & 100m.	18 Nos	
2.	Depth sensor capsule	50m & 100m	2 Nos	

a.) Temperature Sensor Module Specifications for Thermistor chain

Temperature sensor node specification		***Compliance Yes/No***
Temperature Sensor	NTC Thermistor sensor type 46000 series sensor by Measurement specialities/YSI or equivalent	
Range	0 to 45°C	
Accuracy	± 0.05°C (0 to 45°C)	
Resolution	0.01°C	
Calibration range	10 to 30°C	
Sensor enclosure material	Sensor beads and electronics should be integrated along the cable with suitable moulding components	
Supply Voltage	10.5-16Vdc	
Data interface	RS485	
Data	Temperature	
Handshaking	Data polling at required interval by data logger	
Weight	≤ 200grams	
Validation methods for product acceptance by NIOT	Laboratory calibration and comparison test methods	
Calibration requirement	All sensor capsules should be calibrated in NABL lab or ETDC centers.	
Quantity	18 Nos	

b.) Depth Sensor Module Specifications for thermistor chain

Depth sensor node Specification		***Compliance Yes/No***
Depth Sensor	**Absolute type**	
Pressure Sensor element	MEMS / Piezo resistive/semiconductor	
Type	OEM version of RBR/Sensortech/Druck or equivalent sensor shall be integrated.	
Range	0 to 10 bar (0- 100 meter)	
Nonlinearity	±0.25% FSO	
Sensor enclosure material	Plastic /Polypropylene/SS316/any material suitable for marine applications It should be made as a sensor capsule along with the cable at designated depth.	
Data interface	RS485	
Depth sensor module length, diameter	Should not exceed 100mm, 25mm	
Handshaking	Data polling at required interval by data logger	
Weight	≤ 300 grams	
Calibration requirement	All sensor should be calibrated at NABL labs or ETDC centres.	
Validation methods for product acceptance at NIOT	Laboratory calibration and comparison methods	
Quantity	2 Nos	

c.) Under Water Kevlar Cable for Thermistor chain.

Structure shielded twisted pair cable is recommended for integrating designated sensors at required length to fabricate marine grade thermistor string suitable for a depth up to 100m.

Thermistor Chain Cable Specification		***Compliance Yes/No***
Type	Shielded twisted pair-STP	
Under water Cable Make /Model	MacArtney or equivalent shall be used for thermistor chain integration	
Shielded twisted pair-STP	• 0.5 mm2 bare copper conductors insulated with Polyethylene. • Two conductors twisted together with a tinned copper drain wire and aluminium/polyester foil.	
Cores	Multi core preferably 4 STP shall be used Power Supply (1 STP) RS 485 (2 STP) GND (1STP)	
Outer jacket	Polyurethane jacket and standard colour	
Cable diameter	12.7mm ± 0.3 mm	
Weight in air	Approx. 24 kg/100m length of underwater cable	
Standard	ISO/IEC 11801	
Weight handling capacity	It should withstand 50 kg	
Voltage	100V	
Current	1A rms	
Conductor resistance	≤ 45 ohm/km	
Insulation resistance	≥ 500 Mohm*km (cond./cond.) ≥ 100 Mohm*km (cond./shield) ≥ 10 Mohm*km (shield/shield)	

d.) Measurement Scheme

Sensor	*Averaging period*	*Sampling interval*	*Trigger source*
Air pressure sensor& SST Sensor	As per the existing measurement scheme of NIOT drifter buoy		Software trigger from data logger via RS485
Temperature sensor	15 Minutes (Last 15 minutes of every hour)	Every minute	Software trigger from data logger via RS485
Depth Sensor	5 Minute (Last 5 minutes of every hour)	Every minute	Software trigger from data logger via RS485

e). Measurement methodology

- Thermistor Sensor: - Change in the variation of resistance due change in the temperature may be converted to frequency output and use low power digital controllers to send data over RS485 interface.
- Depth sensor: The sensor output may be converted to voltage/current and digitized using low power controllers to send data over RS485 interface.
- RS485 communication channel should be configured for data polling respect to each sensor node.

1). Fabrication Process

Each thermistor/depth sensor along with its signal conditioning circuits and digital interface circuits should be moulded separately on a multi core Kevlar/Armoured underwater cable at specified depth as indicated. The sensors should be well protected and an integral part of module itself. It should be easily deployable in sea. The following fabrication methodology shall be followed during the process of thermistor string fabrication.

2). Encapsulation materials

3M moulding ScotchCast flame retardant compound (2131) or equivalent should be used for moulding and encapsulating the sensor element, electronic circuitry.

3). Encapsulation technique/guide lines

- A suitable mould kit may be fabricated using aluminium for encapsulating sensors and electronic circuitry and cables
- The sensor element, PCB circuitry should be made intact along the cable joint.

- The sensor element should be sufficiently protected and protruded outside the cable & mould.
- Cable splicing and joining should be done without any loose contact and double confirmation check should need to under taken before starting the moulding process.
- Encapsulation should not spoil the basic functionality of the sensing element.
- Once moulding is done it should be allowed for 24 hours curing at room temperature

f. General Measurement Requirement of Thermistor Chain

General measurement requirements		***Compliance Yes/No***
Number of sensor nodes	18 temperature sensor nodes &2 depth sensor nodes in a underwater 100m cable	
Chain Depth rating	100m	
Supply Voltage	12- 16Vdc	
Power consumption-Active for only 20sec	120mA@ 12V or better	
Power consumption- Sleep for 40sec	20mA@ 12V or better	
Standard thermistor	Thermistors of 46000 P Series having High stability shall be used for thermistor string fabrication.	
Thermistor chain	Calibrated to ±0.05°C accuracy as against ITS-90 primary standards	
Resolution	0.01°C	
Response time	Thermistor sensor <30 sec (in water)	
Minimal sampling interval	60 sec	
Electronic circuitry & PCB	Each node should be integrated with suitable low power electronics which provides RS485 output in a multicore cable.	
Cable	Shielded Twisted Pair, 4 STP data cable should be used for thermistor string.	
Data communication should comply with	RS485 output in turn to be connected to data logger.	
Cable termination	Underwater connector at one end MCIL8F or equivalent with locking sleeve.	
Calibration certificate	Thermistor & depth sensor should be supplied with NIST traceable standards	
Weight of thermistor chain (excluding the weight of drifting buoy and associated sensors)	less than 30 kg in air	

g). Quantity & other terms

Quantity Requirement	: 2 complete Drifting buoy system with thermistor chain rated for 100m water depth as per sensor configuration at designated depth along with necessary bulk head type mating connector.
Delivery Schedule	: 1st may 2016.
Warranty	: 12 Months from the date of acceptance
Validity	: 90 days
Payment	: After delivery and acceptance.