Ministry of Earth Sciences (MoES)
Government of India
REACHOUT
PAMC-Technology

Expression of Interest–Indigenous development of equipment

Ministry of Earth Sciences (MoES), Government of India has the primary mandate to provide the nation with the best possible services for weather, climate, ocean, coastal and natural hazards and sustainable harnessing of ocean resources. This is being done through nurturing Research and Development (R&D) in MoES autonomous, R&D laboratories and academic institutions in the country.

2. These MoES institutions rely on a range of specialized equipment and instruments for observing weather parameters, detecting earthquakes, monitoring sea-level changes, ocean currents, and assessing marine biodiversity. However, most of these instruments are currently imported at high cost, resulting in limited availability relative to the actual demand. Foreign manufacturers benefit from early development and large-scale production catering to global needs. Developing such instruments indigenously offers a strategic alternative reducing costs, improving access, and building national capacity in alignment with the 'Make in India' initiative.

3. Among various schemes/ components of this Ministry, Research, Education, Training and Outreach (REACHOUT) promotes technology development and necessitates the indigenous development of equipment attributing to the vision of *Make-in-India*. The Ministry of Earth Sciences invites **Expression of Interest (EoI) (format in *Annexure-I*)** from Universities, Research/ Academic institutions, as well as governmental organisations in the country for focused design and development in the mentioned **list of equipment (*Annexure-II*)** and **technical specification (Annexure-III).**

4. The PIs may portray their specific interest in the technology development for anyone or more, from the list of equipments mentioned in the Annexure-II through the EoI as per the guidelines. The EoIs received will be examined and evaluated by Experts and accordingly the shortlisted EoIs will be informed to submit detailed project proposals. Subsequently, the PIs of selected projects shall be invited to present the proposal before the expert members. The final decision to fund the project will be taken based on the recommendations of the expert members and following GoI Procedures.

5. As per the MoES norms:
i. The equipment/ deliverables/ project outcomes/ applications/ databases, etc., developed by the supported proposals will be transferred to the MoES Institutes for real-time use/ applications before the closure of the project tenure.
ii. The equipment developed must be developed for feasibility of mass-scale production.
iii. All equipment/ assets procured form MoES funds shall be maintained in the stock Register and no asset/ equipment etc., shall be diverted and/ or disposed off without prior approval of the competent authority of the MoES.

Guidelines and deadline:
1. The proposals need to be submitted as per the format in Annexure-I to pamc.techmoes@gmail.com.
2. The project duration can vary proportionate to the project deliverables (~18 months).
3. The last date for receiving the proposal is 21 days from the online publishing date.
4. Only those PI(s) who submitted their EoI within the above-mentioned deadline will be considered for invitation for a full proposal, upon shortlisting by the expert members. However, sending the EoI does not guarantee acceptance of the project proposal by the Ministry.
5. Proposal to be submitted in Arial font with font size 11 and 1.5 spacing.
6. For any further queries, please contact: Dr. M. Ashokan, Scientist-E (Phone: 011-24669643).

Annexure-I

1. Details of Principal Investigator (PI) and Co-PI (Name, Designation, Affiliation)
2. Thrust Area and equipment
3. Title of the project
4. Keywords
5. Project Details which include the following:

    i. State of knowledge (both at national and international level) (<500words)
    ii. Objectives
    iii. Experience of PI/ Co-PI in the subject of the proposal
    iv. Working demonstrations
    v. Manufacturing capabilities (Make in India)-name of the company for mass-scale production
    vi. Servicing/ warranty facilities
    vii. Deliverables
    viii. Methodology(<500words)
    ix. Period of work proposed with tentative timeline

NOTE: The PI must mention the name of the Company to be tied to for mass scale production of their equipment developed under MoES-funded project.

Annexure-II

LIST OF EQUIPMENT

1. Pressure Sensors
2. Buoyancy Modules
3. Underwater Acoustic Transponders
4. Carbon Dioxide Absorbing Curtains
5. Pressure Tide Gauge
6. Solar Radiation (SWR & LWR)
7. Anemometers (Ultrasonic Type)
8. Air temperature and Relative humidity
9. Digital Barometer

Annexure-III

TECHNICAL SPECIFICATIONS

1. Pressure Sensor

Parameters	Specification
Power specification	
Main Input Voltage	10 to 16 VDC
Max current	50mA @12VDC
Technical Specification	
Pressure range	500 to 1100 hPa
Accuracy over full temperature range	± 0.15 hPa or better
Resolution	± 0.01 hPa or better
Long-term Stability	Better than ±0.1 hPa /year
Linearity	±0.05 hPa or better
Operating temperature range	0º to 50º c
Data Flow	RS232
Power on delay	5 sec or better
Housing Classification	IP66 rating

2. Buoyancy Modules

Parameters		Specification
Type of syntactic foam		Foam composite consists of glass microspheres embedded in a matrix of plastic
Application		To provide positive buoyancy in manned submersible/human occupied vehicle
Average density on a 1 m^3 batch (NF EN ISO 845)		540 ± 10 kg/m^3
Nominal Diving Depth (NDD)		6000 m of sea water
Temperature at NDD		2 ± 1 °C
Hydrostatic Crush pressure (Instantaneous, 2°C) typical		>88 MPa
Standard Block Dimensions [Length (±5) x Width (±2) x Height (±1)]		920 x 400 x 100 mm
NF EN ISO 844 – NF 56 – 101	Uniaxial compressive strength	73.3 MPa
	Uniaxial compressive modulus	2.84 GPa
	Uniaxial Compressive strain at failure	2.7%
NF EN ISO 1209-2	Flexural strength	52.6 MPa
	Flexural modulus	2.5 GPa
	Flexural strain at failure	2%
ISO 1926	Tensile strength	22.9 GPa
	Tensile modulus	2.49 GPa
	Tensile strain at failure	0.9%
Poisson coefficient (ISO 1926)		0.3
Glass transition temperature (ISO 11357-2)		>105°C
Water absorption at 6000 m water depth		As per DNV
Rules to be followed		DNV (July 2019)
Approval of manufacturer		DNV
Product certification		DNV

3. Underwater Acoustic Transponders

Parameters	Specification
Frequency band	Low frequency (12 KHz)
Transducer beam width	180°
Operating temperature	-5 to +55 °C
Max. detectable angles	±90°
Accuracy	±2°
Weight in air	62 kg
Housing material	SS or Titanium alloy
Operating voltage	10 to 14.4 V DC
Depth rating	6000 m
Operating Temperature	0° to 55° C
Battery specifications	128 Ah, Non-rechargeable Lithium metal(Li/SOC2)
Connector	Pressure rated underwater connectors from COTS
Pressure Test	pressure test certificate should be attached

4. Carbon Dioxide Absorbing Curtains

Parameters	Specification
Type	Micropore Lithium Hydroxide
Storage Dimension	306 x 155 x 262 mm
Net Weight LiOH	4.4 kg minimum
Net Weight of Curtains	5.1 kg nominal
Gross Weight	8.25 kg maximum
Performance (0.5% to 4% CO_2 in air)	0.75 kg CO_2 per kg LiOH
Store Temperature	0°C to 30°C
Curtains use lithium hydroxide based alkaline adsorbent that neutralizes carbon dioxide and other acid gases in a closed environment.	
Capable of controlling carbon dioxide without power or ventilation	
No dusting even after shock and vibration	

5. Pressure Tide Gauge

Parameters	Specification
Water Level Range	0–10 m to 0–30 m (site dependent)
Water Level Accuracy	±2–10 mm
Resolution	~1 mm
Sampling	0.2 Hz to 10 Hz (configurable)
ADC Resolution	16–24 bit
Operating Temperature Range	−40 °C to +80 °C (electronics)
Interfaces	RS-232, RS-485, USB
Power	12–36 V DC

6. Solar Radiations (SWR & LWR)

a) Pyranometer (Short Wave Radiation)

Parameters	Specification
Classification to ISO 9060:2018	Spectrally Flat Class A
Detector type	Thermopile
Analogue output	0 to 1V
Analog Output Range	-200 to 2000 W/m2
Serial output	RS-485 Modbus®
Serial output range	-400 to 4000 W/m2
Response time (63%)	<0.7s
Response time (95%)	<2s
Spectral range (20% points)	270 to 3000 nm
Spectral range (50% points)	285 to 2800 nm
Zero offsets (unventilated) a. thermal radiation (at 200 W/m2) b. temperature change (5 K/h)	 <7W/m² < 2W/m²
Non-stability (change/year)	<0.5%
Non-linearity (100 to 1000 W/m²)	<0.2%
Directional response (up to 80 ° with 1000 W/m2 beam)	< 10 W/m2
Temperature response	< 1% (-20°C to +50°C); <2% (-40°C to +70°C)
Spectral selectivity (350 to 1500 nm)	< 1%
Tilt response (0° to 90° at 1000 W/m²)	<0.2%
Field of view	180°
Accuracy of bubble level	<0.1 °
Power consumption (at 12VDC)	55mW
Software, Windows™	Software for configuration, test and data logging
Supply voltage	5 to 30VDC
Operating temperature range	-40°C to +80°C
Storage temperature range	-40°C to +80°C
Humidity range	0 to 100%
Ingress Protection (IP) rating	IP67

b) Pyrgeometer (Long Wave Radiation)

Parameters	Specification
Detector type	Thermopile
Analogue output	0 to 1V
Analog Output Range	0 to 1000W/m²
Serial output	RS-485 Modbus®
Serial output range	0 to 1000W/m²
Response time (63%)	< 6s
Response time (95%)	< 18s
Spectral range (50% points)	4500 to 42000nm
Zero offsets (unventilated) (b) temperature change (5 K/h)	< 2W/m²
Non-stability (change/year)	< 1%
Non-linearity (-250 to 250 W/m²)	< 1%
Window heating offset (with 1000 W/m² direct solar radiation)	<4W/m²
Temperature response	< 1% (-20°C to +50°C) < 1% (-40°C to +70°C)
Spectral selectivity (8 to 14µm)	< 5%
Tilt response (0° to 90° at ±250W/m²)	<1%
Field of view	180°
Accuracy of bubble level	< 0.1 °
Power consumption (at 12VDC)	55mW
Software, Windows™	Software for configuration, test and data logging
Supply voltage	5 to 30VDC
Operating temperature range	-40°C to +80°C
Storage temperature range	-40°C to +80°C
Humidity range	0 to 100%
Ingress Protection (IP) rating	IP67

7. **Anemometer (Ultrasonic type) :**

Parameters	Specification
Measuring range : Direction	0-360°
Measuring range : Speed	0-60 m/s or better
Accuracy : Direction	± 5° or better
Accuracy : Speed	± 5 % or better
Resolution : Direction	1° or better
Resolution : Speed	0.01 m/s or better
Output rate	1 Hz (1/s)
Output Communication Mode	RS232
Supply Voltage	10 to 15 V DC
Additional Parameters	GPS and Compass, both integrated with the Anemometer.
Accessories	Mating connector with 3-meter cable.
Housing for sensor	Should be Seawater resistant.
Protection Class	IP68
Operational Temperature Rate	0°C to +60°C
Weight	< 0.6 kg

8. Air Temperature & Relative Humidity

Parameters	Specification
Main Input Voltage	12VDC
Max current	50mA @12VDC
Operating Range: Humidity	0-100% RH
Accuracy: Humidity	±1% or better
Long term stability for Humidity	Better than ±1%RH per year
Output Signals: Humidity	0 to 1 VDC = 0 to 100 %RH
Operating Range: Temperature	0°C to 60 °C
Accuracy: Temperature	±0.2 °C or better
Output Signals: Temperature	0 to 0.6 VDC = 0 to 60°C
IP Protection Rating	IP65
Dimension (Max)	L210 x Ø 25 mm
Weight	Less than 150g
Connector	7 pin Tuchel connector (Male) directly on the probe
Sensor Protection	Teflon Filter
Protective Shield	A suitable protective shield should be provided to protect the sensor from harsh marine weather and radiation.
Maximum dimension of Protective Shield	L210 x Ø150 mm

9. Digital Barometer

Parameters	Specification
Pressure Measurement	300 to 1200 hPa (millibars) absolute pressure.
Accuracy	±0.10 to ±0.30 hPa
Linearity	Typically <0.02 hPa
Pressure Resolution	0.001–0.02 hPa
Operating Temperature Range	−10°C to +55°C
Output Interface / Communication	I²C, SPI, UART/RS-232, USB.
Input Voltage	Typical MEMS sensors: 1.8–3.6 V
IP ratings	IP60 – IP65
Analog output	0-5 V or 4-20 mA.