

M/s. BEML LIMITED,**BEML SOUDHA,****SAMPANGIRAMNAGAR,****BENGALURU - 560002**

Invitation for Expression of Interest (EOI) for **supply of AI based Oil Condition Monitoring system on Heavy Earth Moving Machinery (HEMM)**

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Eoi Reference	Ref. No. Q/AI/2022-23/R&D dt 15.11.2022
Eoi closing date	Closing date: 25th November 2022, Time: 17:00 Hrs
Eoi response mail Id	bemleoi@beml.co.in
Contact for technical clarifications	Name: Mr. Naveen – DGM(R&D) email: gep@beml.co.in Contact No.: 9448430606
PLEASE MENTION Eoi Reference in e mail subject	

Eol-Ref.: Q/AI/2022-23/R&D

Date: 15-11-2022

Expression of Interest (Eoi) for supply of AI based Oil Condition Monitoring system on Heavy Earth Moving Machinery (HEMM)

1.0 Back ground:

BEML Limited is a leading multi-technology and multi-location Mini-Ratna category-I company under the Ministry of Defence. BEML is operating its business in three verticals viz., Defence & Aerospace, Mining & Construction and Rail & Metro. It offers high-quality products for diverse sectors of economy, such as coal, mining, steel, limestone, power, irrigation, construction, road building, aviation, defence, metro and railways. It has emerged as the forerunner of heavy engineering industry with a track record of growth and revenues for over five decades.

The company has state-of-the-art manufacturing facilities at Kolar Gold Fields, Mysuru, Bengaluru and Palakkad, all possessing ISO 9001-2015 and ISO 14001 (HSC) certifications. BEML has its own world-class composite R&D establishment for Design & Development of products.

The Company has a nationwide Marketing Network and an International Business Division for Exports activity.

Details of BEML Ltd are available at www.bemlindia.in

2.0 Overview of BEML Capabilities:

BEML Limited, a Central Public Sector Enterprise under the Ministry of Defence was incorporated in 1964. Subsequently it became a listed company and is engaged in the design, development and manufacturing in the areas of Mining & Construction, Defence & Aerospace and Rail & Metro equipment.

2.1 Mining & Construction:

BEML Ltd is engaged in the business of Hydraulic Excavators, Bulldozers, Wheel Loaders, Wheel Dozers, Dump Trucks, Motor Graders, Pipe Layers, Tyre Handlers, Water Sprinklers and Backhoe Loaders to customers in the Mining and Construction segments.

BEML has also developed Mining Dump trucks of 150 Ton and 205 Ton class and Excavators of both Hydraulic and Electrical of 180 Ton capacity.

2.2 Defence & Aerospace:

BEML Ltd is engaged in the business of High Mobility vehicle for all terrain operations, Heavy Recovery Vehicle, Pontoon Mainstream Bridge Systems, Crash Fire Tenders, Mobile Mast Vehicle, Engineering Mine Ploughs, Tank Transportation Trailers, Weapon Loading equipment, Armoured Recovery Vehicle, Milrail Coaches and Wagons, ground support vehicles and other products to the Indian and other Armed Forces.

2.3 Rail & Metro:

BEML Ltd is engaged in the business of Integral Rail Coaches, Overhead Inspection Cars, AC/DC Electrical Multiple Units, Stainless steel EMUs, Utility vehicles, Track Laying Equipment, Broad-gauge Rail bus, Treasury Vans, Spoil disposal Units to the Indian and other Railways.

BEML Ltd has also successfully diversified into manufacturing state-of-the-art technology stainless steel Metro Cars for various urban Metro Corporations and enjoys a dominant market share in this segment

3.0 Research & Development:

BEML Ltd has R&D establishment for Design & Development of high tech engineering products for its three verticals. It employs over 300 professionals with high experience and skills spanning a wide range of technology areas.

The R&D establishment has CAD Centre, Fluid-power, Powerline, Structural Engineering & Material Science laboratories and is continuously engaged in New Product Development and upgradation of existing products to meet customer requirements. More than 68% of Company's Sales Turnover is through in-house developed R&D products. The R&D expenditure is around 2 ~ 3% of its turnover.

4.0 International Business Division:

BEML has a sizeable market share in export markets with exports to 68 countries across the globe. Over the years this division has exported over 1200 machines covering all the three verticals.

5.0 Objectives of the EoI:

To identify potential partners with whom collaboration can be established for development of AI based Oil Condition Monitoring system on HEMM.

6.0 Scope of the collaboration



DUMPER



EXCAVATOR

- a) BEML scope of Supply: BEML shall provide the equipment for installation & testing.
- b) Collaborator's scope of supply software development along with necessary Hardware, engineering on the equipment and proving of system.

BEML makes heavy equipment for mines, defence and construction industry. Such equipment is prone to operate in rough and dusty environments.

Problem Statement

Accurate, high quality oil condition analysis provides a deep insight into the health and status of equipment and provides an early indication of potential breakdowns in gear boxes, transmissions and engine aggregates etc.

The proposed AI based Oil Condition Monitoring (OCM) is a crucial element of any predictive maintenance schedule. The system shall include measuring, monitoring and AI based data analytics for various parameters which are required to assess the oil health condition such as contamination, oxidation, water content, viscosity, temperature, wear debris, soot, Acid number, Base numbers etc., thereby tracking degradation in oil quality from new to end-of-life.

The AI based oil condition monitoring system shall be so designed to provide diagnostics & prognostics solutions to:

- (i) To the operator about the health of the oil.
- (ii) Trend data and predict events.
- (iii) Monitor degradations; predict remaining useful life (RUL) of oil.

The above system shall also have the provision to be accessed through the web portal supported by real-time Data visualization, Analytics and Reporting tools.

Current Status

Presently, no mechanisms are available in the equipment to detect condition of oil. Based on the preventive maintenance schedule / service schedule, oil on equipment is changed after predefined hours of equipment operation.

Alternately oil sample are tested in lab for carrying out analysis at particular intervals and results will be based on limited resources datas which are not yielding accurate results to evaluate the condition of oil Issues in Current Solution. If any sudden contamination or coolant or water leakage takes place between two intervals then it makes major damage to the system.

7.0 Technical Requirements

- The system is to be cost-effective, easy to install on mobile mining equipment and shall be modular.
- The proposed system has to work on 24VDC.
- The proposed system shall be reliable and rugged which is suitable for various severe mining environmental conditions such as temperature, dust, vibrations, rain, fog etc..
- The AI based Oil Condition Monitoring system should have real time Oil Health monitoring and On board data storing device.
- The system should be able to transmit the data to cloud or remote server.
- The system should have robust and reliable Machine learning model develop and should be able to predict the remaining useful life of the oil based on the parameters data collected from the different sensors.
- The system should be able to detect any sudden contaminations as fast as possible and give warning to the operator.
- The supplier should provide web portal supported by real-time Data visualization, Analytics and Reporting tools.
- Modular design with various sensors interfacing on a CAN bus & shall interface with other CAN protocols e.g. CANOpen.
- The system shall have the provision for connecting multiple sensors.
- Operator inputs to be given preference
- Both the operator and the sensor data shall be recorded at regular intervals to train the AI model
- Voltage rating: 12-32V DC

8.0 Eligibility Criteria:

The following are the mandatory conditions to be fulfilled by the firm for responding to the EoI.

- a. Should be a recognized MSME or Startup by Department for Promotion of Industry and Internal Trade (DPIIT) under the Ministry of Commerce and Industry.

- b. Should have a Registered office in India.
- c. Should have demonstrable experience of developing/customizing AI based system on MHE/ HEMM.
- d. The firm shall be an OEM or a IT company having track record in Artificial Intelligence based products/Technology. Only the OEM needs to respond to this EOI. Dealers/distributors/agents/representatives need not respond.
- e. The firm shall be willing to modify the equipment to the customer's need and coproduce the equipment in BEML's plant in India.
- f. The firm shall transfer the technology to BEML to locally produce the parts/assemblies as per '*Buy & Make (Indian)*' category.
- g. BEML will have the sole right to market the product in India for customers in India.
- h. The firm shall accept co-branding of the product.

9.0 Presentations on proposed Solution/ Methodology

The firms shortlisted based on the eligibility criteria may be invited to make a presentation at a date, time and location notified by BEML. The purpose of the presentation would be to allow the participants to present their solution/ methodology, experience, capabilities, infrastructure, and other key points, if any.

10.0 Benefits of partnering with BEML

BEML Ltd has an extensive Marketing network and service centres. BEML has a strong R&D in all business verticals which have developed high end Mining and Construction equipment such as 150 and 200 Ton Dumpers and 180 Ton Excavators etc. BEML have delivered more than 1600 Metro Cars and have a dominant market share in the Indian Market. BEML Limited keeps the Indian Army and other defence forces abreast with state-of-the-art military equipment. The company manufactures variants for all terrain operations including Bridge Layer, Field Artillery Tractor, Medium & Heavy Recovery Vehicle, Pontoon Mainstream Bridge Systems, Crash Fire Tenders, Mobile Mast Vehicle, etc. BEML also supplies Engineering Mine Ploughs, Tank Transportation Trailers and Weapon Loading equipment, Armoured Recovery Vehicle, Mil-rail

Coaches and Wagons. BEML plays a stellar role in the country's Integrated Guided Missile Development Project by supplying ground support vehicles. With extensive manufacturing facilities spread across India, a highly skilled and experienced manpower, presence and reach through its wide network of offices and divisions in India and a successful model of collaborating with other reputed OEMs, BEML is ideally placed to be the partner of choice in India for cooperation.

11.0 Submission of the EOI

In this context, EOI, Providing all details, documents and certificates shall be submitted by interested reputed firms to e mail bemleoi@beml.co.in , mentioning in subject ***“Eoi’ for supply of AI based Oil Condition Monitoring system on HEMM***

” on or before **17:00 hours of 25.11.2022.**

EOI in soft copies to be sent to e-mail id: bemleoi@beml.co.in

Contact for technical clarifications

Name: Mr. Naveen – DGM (R&D)

email: gep@beml.co.in

Contact No.: 9448430606

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| Annexure-1                                         |                                                                                                                                                                                                                             |            |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Compliance to point no. 8 (Qualification criteria) |                                                                                                                                                                                                                             |            |
| Sl No                                              | Parameter                                                                                                                                                                                                                   | Compliance |
| 1                                                  | Should be a recognized MSME / Startup by Department for Promotion of Industry and Internal Trade (DPIIT) under the Ministry of Commerce and Industry.                                                                       |            |
| 2                                                  | Should have a Registered office in India.                                                                                                                                                                                   |            |
| 3                                                  | Should have demonstrable experience of developing/customizing AI based systems on MHE/HEMM.                                                                                                                                 |            |
| 4                                                  | The firm shall be an OEM or a IT company having track record in Artificial Intelligence based products/Technology. Only the OEM needs to respond to this EOI. Dealers/distributors/agents/representatives need not respond. |            |
| 5                                                  | The firm shall be willing to modify the equipment to the customer's need and coproduce the equipment in BEML's plant in India.                                                                                              |            |
| 6                                                  | The firm shall transfer the technology to BEML to locally produce the parts/assemblies as per ' <i>Buy &amp; Make (Indian)</i> ' category.                                                                                  |            |
| 7                                                  | BEML will have the sole right to market the product in India for customers in India.                                                                                                                                        |            |
| 8                                                  | The firm shall accept co-branding of the product.                                                                                                                                                                           |            |



|                                                  |                                                                                                                                                                                                                 | Annexure-2 |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Compliance to point no. 7 (Technical Parameters) |                                                                                                                                                                                                                 |            |
| SI No                                            | Parameter                                                                                                                                                                                                       | Compliance |
| 1                                                | The system is to be cost-effective, easy to install on mobile mining equipment and shall be modular.                                                                                                            |            |
| 2                                                | The proposed system has to work on 24VDC battery.                                                                                                                                                               |            |
| 3                                                | The proposed system shall be reliable and rugged which is suitable for various severe mining environmental conditions such as temperature, dust, vibrations, rain, fog etc..                                    |            |
| 4                                                | The AI based Oil Condition Monitoring system should have real time Oil Health monitoring and On board data storing devise.                                                                                      |            |
| 5                                                | The system should be able to transmit the data to cloud or remote server.                                                                                                                                       |            |
| 6                                                | The system should have robust and reliable Machine learning model develop and should be able to predict the remaining useful life of the oil based on the parameters data collected from the different sensors. |            |
| 7                                                | The system should be able to detect any sudden contaminations as fast as possible and give warning to the operator.                                                                                             |            |
| 8                                                | The supplier should provide web portal supported by real-time Data visualization, Analytics and Reporting tools.                                                                                                |            |
| 9                                                | Using cameras to detect environmental conditions                                                                                                                                                                |            |
| 10                                               | Modular design with various sensors interfacing on a CAN bus & shall interface with other CAN protocols e.g. CANopen.                                                                                           |            |
| 11                                               | System shall have the provision for connecting multiple sensors.                                                                                                                                                |            |
| 12                                               | Operator inputs to be given preference                                                                                                                                                                          |            |
| 13                                               | Both the operator and the sensor data shall be recorded at regular intervals to train the AI model                                                                                                              |            |
| 14                                               | Voltage rating: 12-32V DC                                                                                                                                                                                       |            |