



Neptunus Condition Monitoring System for engines and rotating machines

The System, Brief Description:

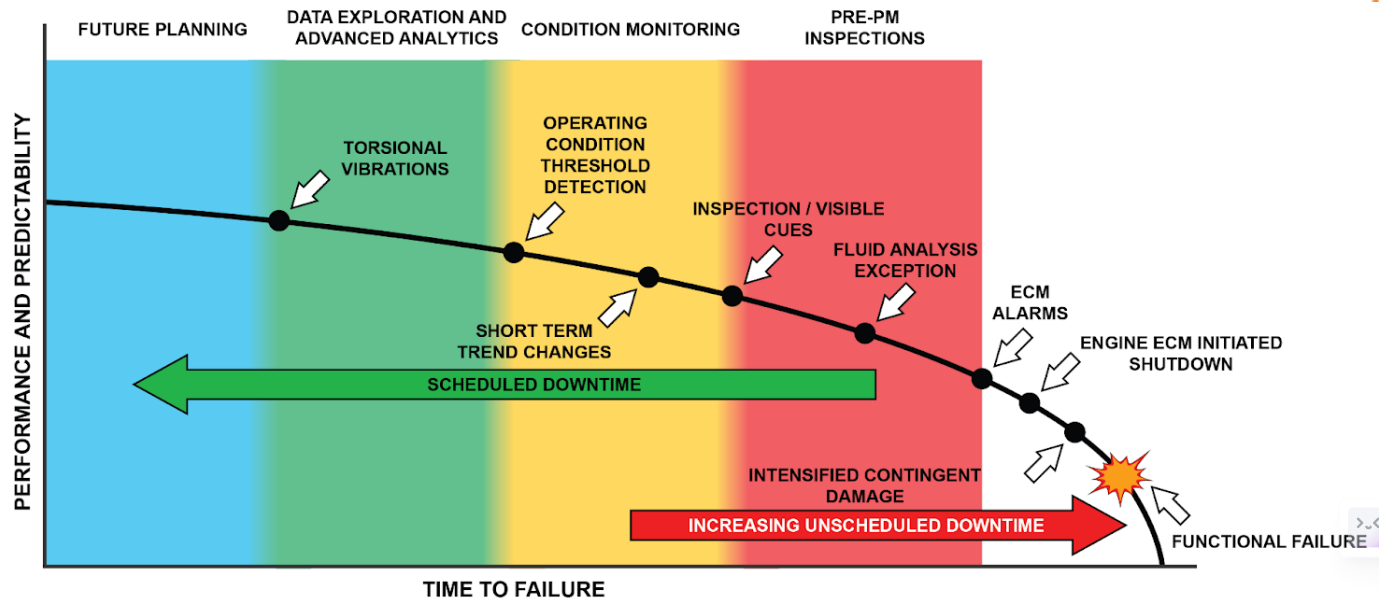
The system is an AI-based, data-driven learned model designed for condition monitoring of engines, with a specific focus on analyzing torsional vibrations. It combines statistical data analysis and physics principles to establish a robust foundation for predictive accuracy. As the system continuously accumulates data, it autonomously refines its understanding into a learning model and enhances its ability to assess engine health effectively.

Measurement of speed and derivation of Instantaneous Angular speed (IAS) is one of a few non-intrusive condition monitoring techniques to predict engine health and defects much earlier than all other systems. This method needs only a non-intrusive speed sensor (Magnetic induction based MPU sensor) signal to assess in detail the mechanical behavior of an engine and operating condition by diagnosing injection, compression, or valve state defaults, and bearings/moving parts damages. This method points out the exact defective cylinder using an additional MPU sensor on the Camshaft or any other location for the identification of TDC position of Cylinder-1. Hardware life, Sensitivity, longevity, accuracy of results are high using this technique as compared to other vibration and acoustic emissions. Instantaneous angular speed analysis based on Hilbert transform associated with order analysis and statistical moments is used to give detailed and robust diagnosis. This system is tested on 2 stroke and 4 stroke engines in many applications like tugboats, cargo vessels, gas carriers, warships, submarines, army tanks, air force engines.

Defects of an engine generate non-uniformity in rotation (torsional vibration) of the crankshaft which can be measured on the flywheel by the installation of a speed sensor. Another RPM sensor on the Camshaft for the identification of Top Dead Centre of Cylinder-1 will help pinpoint the cylinder level defects.



Main advantages of the System

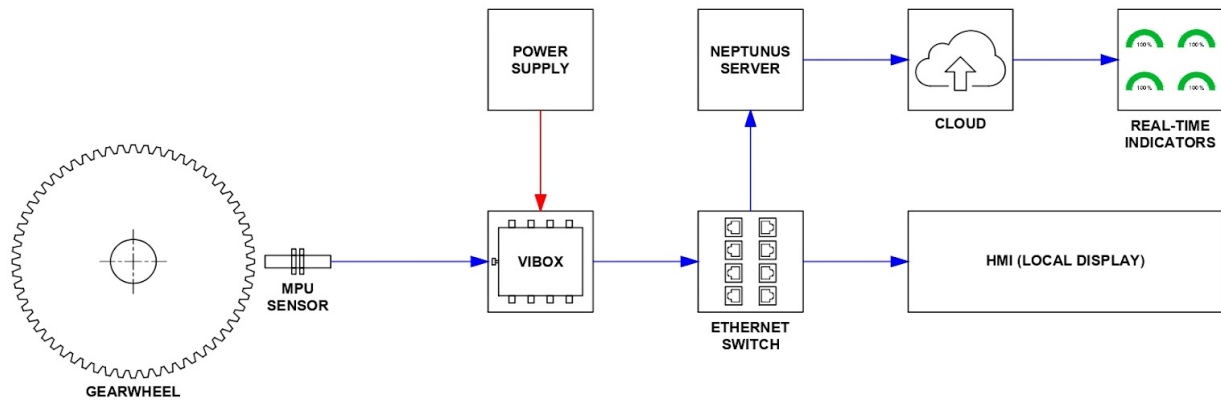


While the installation of engine-mounted sensors serves as a crucial safeguard, it alerts operators only once significant damage has already occurred and protects machinery from catastrophic failure.

Employing a torsional vibration-based system enables early detection of emerging defects, ensuring timely maintenance actions to mitigate potential risks. This proactive approach not only prevents costly damages but also results in significant operational cost savings. As repair costs tend to rise exponentially with time, the system's early prediction capability enables machines to operate at peak efficiency, making prompt corrections to restore them to optimal working conditions. By employing this method, businesses can enhance equipment longevity, minimize downtime, and maximize overall operational efficiency.



Basic Installation:



Data that is displayed in real time, online:

Sr	Indicator	Description
1	Fuel Loss	Increase in Fuel Consumption due to increased friction and losses in the engine
2	Mechanical Health	Overall indication of engine health. Takes into account all other indicators
3	Combustion Health	Overall indicator of Combustion health, takes in account injection and compression indicators
4	Crankshaft Stresses	Unbalanced stresses on the crank either due to external drive or due to combustion conditions
5	Damper	Malfunctioning of damper
6	Foundation	Loose foundation bolts, Defects in Mounting pads, poor condition of Foundation
7	Crankshaft Drive	Defects in gear train and in regulation of engine by governor
8	Compression	Identifies Compression issues in individual cylinders



9	Injection	Identifies injection issues in individual cylinders
10	Bearings	Identifies bearing issues in individual cylinders
11	Friction in moving parts	Identifies increased wear and tear in piston and liner
12	Misfiring	In case of gas engines, identifies misfiring in any cylinder.

The Vibox Intelligent Controller

The Controller is a custom built device that processes the analog signal, converts it to a digital signal then processes the signal and displays data on an easy to read custom built web server. The web server, embedded in the Vibox, displays all parameters as trends and has sufficient storage capacity for approximately 90 days of operation. Long term trends can be stored on a storage device.

Approvals:

The system has been tested on several Marine installations. It has been approved by Indian Register of Shipping as a Condition Monitoring system for vessels and is under approval from ABS for a SmartShip notation.