Center for Predictive Maintenance

College of Engineering and Computing University of South Carolina

Highlights:

- Unique large scale aviation Test Stands

- Provide training and certifications in predictive maintenance

- Help in identifying critical components in industrial systems

- Millions of dollars in cost savings annually for the U.S. Army

- Time between overhauls extended for components

- Highest return on investment for any Army funded project at 20.2:1

- Number of gearbox replacements reduced by 34.5%

Learn more

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UNIVERSITY OF
SOUTH CAROLINA
College of Engineering
and Computing

Smart Maintenance or commonly known as **Predictive Maintenance (PM)** is a goal-driven process that offers the highest attainable level of asset proficiency . A true world-class maintenance system should be defined by three fundamental pillars; **Smart Maintenance & Reliability Organization, Comprehensive Performance Tracking (Monitoring) System and A Well Designed and Implemented Maintenance Work System.**

The widely known adage, "You can't manage what you can't measure," is very true for asset management. Moving forward in the maintenance excellence path requires having the appropriate dashboard with gauges showing the correct measures and predictions. The PM program at the University of South Carolina (USC) combines comprehensive engineering fundamentals and research with a multi-faceted process to support the continued success of various work systems. Three primary data types or meausrements (historical operational and logistical sytem's data, usage/health monitoring system's data and controlled testing data) are the main igredients for a good tracking system.
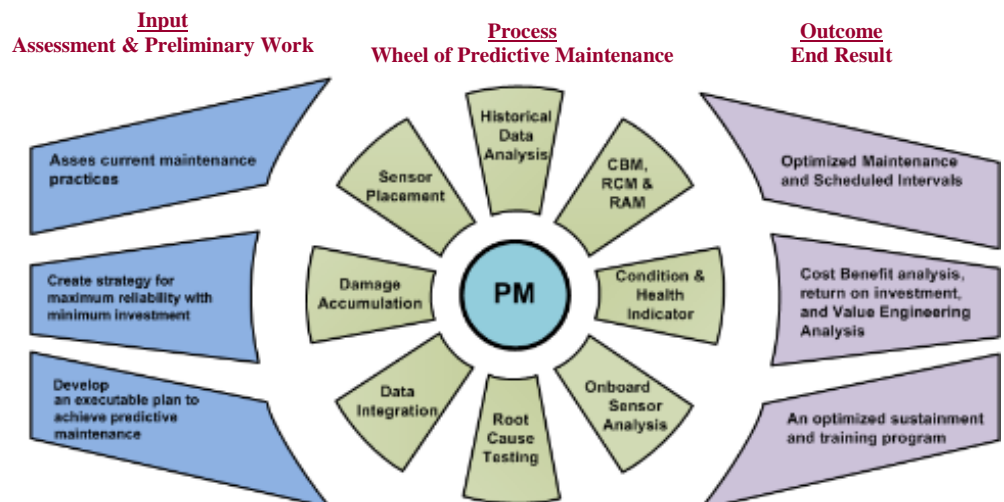
Maintenance research activities began at USC in 1998. Since its inception, the center has strived to undertake new tasks and responsibilities to satisfy the needs of defense aviation. This interdisciplinary program encapsulates the best practices of basic engineering and computer science fundamentals, design, manufacturing, control, sensing, data acquisition, data collection, data/signal analysis/processing, economics, cost benefits anlysis, value engineering analysis, and statistics.

Activities at the center also include validation and reliability methods such as testing of major components and systems such as full scale drive trains, transmissions of aircraft. The testing is also utilized in studies of time between maintenance actions, systems availability and readiness, diagnosis and prognosis algorithms, machine learning and sensor development.

The CPM at USC interdisciplinary team consists of engineering staff, retired military staff, students, and faculty from engineering, business and public health colleges with more than $25M of external funding over the past 10 years. Additionally, CPM at USC activities have received national and international recognition due to its focus, uniqueness, and value-added to the general areas of machinery (aviation, aerospace, automative). Activites have extended to petroleum and petro-chamicals industries (energy, gas, nuclear), and water resources (water purification, and water desalination).

The CPM also collaborates internationally in Europe, the Middle East and South America.

Input
Assessment & Preliminary Work

Process
Wheel of Predictive Maintenance

Outcome
End Result

Three steps are used to create an effective predictive maintenance program for any industry looking to better their current maintenance routine.

Training and Educational Offerings by CPM@USC for Industry

General Machinery

This area addresses maintenance issues related to general machinery components and systems. These components have existed in a multitude of industries for years and have been repaired on a time-based schedule. Due to this, maintenance is one of the largest cost drivers in this industry today. Implementing predictive maintenance can help reduce the amount of unnecessary repairs.

Higher Education Offering

The College offers degree programs for those who want more in-depth knowledge about PM on General Machinery. Degree programs are established on four core classes and two electives of the student's choosing.

Training and Cert. Courses

The center will offer short courses and workshops to industry members. These sessions will last approximately five days and include an introduction PM concepts, signal processing, and value engineering analysis. The student will put their new knowledge to use by implementing the process in a real-world application using general demo kits.

Demonstration Capabilities

CPM@USC has created a demonstration has created a demonstration founded on the basics of general machinery, rotating components, consisting of a gearbox that will help educate the industry's personnel on the importance of PM and how it can be advanced within a company. The demo uses of sensors and monitoring software that show how a component fault can be transformed into a maintenance action without user input.

Petro Chemical

The products of this industry provide many of the needed materials for our daily lives from fabric for shirts to propane for grills and nuclear energy. This area is experiencing large growth and with it the need for maintenance constantly increases. CPM@USC has the resources to help address any needs in predictive monitoring for this application.

Higher Education Offering

These degree programs expanded further on what is introduced in the training courses and allow the student to become an expert on PM in the petrochemical industry. There are M.S. and M.Eng. degrees to fit all needs.

Training and Cert. Courses

The courses are conducted over a business week and can vary in complexity from an introduction of PM to optimal sensor placement and data collection frequency. It also introduces vibration, thermal, oil, and ultrasonic sensors and how to analyze the data coming from them when mounted on an industry standard system. The course will also contain hands-on learning on an industry standard component and use the PM process to better a machine in industry.

Demonstration Capabilities

A demonstration is currently being created by CPM for an open system containing problematic components (control valves and process automation) to educate users on the importance of a PM program. It will also introduce new monitoring techniques and how it could benefit their company.

Water Resources

The desalinization of water is becoming a more pressing issue as the human population increases. This process is mostly conducted through reverse osmosis and incurs many costs. Establishing a predictive monitoring program can reduce downtime, thus dramatically decreasing the price of operation.

Higher Education Offering

Higher education options allow individuals the opportunity to learn more about PM in the water resources industry and how they could further advance the current work being done.

Training and Cert. Courses

Training conducted would involve educating users on the basics of PM and how to use sensors that are critical to their industry over a five day period. This process would include temperature, motor power, and pressure measurements to determine the overall health of the system. Proper logging and notifying other users of potential failure is also crucial for a PM plan. Students will be able to further their knowledge by implementing PM on a desalinization system.

Demonstration Capabilities

A pressurized reverse osmosis system will be used in this demonstration to help develop PM in this industry. The demonstration will contain common sensors to the industry including: pressure, temperature, and motor amperage. This ensures that unscheduled maintenance is not the cause of the high cost of desalination.

INDUSTRIES

TRAINING, CERTIFICATIONS & SHORT COURSES DEMOS

TRAINING, CERTIFICATIONS & SHORT COURSES

DEGREES

General Machinery
- Gears
- Bearings
- Shafts
- Structure

- Aviation
- Aerospace
- Heavy Industries

M.S.
M.E.

Petroleum & Petro Chemicals
- Control Valves
- Process Auto.

- Energy
- Gas
- Oil
- Nuclear

M.S.
M.E.

Water Resources
- Pumps
- Valves

- Water Purification
- Water Desalination

M.S.
M.E.