MEAN TIME BETWEEN FAILURE (MTBF) & MEAN TIME TO REPAIR (MTTR)

Simplifying the approach to two key metrics in maintenance

AQUITAS SOLUTIONS

EXECUTIVE SUMMARY:

Mean Time Between Failure (MTBF) and Mean Time to Repair (MTTR) – these metrics are frequently talked about in maintenance, but surprisingly few organizations are actually tracking them. MTBF and MTTR help us understand the frequency of failures for a given system or piece of equipment and the amount of time it takes to bring the equipment back on-line. Both are inherently important because every failure costs money. The longer it takes to get an asset back up and running, the more money an organization loses.

For large industries with significant and complex resources, tracking this information can be done but it takes effort to do so in a detailed manner. Specific downtime data for every part of a system can be challenging to compile.

If you are lucky enough to put together a new line with modern equipment, the tracking of this information becomes much easier. In fact, with IoT technologies in place, the machines can provide this information directly – but there are also other ways to calculate these measurements if you aren't there yet.

Mean Time Between Failure

MTBF relates the average time elapsed between an asset failure and the next time it occurs. Simplifying all the information you can collect on MTBF will tell you which assets and equipment cause the most downtime. This is the equipment you should focus on, *if you have limited resources!*

Mean Time Between Failure (MTBF) is a measure of total uptime of the system (or assets) divided by the total number of failures:

$$MTBF = \frac{Total\ Uptime}{Number\ of\ Failures}$$

Total Uptime is a measure of the total time a system or component is working. This metric is measured by taking the total time the machine (or asset) should be operational minus the

amount of time taken to repair. Number of failures refers to the number of failures within the total uptime.

Failure Rate (λ) is the inverse of MTBF or how often something fails per hour:

$$\lambda = \frac{1}{MTBF}$$

Which Computerized Maintenance Management System (CMMS) data can be leveraged to help understand MTBF? Two options can get you *really close:*
1. Inventory (Parts) Data
2. Work Order Labor Data

Mean Time Between Failure (MTBF) will tell you which assets and equipment cause the most downtime.

Inventory (Parts) Data – If you are issuing parts to emergency work activities, you have the dates that these parts were used. You can download the Parts, Costs, Dates Issued and Issued To Location into a spreadsheet and create a pivot table or pareto chart showing the MTB(PI) – Mean Time Between Parts Issued. Since most repairs require parts, this will give you a good indication of which systems/equipment are requiring the most emergency response with parts.

Work Order Labor Data – Using the same concept as Inventory, we have the dates and labor times for our Emergency Work Activities. You can download the Labor Hours, Costs, Date of work and Work Location into a spreadsheet and create a pivot table or pareto chart showing MTB(EW) – Mean Time Between Emergency Work.

While neither of these methods can provide pin-point details or the exact MTBF to the minute or second, they can provide indicators of which system or equipment is best suited to investing in an Internet of Things (IoT) solution that will provide a solid return on investment. The use of simple IoT technology can change the game in calculating that hard-to-find MTBF data.

IoT technology does not have to be a massive intrusion into your factory, systems or life! IoT can be as simple as installing sensors and a data collection system. Yes, a PLC output, or a sensor that tells you whether the machine is running or not is the start of IoT! While there are plenty of nano

"For us, simplicity has come to mean **a single managed source** for all our monitored IoT Reliability activities. This also enables a simple, accurate report of Key Performance Indicators like MTBF & MTTR."

-Nikolaus Despain, Senior Director of Maintenance

one-off, stand-alone systems that can perform this task, we need to think of the future. If you think MTBF information can be beneficial, you probably also think Reliability Maintenance is what we should be working on instead of Reactive Maintenance. If that is true, you will want an IoT system that can be used as a building block for other information. After MTBF, you may want to start tracking Run-hours, then possibly electrical inputs and even vibration checks – the list can go on. The benefit of using IoT is enormous, but do so through building blocks instead of one-off, stand-alone systems. By doing so, you will find that you can build your Reliability program with IoT in a non-intrusive way.

Mean Time To Repair

Want to know the total time from when the failure occurred to when the asset is back up and running? This is MTTR – the time it takes to complete the repair after the incident of failure. Simplifying all the information you can collect on MTTR will tell you which of your equipment takes the longest to get back up and running.

Mean Time To Repair (MTTR) is a measure of the average downtime. MTTR takes the downtime of the system (or assets) and divides it by the number of failures:

$$MTTR = \frac{Total\ Downtime}{Number\ of\ Failures}$$

This calculation enables you to then ask two important questions:

1. Is it a training issue? Do I need to invest more time training my people to more efficiently repair equipment?
2. Is it an access issue? Was the system/equipment designed without consideration for repair access?

Mean Time To Repair (MTTR) will tell you which assets and equipment take the longest to get back up and running.

Depending on which answer resonates, you can determine *how to spend limited resources*. It may not be feasible to revamp your repair and maintenance training program, and you may have little control over how a piece of equipment was designed in terms of repair access; however, these MTTR indicators can be resolved through the power of IoT and "predictive" maintenance.

MTTR data is extremely helpful in determining the effectiveness of your mechanic skills and maintenance training programs. IoT data is beneficial in the long term, which means you need to be tracking the data for a while to get the benefit of MTTR analytics. A simple IoT sensor or PLC output with a data collection system will compile this data while you are busy doing your regular maintenance activities. Then when you are ready, you can use the data to adjust your programs and/or build a Reliability program by expanding your IoT solution.

Conclusion

Like many maintenance organizations, you may be limited in resources but aware of the criticality of improving your processes to better calculate, interpret, and leverage MTBF and MTTR data. This is where there is an overwhelming benefit of investing in an IoT solution - sensors on systems can automatically calculate these important metrics for you and feed the data directly into a report or dashboard. *Listening* to your machines through IoT ensures this data is as accurate and reliable as possible.

But what if you don't know where to start? Start small. Use the standard MTBF and MTTR calculations to select the 2 or 3 machines that require the most time and energy to maintain. Gather this critical data to improve how maintenance is planned and then consider investing in an IoT solution.

Think big, start small, act fast.

WANT TO LEARN MORE?
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ABOUT AQUITAS SOLUTIONS

Aquitas Solutions is a leading provider of EAM and IoT solutions that optimize asset intensive industries. The Company prides itself on working strategically and collaboratively with the top, globally recognized EAM and IoT platform solution providers to heighten business value and bring bottom-line benefits to their clients.

Based in Atlanta, GA, Aquitas' leadership team and management consultants have industry leading enterprise asset management experience and have been early adopters of IoT technology that helps clients leverage their EAM system to optimize performance and improve productivity and service levels across the entire spectrum of their organization.

The Company has a long history of delivering faster, smarter, and more agile solutions at a competitive rate helping customers streamline their internal processes and compete more efficiently in an increasingly synergetic world.

Aquitas Solutions is a registered Service Disabled Veteran Owned Small Business (SDVOSB), proud supporter of Women in Reliability Asset Management (WIRAM). The Company has received several awards since expanding into the IoT space including a 2018 CRN® Top IoT Innovators Award, 2019 Solution Award for Work Execution Management, and MaximoWorld Awards for Best IoT Implementation and Best Data Alignment to Business Processes.

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