VE3RUM
WORK VISUALLY

How to solve the biggest maintenance challenges in the energy and mining industries

TRANSFORMING ASSET MANAGEMENT WITH VISUAL INTELLIGENCE

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Operations, maintenance, and reliability is 'big busines

In March, the United Nations Conference on Trade and Development published the 2023 Technology and Innovation Report, which left one resounding message: the world must embrace the tech revolution or risk falling behind.

UNCTAD Secretary-General Rebeca Grynspan affirmed that "*this new wave of technological change will have a formidable impact on the global economy.*" The report established that missing this technological wave would have long-lasting negative implications. It is more critical than ever that the operations, maintenance, and reliability (OM&R) industry take urgent action to digitally transform in the face of the tech revolution.

This is no small feat. OM&R at capital-intensive facilities is big business. From producing constraint-free maintenance plans to anticipating and eliminating potential delays through meticulous planning, OM&R in heavy industry is under pressure to sustain production, while managing the headwinds of increasing OpEx and CapEx as facilities age, and has a significant impact on a company's ability to generate consistent quarterly profits.

When maintenance managers make poor decisions, the profitability of the entire field operation can be put in jeopardy. What happens when the business of maintenance is suboptimally managed? Let's consider a few examples:

1. **Lack of pre-emptive and emergency planning**

No one thinks a terrible event is going to happen to them - until it does. Fires, floods, attacks, storms, earthquakes, and other natural disasters can strike a business at any time. When maintenance is not prepared for emergencies, operations come to a grinding halt, causing downtime and significant revenue loss. Examples of poor management that can lead to emergencies include:

- Key assets and machinery not diligently monitored
- Lack of staff training on evacuation protocols and procedures
- Non-existent or incomplete business continuity plans
- Failures have not been preempted
- Asset warranties have not been enforced
- Documentation is siloed

When a crisis strikes in a suboptimally managed facility, the unfolding disaster is clear to imagine.

2. Underestimating the importance of contractor management

Operations, maintenance and reliability is not just big business, it's a high priority business, and in the mix of multiple competing high priority tasks, the development of efficient processes and procedures for managing contractors is frequently deprioritized. Outsourcing to contractors is common, 87% of facilities outsource at least a part of the maintenance operations due to lack of personnel or specialized skills*.

Lack of contractor management combined with siloed data is a recipe for disaster. Contractors cannot get the right information to complete contracts in a timely manner,, communication between contractors and the maintenance teams is stilted and incomplete, and legal documents including service-level agreements (SLAs) are poorly defined.The resultant overages, delays, and frequent change orders place a significant burden on the entire organization, and negatively impact profitability.

3. Continuing to adhere to ‘if-it-ain’t-broke-don’t fix-it’ when it comes to change

While there are many progressive, proactive people in the business of OM&R, the business remains slow to change. The challenge lies within the industry itself. There is a perception that the cost of change will be monumental due to the size of assets involved. Let’s consider this perception.

First, consider a few of the primary objectives of the maintenance business:

1. Maintaining the capability of the company's assets to perform their designed function, thereby maximizing the company's return on assets and increasing shareholder value
2. Maximizing production or operational throughput
3. Identifying and implementing cost reductions
4. Optimizing maintenance resources including labor, materials, contract

* https://limblecmms.com/blog/cmms-maintenance-statistics/

OM&R is ‘big business’

Now consider that in 2023, many OM&R personnel are **still attempting to capture and process data manually,** perpetuating the inefficiencies and mistakes of the past two and half centuries.

This could be due to lack of executive buy-in regarding new technology, lack of time, or lack of personnel to set up new systems. Despite a myriad of factors, there’s an underlying mindset of “we’ve done this for years and it works fine”.

Sure it works. ‘Fine’ is a stretch. But continuing to resist change is not going to help achieve any of the goals listed above. **Data will remain siloed. Human error due to the need to enter the same data multiple times into different systems will prevail. Finding data will continue to be a time-consuming challenge. Aggregating data will remain an impossible dream, and data visualization and contextualization will continue to live in the realm of tomorrow-land.**

OM&R is 'big business'

It's time for the business of OM&R to step into the future and embrace digital transformation. When done well, this can make the entire organization part of the solution by ensuring the right maintenance on the right assets at the right time.

These are the six key steps in creating an effective maintenance and reliability plan, and they look very much like any other critical management 101 plan:

1. **Create an outline of the organization** measuring performance against a set of best practices and permissible variances. This is the benchmark and should consider technology, expertise, management, work culture, and work processes.
2. **Establish goals, objectives, policies and procedures, including a plan for improvement,** to close the gaps identified in step one. This could include developing and optimizing processes, integrating new systems, or planning for training.This should be based on a ranking of the operation's assets based on their criticality to the business.
3. **Carry out the plan** based on the **unbiased prioritization of the assets**.
4. **Define the maintenance requirements** based on the maintenance strategy employed (preventive, reactive, predictive, reliability-centered, etc.)
5. **Determine the annual workload** to carry out the plan, then deploy tools and allocate resources.
6. **Continuously improve** to meet and beat measurable objectives.

At the end of the day, **disruption has become the new normal** for many industries. Those that are embracing change and using it to their advantage are much more likely to stay competitive.

Understanding how to navigate change, and better prepare for disruption is the key to maintaining the health and future of your organization. In fact, it is likely to be **far more costly in the long run to continue to resist digitalization** and change in favor of unrelentingly clinging to the old ways. For many, it's not technology that will replace you; people who use technology will.

Avoiding the three common pitfalls of suboptimal maintenance management

Maintenance planning is arguably one of the most important elements of running a productive and reliable facility. It's a continuous process that requires constant improvement and efficient management for success. We include simple steps that can be taken to improve your maintenance management, and enable teams to be more productive in a safer and more collaborative way. We'll look at how to **address the common pitfalls of suboptimal maintenance management**: lack of pre-emptive and emergency planning and training, mis-managing contractors, resisting change, and the lack of digital maturity in the workforce..

1. Pre-emptive and emergency planning and training

In order to prepare for emergency planning and training, aggregated, up-to-date and accurate information is essential for a complete understanding of an asset. The question is how?

One of the quickest and easiest solutions is to implement a digital twin. A digital twin is a virtual representation of a physical environment, model, process, asset, or service.

Digital twins ingest, aggregate, unify, and analyze all engineering, geospatial, planning, scheduling and operational data in a single web-based interface. The insights provided through this analysis include operating conditions, production rates, bottlenecks, malfunctions, structural integrity, potential failure modes and rates, and requirements for near term repairs and replacements. Insights can be used by teams to perform 'what-if-scenarios', and to optimize plans for intervention for repairs and replacements, and production.

01 LACK OF PRE-EMPTIVE AND EMERGENCY PLANNING AND TRAINING

02 CONTRACTOR MISMANAGEMENT

03 RESISTANCE TO CHANGE

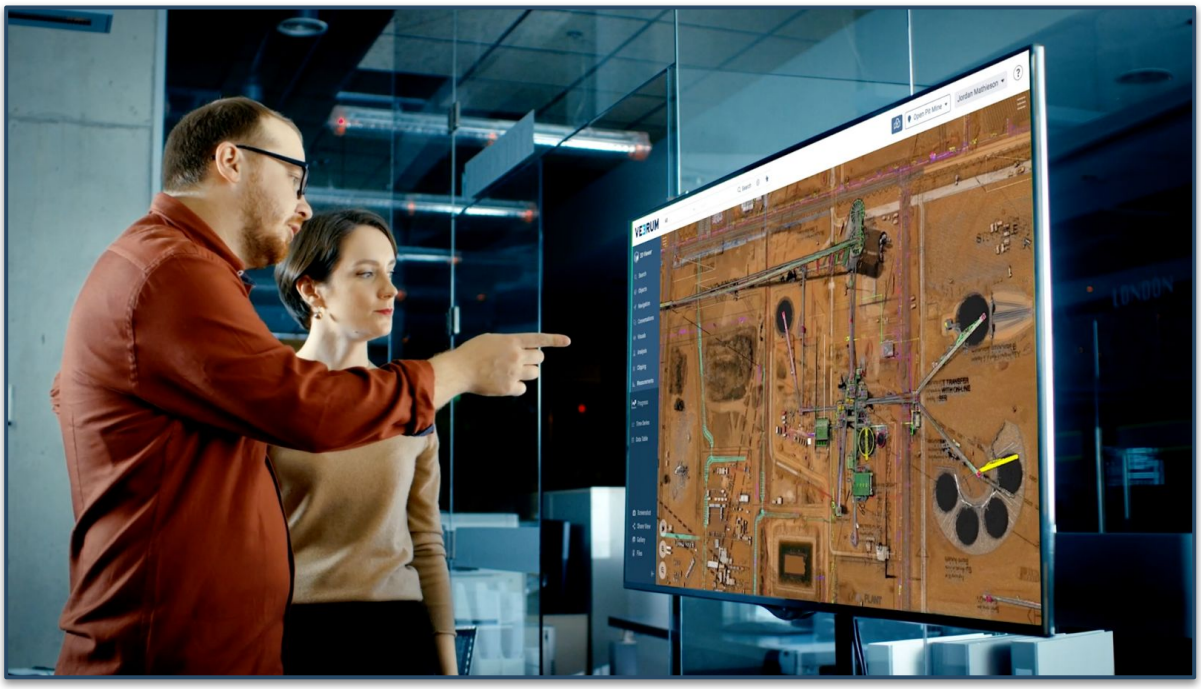
Avoiding the three common pitfalls of suboptimal maintenance management

Using a digital twin for operations, maintenance, and reliability, teams can conduct mandatory safety training virtually. For some facilities, this removes the need for real equipment shut down and suspension of operations, negating the resultant drop in productivity of the facility associated with shutdown, disconnect, reconnect and restart activities.

2. Staying in-step with contractors

A digital twin enables remote operations and maintenance. Planners, inspectors, engineers, and supply chain managers are no longer required to be physically present on site. Inspections, assessment of as-built information, unified data access, and collaboration with all stakeholders, including contractors and vendors, can be conducted remotely from the safety of the office or home.

Digital twins ingest and aggregate all data into a single pane of glass. Any verified user can easily access the asset in 3D anywhere in the world. All documentation associated with any work order is easy to find and contextualize within the interface. All communication and collaboration is enabled and accessible within the digital twin, ensuring everyone is up to date with the same data in real time.



Avoiding the three common pitfalls of suboptimal maintenance management

3. Easing resistance to change

Understanding what a digital twin is (and is not) capable of doing will help alleviate the fear of being usurped by the software.

Digital twins do employ machine learning, but are not intended to replace workers. VEERUM depends on humans for several reasons; to provide the data for it to ingest; to interpret the data it analyzes; to leverage the visual data it outputs, and to enable productivity improvements and cost reductions. Digital twins empower workers to be more productive, with less time wasted, in a safer and more collaborative way.

Implementing a digital twin application is a vital step in overcoming the common pitfalls of suboptimal maintenance management. No longer is a digital twin just a technology, it is a powerful catalyst for your maintenance team with an immediate impact on cost savings, efficiency, and schedule improvements. As organizations around the world are well on their journey to complete digital transformation, digital twins are a great place to get started in fostering an efficient and safer way of working.

> "We built our maintenance plan around reality. The built visualization is also used to provide training for the rest of the organization, so our ROI has already skyrocketed way beyond the maintenance space."
>
> Senior Business Analyst - Imperial Oil and VEERUM user

4. Workforce digital maturity

The majority of maintenance planners spend multiple years on site with hands-on-tools performing maintenance activities, and do not typically have a high degree of on-the-job digital literacy. Career progression requires the ability to conceptually consider the activities to be completed, and involves a significant amount of training on the access and utilization of data across an array of siloed software systems. Digital twins serve as an easy-to-use point of access to the contextualized data ingested from multiple software systems. The aggregated data, the facility, and the equipment are all visualized in a manner familiar to maintenance planners in the reality model. Digital twins seamlessly integrates into workflows, providing a vastly different experience to that of the common digital transformation approach that skews towards modifying human behaviour to adapt to machine-centric software systems.

Maintenance work order management

With a complete understanding of the importance of maintenance and reliability, let's dive into the work of maintenance and take a look at an overview of work management processes:

01 Work identification

Work identification comes from many sources has numerous triggers, and requires the creation of good work orders. We'll cover all of these elements of work identification, and how digital twins are changing the landscape.

02 Work planning

Maintenance planning is complicated, and under the status quo can be enormously time consuming, frustrating and unsafe. We'll dive into the current state and what the future holds.

03 Work scheduling

Maintenance scheduling in the current state has two major challenges; unplanned work and time estimations. We'll address both in the light of the impact of technology..

04 Work execution and close out

The execution and close out of maintenance tasks is like a well choreographed dance when proactively managed. We'll consider how technology is optimizing these processes

Maintenance work order management: Work identification

Work identification comes from many sources including operations, maintenance and new projects.

From a maintenance standpoint, there are a two main types of work orders:preventive (or scheduled) and corrective (or unscheduled).

1. Preventive or scheduled maintenance work orders

This refers to scheduled, routine maintenance (and inspection) activities to **prevent constantly unplanned downtime and equipment failure**. These work orders include resources requirements, checklists, instructions and notes. Predictive maintenance is a type of preventive maintenance as it is scheduled. It differs only in that preventive maintenance is scheduled regularly, whereas predictive maintenance is scheduled based on asset conditions.

Types of preventive maintenance work orders include:

i. **Time-based work orders**; these are created based on a scheduled, time-based maintenance plan.

ii. **Failure finding work orders**; these work orders are targeted at finding hidden failures in equipment like safety valves that are not required to function until or unless something else fails

iii. **Risk-based work orders**; these work orders are prioritized in order of the assets that carry the greatest risk (and consequences) in case of failure

iv. **Condition-based work orders**; these monitor the actual condition of the asset and are only carried out when there are signs of upcoming failure/performance

v. **Predictive work orders;** predictive maintenance requires condition monitoring and is carried out to actively reduce the likelihood of failure

Maintenance work order management: Work identification

2. Corrective or unscheduled, on-demand work orders

Corrective maintenance is also referred to as run-to-failure, reactive, or unscheduled. Unfortunately, these are t**he majority of maintenance work orders for most operators**.

Types of corrective maintenance work orders include:

i. **Emergency work orders**; when an unplanned asset breakdown occurs, these work orders track the reactive maintenance activities including what happened, what was done to correct it, and how to prevent it from recurring. Emergency maintenance is **three to five times as expensive as preventive maintenance**, typically leads to longer equipment outages and has more production impact.

ii. **Corrective or deferred work orders;** these are created when a maintenance technician discovers an issue while conducting other maintenance work order tasks. Unlike emergency work orders, these work orders are then prioritized, planned and scheduled because the issue was identified in time.

Four elements of a great work order

01 Complete information

Clarity on what maintenance technicians are being asked to do, including a completion date and clear instructions, helps reduce the risk of recurring problems through effective cause analysis and solution planning. Complete information requires a title and description of the task, the name of the requestor, the name of the assigned worker with contact information, and the necessary tools or support for completion.

02 Clear, timely communication

Timely communication of an issue, its severity, and expectations on time to resolution ensures everyone involved is on the same page. It makes the entire team aware of the same expectations, allowing for further conversations on amending expectations based on other priorities.

03 Effective job prioritization

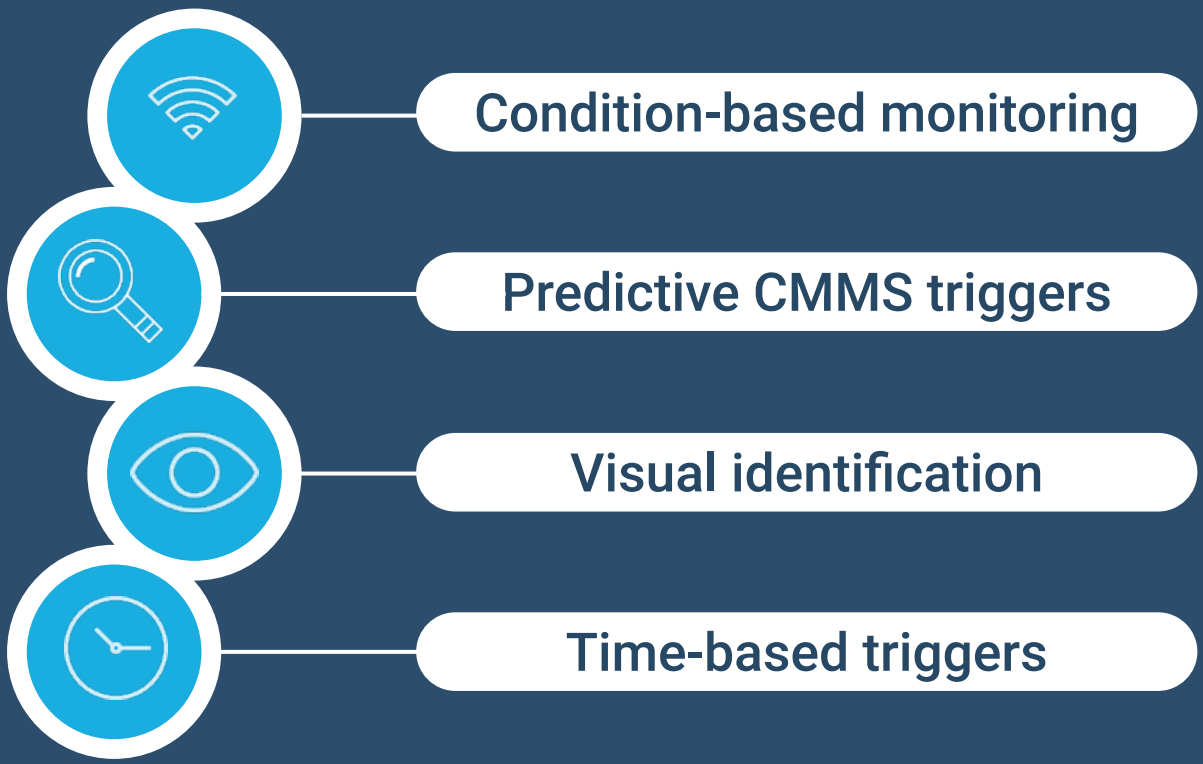
Creating, implementing, and consistently using a set of standardized prioritization rules with every work order gives maintenance teams a clear understanding of what jobs need to be done next.

04 Compliance data inclusion

It is imperative that compliance requirements are satisfied. Including this data with each work order is important. Data aggregation can help.

Work order triggers and the impact of technology

Whether a work order is preventive or corrective, it will be generated based on one of a few triggers or activities. We'll consider traditional management of work that is triggered via the following four maintenance tasks, and then take a look at **how technology is changing and impacting the status quo**.



Work order triggers

1. Condition-based monitoring (CBM) work order trigger

Condition-based monitoring is a predictive maintenance strategy. It utilizes sensor data from gauges and IoT, to vibration analysis and alarms indicating variable pressure, temperature, flow changes and other deltas to monitor the condition of assets in real-time. This data can help increase throughput and asset utilization by reducing unscheduled downtime and maintenance costs while driving productivity improvements and cost savings.

CBM: Current state and challenges

Sensor data is captured in disconnected systems, real time information is frequently only available in 2D, and alerts and alarms are on equipment or in control rooms.

Data is siloed, requiring significant time to locate, aggregate, analyze and share through yet further disconnected channels. 2D data (the standard systems of record within the company, extending into file and object storage and application and insights via warehousing and data lakes) is difficult to search and access. There is no way to compare assemblies, parts or objects at the 3D, geometric level, and frequently it requires a 3D view to determine if highly similar parts with different file extensions due to different CAD packages (for example) are in fact identical, or different. Alarms and alerts require on-site monitoring and checking in control rooms or equipment.

CBM: Optimizing the current state with technology

Digital twin technology is making significant inroads with regards to safety improvements, productivity improvements and cost savings. This technology ingests, aggregates, unifies, and analyzes all engineering, geospatial, planning, scheduling and operational data including sponsor data in near real time, in a single pane of glass.

Your entire team and third-party contractors are able to remotely access, collaborate on, and view the same asset data in the context of both 2D and 3D modeling. Subject matter experts can add further context to visual data sets to help decision makers make better informed decisions, and non-subject matter experts are able to analyze the latest data within the 3D viewer from anywhere in the world with an internet connection.

Alerts and alarms can push notifications on IT data.

2. Predictive computerized maintenance management system (CMMS) based work order trigger

Maintenance tasks that possess the following three attributes are considered predictive maintenance; (1) they are systematic, (2) they are performed routinely, and (3) they are aimed at minimizing or reducing failures.

Current state and challenges in predictive maintenance

Predictive maintenance is scheduled and is aimed at optimizing capital asset life. It includes repair, replacement, adjustments, lubrication and cleaning. Current workflows are disconnected and rely on textual information, making it difficult to understand exactly what is happening on site. As remote sites are difficult to travel to, maintenance teams need to rely on historical data, manufacturing specifications, on-site sensors, and weather patterns to predict when maintenance is required. Lots of assumptions are made in this workflow, resulting in inefficiencies and risks in the organization. Having a visual tool to confirm existing site conditions provides maintenance teams with additional context to predict and plan maintenance activities more effectively.

Optimizing predictive maintenance workflows with technology

With reduced barriers to entry to reality capture technology, organizations are finding new value in capturing and visualizing their remote facilities. Deploying scheduled mobile mapping scanning on large industrial assets, and drone scanning on long, linear assets provides powerful insights to the asset management team without needing to send anyone else to site.

VEERUM provides a collaborative tool enabling visual inspections of remote facilities. Teams are able to input images to geospatial locations to identify defects, and 360' panos help visualize current site conditions to better support inspection. Visual inspections allow off-site stakeholders to analyze the digital twin and identify any issues on site. Hosting all this information in the context of a collaborative 3D viewer enables remote planning and orientation, so when stakeholders need to perform on-site maintenance, users are familiar with site conditions before they arrive, reducing the need for unpredictable and risky rework. Adopting these new technologies today will continue to promote the use of collaborative digital tools across the industry, and in turn, assist in training AI/ML algorithms to enhance predictive maintenance practices over time.

3. Visual identification work order trigger

Work orders can be triggered via digital inspection or human observation. Digital inspection including UAV and aerial inspection, borescope, light detection and ranging (LIDAR), photogrammetry, ground penetrating radar (GPR), video, pictures, bathymetric mapping, infrared, intelligent pigging, and other devices and methods. Human observation is exactly what it says; humans inspecting assets and objects through operator rounds, magnetic particle inspection (MPI), and other on-site activities and processes.

Visual identification: Current state and challenges

i. Digital Inspection
Subcontractors manage the data capture and deliver it back to the asset owner in a visualization tool (pix4d, Drone Deploy, HUVR, drone to map, or other web solution). The client inspector receiving or analyzing the data then enters a work notification into CMMS as a separate/siloed step.

ii. Human Observation:
Humans go to site, walk around, take pictures and videos and make notes. They then upload this data into a work identification system using phones, laptops, desktops and then enter a description into the system. It is time consuming and impacts site exposure risks. The data is only uploaded to the work identification system and is siloed.

Visual identification: Optimizing the current state with technology

i. Digital inspection
With VEERUM's new visual way of working, stakeholders from across the asset portfolio can collaborate on the same visual information in near-real time, reducing the need for ad-hoc reports and manual inspections. Now, all users have access to the same visual data, and can plan for maintenance based on the digital inspection delivered in VEERUM's cloud-hosted application.

ii. Human observation
VEERUM acts as the single-source-of-truth for all on-site information. Reality and CAD data can be updated and enriched by on-site photos, object status updates, and linked to active work orders. On-site users can upload photos directly to the VEERUM application, ensuring all stakeholders have access to the latest site information for decision making.

4. Time based work order trigger

Time based maintenance (TBM) is maintenance that is planned, and performed based on a calendar, therefore time is the trigger. This type of maintenance may be performed whether it is needed or not, and as a result does not always strike the right balance between risk and reward.

TBM: Current state and challenges

The current state of TBM is relatively self explanatory. CMMS sourced work notifications are produced based on the planned maintenance schedule. This doesn't sound like it presents too many challenges, until you look at it with the lens of what technology could do

TBM: Optimizing the current state with technology

Let's start with imaging that every piece of data related to your asset is in a single application. It is all aggregated. It is fully contextualized. And you can visualize the entire site, and all of its components in 2D or 3D, including 360° panoramic views with full high res zoom capability in a single web-based interface. OK, what does that actually mean? It means that you can:

- Search for and easily find the time-based work order, and visualize all other work orders in the area so that you can coordinate resources more efficiently
- Retrieve all the documentation you need for the order from the same place including inspection records, compliance documentation, permits, imagery, diagrams etc.
- Conduct the required quality assurance audits right in the 3D visualization platform
- Collaborate with your team and subcontractors on the work order within the application and tie all commentary to the relevant object

The importance of Planning in maintenance and work order management

Having addressed the importance of maintenance and reliability, and taken a look at an overview of work management processes with a deep dive into work identification, we'll move on to a thorough **review of maintenance planning, the current state, and how technology is optimizing planning, increasing productivity, and impacting safety.**

01 Controlling OPEX

The high costs of maintaining physical assets requires that they be carefully managed. They inflate operational costs and thin out profit margins. Failing to do maintenance the right way means more labor, parts and contracts. It also means lower product quality, lost production time, wasted resources, safety issues, higher energy costs, environment issues, and reduced asset life space.

02 Budget management

Budget needs to include funds for preventive (planned) and corrective maintenance. Budget and controlling costs is managed by combining multiple styles of maintenance including time-based, and predictive maintenance strategies to optimize the efficiency of each asset. Preventive maintenance is particularly important as it contributes to the reduction of unanticipated breakdowns and the associated costly emergency repairs.

03 Regulatory compliance

Each industry has numerous regulations with which they must comply. For example, in the US oil and gas companies are required to comply with the Federal Energy Regulatory Commission (FERC), the Environmental Protection Agency (EPA) and other regulations. Each compliance goal requires a plan of its own and can include: inspecting assets for damage, having a system in place to report damage, ensuring there are adequate safety guards and processes in place, ensuring proper documentation, reporting and storage of all repair and replacement work, and more.

Six key reasons maintenance planning is critical

04 Ensuring safety

Health and safety requirements are highly regulated in many industries today. Maintenance management must ensure that the safety of personnel is ensured both inside and outside the maintenance department. Apart from inspection, other activities include pest control, waste management, sanitation services, managing electrical, plumbing and other work, and more.

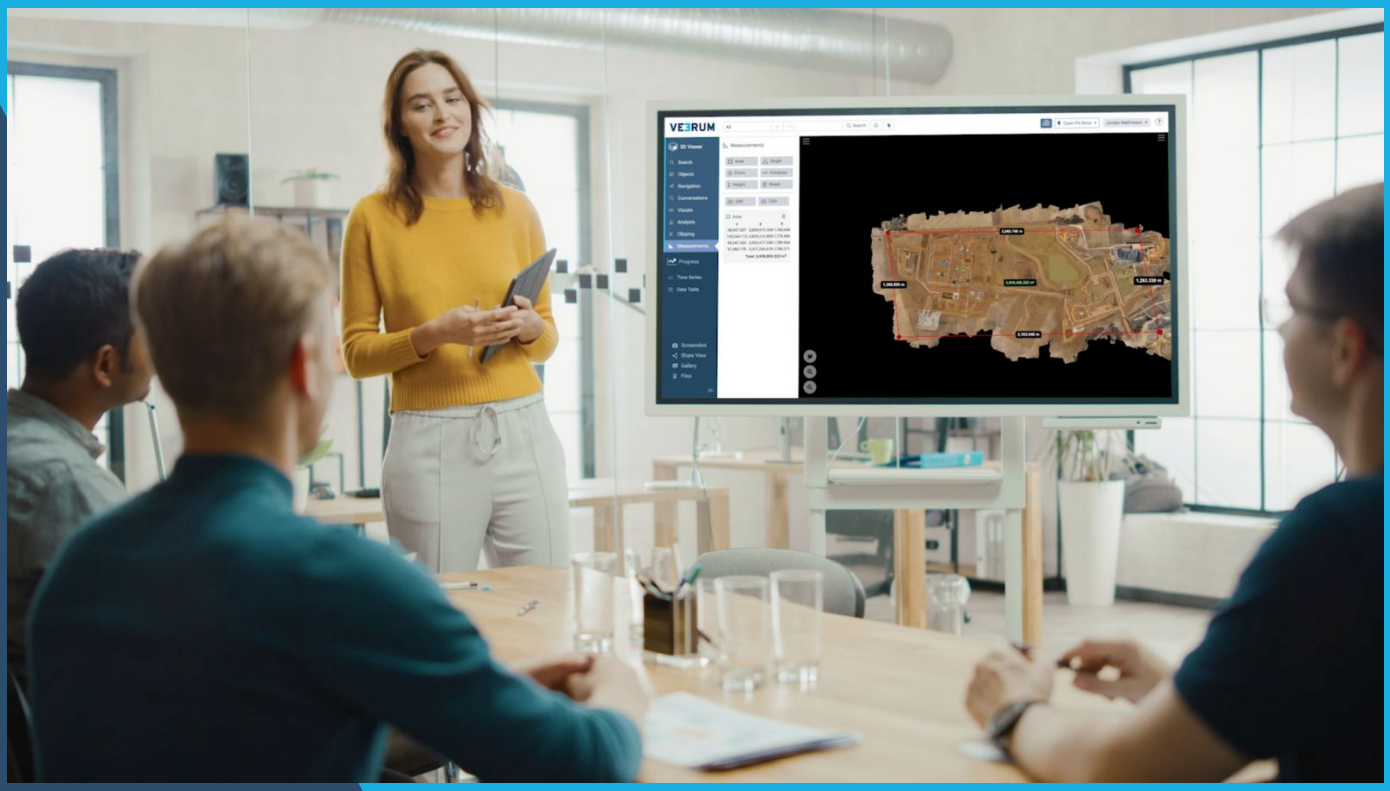
05 Extending machine life

When a machine fails it results in downtime and has a significant impact on operations. Maintenance planning assists in minimizing the effects of wear and tear on frequently used components. Additionally,preventive measures can be taken to make adjustments and perform calibrations to keep equipment in optimal operating order.

06 Maximizing facility performance

Properly managed maintenance will have a positive impact on the facility's key performance indicators (KPIs), including equipment utilization and inventory accuracy.

But maintenance management is changing. And with it, maintenance planning...



Consider a few of the jobs maintenance planners do today:

We'll look at a 'day-in-the-life' of a maintenance planner in more detail later when we consider how technology is changing working life for those in heavy industry. For now, this list covers just a few of those daily responsibilities:

- Validating the scope of the maintenance activities
- Documenting what needs to be done and how to do it
- Visiting the site to conduct inspections
- Documenting those inspections and uploading to the CMMS
- Verifying and documenting existing conditions at site
- Removing obstructions (logistical verification)
- Validating and/or requesting work permits
- Checking compliance documentation
- Planning for resources using the CMMS and ordering materials required
- Managing the logistical planning

This is all enormously time consuming, frustrating, and can be unsafe. Why? There are three main reasons.

Three key reasons current maintenance planning is sub-optimal

01

Documentation

Documentation is not all in the same place. It is siloed, and in different non-integrated systems that are not easily searchable. The data that is available is not contextualized and is all in 2D.

02

Communication

Collaborating and communicating with their team and subcontractors is time consuming. It can be difficult, if not impossible to ensure that everyone has access to the same information at the same time to facilitate conversation and good decision-making.

03

Site visits

Visiting the site increases their risk of site exposure and requires travel time and cost.

So, how exactly is technology revolutionizing traditional maintenance planning?

Four ways digital twins are revolutionizing maintenance planning

01 Remote planning

3D remote planning allows for the visualization of rights of way, hazardous areas, elevation lines, boundaries between assets and more in 2D or 3D, including 360° panoramic views with high resolution zoom capability

02 Dimensional objects

Planners can Insert dimensional objects to imitate equipment and materials that are to be brought on site to visualize them socially in 3D, simulate where that equipment will sit on site, and move it around to make sure it can access the point of interest

03 Documentation

Data aggregation, contextualization, tagging and visualization allows maintenance planners to easily search for and find all the documentation needed including permits engineering documents, internet of things (IoT), geospatial information, digital inspection records from UAVs, drones and site cams, and more in a single web-based application that is fully integrated with all other databases and systems

04 Communication

Collaboration and communication with the team and subcontractors within the application is enabled, tying all commentary to the relevant objects in real-time and within the same interface

Maintenance work order management: Scheduling

Before we dive into the maintenance management stage of scheduling and look at current state challenges and what the future holds, let's first consider the current state of scheduling, and two major challenges asset managers face:

1. Unplanned work

The intent is to schedule the maximum number of hours available based on available resources; to improve efficiency, speed up workflow, prevent problems, and cut costs. One of the biggest challenges faced by maintenance or asset managers is how to deal with unplanned work. Unplanned work should only be allowed to break into schedules if it is deemed to have a high enough priority based on the potential risks associated.

Maintenance managers also must consider the impact on the current work orders, along with the risks of the opportunity costs of delaying that work - understanding the criticality of equipment is key. Unfortunately, **unplanned work is often incorrectly prioritized over scheduled tasks, affecting weekly compliance, posing a risk to completion of planned work, and adding to the growing maintenance backlog**.

Traditionally, technicians frequently work in firefighting mode. Inevitably, preventive planned maintenance is negatively impacted, if not completely ignored. This in turn causes further breakdowns and emergency work. Disciplined allocation of time and resources is sometimes a seemingly insurmountable obstacle to achieving best-in-class maintenance execution. The need is for more… More time. More resources.

2. Time estimations

Planning and scheduling of maintenance execution is based on historical hours logged in the CMMS. There are two challenges that often arise with this practice. Firstly, hours allocated during the project phase are often not transferable to the operate phase, and as a result initial planning and scheduling is inaccurate. Secondly, CMMS data is not updated with any regularity, if at all, with realistic estimates as the asset life cycle evolves.This leads to underestimated hours in the planning and scheduling phases which result in morale issues, safety issues, and plans that are unachievable; or overestimated hours, which result in unnecessary backlog, manpower bloat, downtime and spares holding gaps, and inefficient execution. Both lead to an inefficient allocation of resources which always has a financial impact. The root of this challenge lies in the incomplete, out-of-date data in the CMMS.

Maintenance work order management: Scheduling

2. Time estimations

Planning and scheduling of maintenance execution is based on historical hours logged in the CMMS. There are two challenges that often arise with this practice:

1. Hours allocated during the project phase are often not transferable to the operate phase, and as a result initial planning and scheduling is inaccurate.
2. CMMS data is not updated with any regularity, if at all, with realistic estimates as the asset life cycle evolves.

The result is glut underestimated hours in the planning and scheduling phases, morale issues, safety issues, and plans that are unachievable; or overestimated hours which result in unnecessary backlog, manpower bloat, downtime and spares holding gaps, and inefficient execution.

Both lead to an inefficient allocation of resources which always has a financial impact.

The root of this challenge lies in the incomplete, out-of-date data in the CMMS and elsewhere.

Maintenance work order management: Scheduling

Technology is addressing the common challenges associated with unplanned maintenance and time estimations.

Giving back time with remotely accessible, aggregated, contextualized, up-to-date data

Certain technologies allow maintenance teams to access all the data they need to plan and schedule maintenance tasks in a single interface, including documents, inspection records, work orders, permits, and real-time operating data. Digital twins do this by integrating all the backend systems, aggregating the data, contextualizing it, visualizing it in 2D or 3D, and providing 360° zoomable panoramic views down to the component level.

What does this mean? It means that:

- All the data the organization has is available in the application, to all users with access, in real or near-real time. The digital twin is up to date, and is fully integrated with other systems
- Asset managers, sub-contractors and technicians can view the asset data and the schedule in a common viewing environment, collaborate within the interface, and view the asset remotely in 2D or 3D
- Apart from actually carrying out maintenance tasks, much of the identification, planning and scheduling can be efficiently managed remotely, minimizing travel time and time on site
- The technology supports seamless simultaneous operations (SIMOPS) and integrates with other scheduling applications

Impacts include increased productivity, decreased costs, reduced site exposure risks, and reduced travel time - the technology quite literally gives back time.

Maintenance work order management: Execution and close out

The execution and close out of maintenance tasks is like a well choreographed dance when proactively well managed. These maintenance managers have created the right team, documented their assets, established procedures, and prioritized and categorized the maintenance tasks.

They have gathered their baseline information, use a thoughtfully developed checklist, and ensure consistency in inspection.

These best practices help to minimize the likelihood of unplanned downtime which on average costs $260,000* an hour due to the costs associated with:

- Material waste from unused resources
- Loss in production
- Overtime due to unexpected downtime
- Rescheduling of the entire project
- Early disposal of machinery or equipment'

Clearly, there is a lot to be considered in the execution stage, so we'll limit our discussion to a few key areas; we'll look at work permitting, the tasks involved with conducting quality inspections, and the task of documenting and updating statuses.

Current State

Maintenance teams are responsible for predicting, planning, and executing on-site maintenance activities without impacting production. This requires multiple site visits to confirm site conditions on as-built drawings before execution. These site visits are time consuming, expensive, risky, and can be unproductive due to current reporting methods. Taking pictures, making manual measurements, and documenting site conditions with pen and paper can be confusing for off-site stakeholders, and results in poor planning.

How technology is optimizing these processes

Teams using technology to optimize maintenance activities are leveraging new reality capture methods to accurately visualize existing site conditions. With a combination of LiDAR, mobile mapping, 360 photos, and as-built drawings, all stakeholders are able to work on the same information, enabling seamless remote collaboration. With VEERUM, all visual information is displayed in a common 3D viewing environment integrated with tools such as CMMS and document management systems. By visualizing this information with the context of the rest of the site, maintenance teams can effectively familiarize themselves with the work area from a remote location so when they do arrive on site, there are no surprises. Furthermore, when work is executed, the virtual site continues to be enriched with new information, so future maintenance projects have the latest site information for quick decision making.

Nine maintenance business objectives and digital twins

1. Maintaining the capability of the company's assets to perform their designed function, thereby maximizing the company's return on assets and increasing shareholder value

Removing data silos is critical. Technology enables digital twins to ingest, aggregate, unify, and analyze all engineering, geospatial, planning, scheduling and operational data in a single web-based interface.

The insights provided through this analysis include operating conditions, production rates, bottlenecks, malfunctions, structural integrity, potential failure modes and rates, and requirements for near term repairs and replacements. Insights can be used to perform 'what-if-scenarios', and to optimize plans for intervention for repairs and replacements, and production.

2. Maximizing production or operational throughput

Digital twins support remote operations and maintenance. Planners, inspectors, engineers and supply chain managers are no longer required to be physically present on site. Inspections, assessment of as-built information, unified data access, and collaboration with all stakeholders, including contractors and vendors can be conducted remotely from the safety of the office or home. Employees are empowered to work more efficiently, accurately, and safely from anywhere in the world, and business continuity is ensured.

3. Identifying and implementing cost reductions

Digital twins monitor and analyze data in near real-time and can be used to automate operations and large complex physical sites, minimizing site exposure risk and improving the safety of the asset by decreasing accident rates and enabling 24/7 operation and business continuity.

Digital twins also enable remote access to site for site inspections, as-built assessment, and work identification, significantly reducing time required on site, and as a result reducing site exposure risks and travel costs.

Nine maintenance business objectives and digital twins

4. Providing accurate equipment maintenance records

Disciplined record keeping saves lives. It's critical that the maintenance department accurately documents and records all maintenance related activity. Integrated with all other systems, the application allows maintenance teams to easily search and find all required information relating to a work order. They can easily upload new information, and capture conversations within the application which acts as the single source of truth for all users, including head office, site workers, and subcontractors.

5. Optimizing maintenance resources (labor, materials, contract)

This is a clear objective for any heavy-asset maintenance department. We'll dive right into the impact of utilizing digital twin technology on this objective:

- They enable maintenance teams to visit their assets and plan maintenance projects from anywhere in the world, minimizing the time required to travel to site and the risks of site exposure
- By simulating equipment placement and movement with precise measurements on the digitized site, digital twins minimize rework and enable off-site orientation for maintenance teams and 3rd party contractors
- Digital twins connect the systems of cross-functional teams, enabling seamless simultaneous operations (SIMOPS) execution
- As a 3D online model of the facility, users are enabled to share unique URLs of specific views with team members and contractors, adding visual context to emails, report and virtual meetings for improved remote collaboration
- Users can have conversations within the application to identify and track new equipment, collaborate with other stakeholders, and resolve issues in the virtual world before they impact reality. By enabling real-time communication between the site and the office, productivity on site is improved.
- Digital twins easily connect CMMS work orders and real-time internet of things (IoT) data to the 3D model. This enables visual work identification so the entire team knows what work orders are coming next
- They enable remote maintenance planning with visual support, allowing teams to build a digital record of all maintenance activities
- The technology allows users to assign tasks and create a schedule in the interface. Maintenance teams can update the status of a work order in real-time, helping identify any schedule slips and bottlenecks before they impact subsequent maintenance projects

Nine maintenance business objectives and digital twins

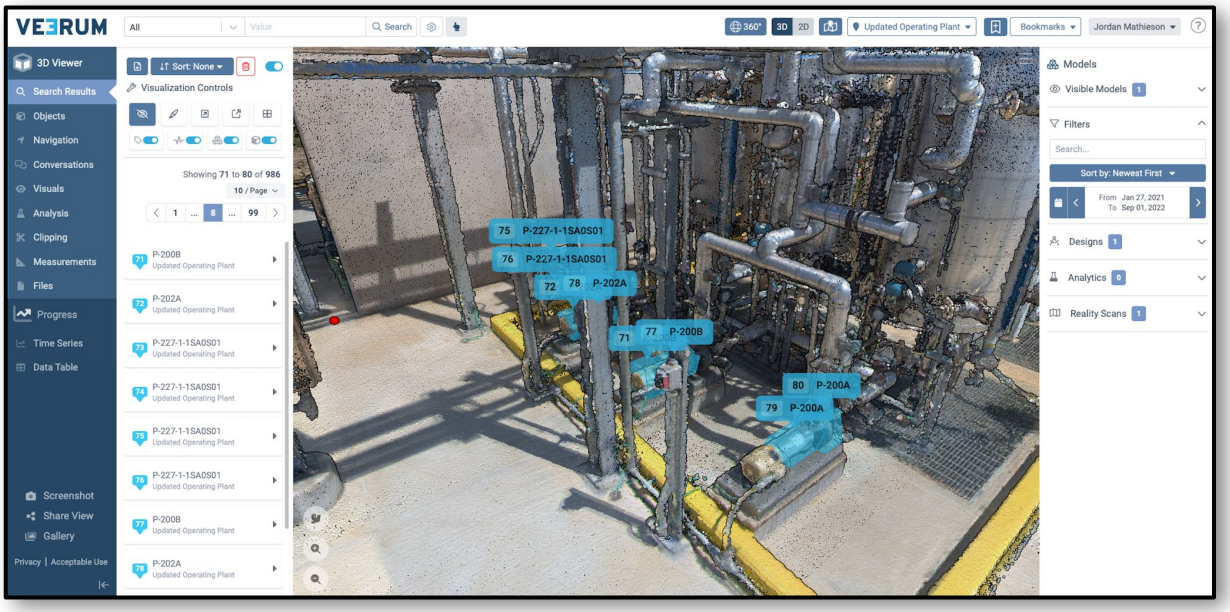
6. Collecting necessary maintenance cost information

Tracking maintenance costs is one of the ways asset-heavy industries evaluate maintenance department effectiveness. These costs represent the result of all the department and company's' efforts to maximize the lifetime and productivity of their physical assets.

When maintenance is considered an investment as opposed to a cost center the maintenance department undergoes a mindset shift:

- As a cost center, maintenance managers are constantly pressured to reduce total maintenance costs even to the detriment of the long-term horizon
- As an investment, the mindset is more about optimizing performance and useful life while reducing the number of production days. While poorly managed maintenance absolutely erodes profitability, well managed maintenance budgets can reduce operational costs by extending lifetime value and working to minimize both the direct and indirect costs of maintenance.

To effectively manage any department, especially those with heavy-assets that are highly cost intensive, meticulous record keeping is essential. With digital twins, all the documentation associated with any work order or object is easily uploaded.



The data is easy to find and contextualize within the 3D interface, and collaboration is enabled within the digital twin. This ensures that everyone is up to date with the latest communications and has access to the same data.

Nine maintenance business objectives and digital twins

7. Optimize the useful life of capital equipment

This objective is self-explanatory: by optimizing the life-span of capital equipment, maintenance teams maximize the productivity of that asset, defer replacement costs, and help assets reach their full service life potential. This reduces annual capital reinvestment costs. Decisions regarding optimizing maintenance and the timing of asset renewal, replacement, or decommissioning requires full tracking of all maintenance activities, including costs as reviewed in objective six.

Tools and systems that help to both optimize maintenance and increase collaboration among internal departments help to improve outcomes. Digital twins enable both of these. See objectives one through four for more on this.

8. Minimize energy use

Running heavy-equipment and managing industrial assets by nature consumes a significant amount of energy. By ensuring equipment and systems are correctly calibrated, tuned to run as efficiently as possible, and scheduled to run only when needed, is one way to help to reduce these costs. Effective maintenance strategies that facilitate this are preventive in nature, and digital twins assist in enabling these strategies while reducing the need for corrective maintenance.

Digital twins allow entire teams and third-party contractors to access, collaborate on and view the same, complete asset data in the context of both 2D and 3D modeling. By facilitating remote visualization and collaboration, travel to site is minimized reducing all associated costs. By connecting cross-functional teams, SIMOPS can be managed in a single environment, including work orders, clash detection and existing site conditions. All of these result in energy reductions, contributing to the achievement of this maintenance objective.

Nine maintenance business objectives and digital twins

9. Responsibility for Environmental, Safety, and Health compliance

Digital twins provide simulations to enable the development of future-operating and future-development scenarios. This reduces rework, facilitates off-site orientation, and enables remote emergency training reducing site exposure risk.

The ability to work remotely with access to all data inputs in one platform allows users to be on site without going to site, further saving time while reducing costs and site safety exposure. Reduced travel and a common viewing platform can result in productivity improvements of up to 33%.

Use case

"VEERUM ran a constructability simulation, virtually assembling digitized components. It was discovered that a critical pipe had been built improperly, although the fabricator's specifications did not show any issues. The affected pipe would not have been used until toward the end of the shutdown, at which time its discovery would have required significant rework. At that time, the precise nature of the problem would not have been immediately obvious, and it would have taken time to discover the source. The shutdown would have necessitated an extra two to three days of unplanned work. In this case, VEERUM saved the client hundreds of hours and between $800 thousand to $2.7 million in extra on-site work and field exposure hours, and a loss of upwards of 90,000 barrels of product per day."

"A company making significant contributions to this thriving wave of next-gen digital transformation in asset-intensive industries is VEERUM."

~ CIOReview

READ FULL ARTICLE >

VEERUM Advantages

Capital-intensive industries, including oil and gas, manufacturing, chemicals, mining, and utilities, manage complex assets in which even a single hour of downtime can cost millions. In 2023, it's essential for organizations to utilize digital technologies to increase efficiency, prioritize safety, and cut costs.

VEERUM allows you to connect asset information

Pull a master tag registry from your enterprise asset management system. Any information source associated with the tag will be connected and viewable in the single interface of the reality site including:

- Documents
- Inspection records
- Work orders
- Permits
- Real-time operating data

Let's dive into the details…

Eight advantages of VEERUM

01

Visualize large files

Visualize large geo-referenced 3D reality and design models in a single viewer. Quickly understand the latest visual information in the context of other visual layers.

02

Crowdsource and collaborate

Add information to objects in the CAD models and reality scans in the collaborative 3D viewer. Crowdsource the latest asset information from subject-matter-experts in your organization to keep the digital asset up to date.

03

Enable engineering

Isolate select areas of your 3D models for analysis in the application, or export into 3rd party engineering tools. Enable engineering within reality and design.

04

Search and display

Asset information can be searched for and displayed beside the digital site. Users can quickly find this information by clicking components in the digital site, or by searching with tag information in advanced search.

Eight advantages of VEERUM

05

Share view

You can save or share a unique URL of your view in the application to access later or share with your team members. This adds visual context that can be added to emails, reports, and virtual meetings for improved collaboration.

06

Verified measurements

Make digitally verified measurements between 3D models. Enable virtual maintenance planning and remote bidding from the safety and convenience of the home or office.

07

Virtual and augmented reality

Users can experience any of their VEERUM sites in immersive augmented or virtual reality. VR/AR can be directly launched from the VEERUM application with any WebXR enabled device.

08

Accelerate digital

Deploy hardware such as laser scanners or camera mounted drones to capture your site to any desired precision. Combine with any existing 2D, 3D design, satellite imagery and plot plans to create a rich 3D digital twin of the asset.

A day in the life...

Changing times

Driven by digital adoption and acceleration, work life is changing for those in heavy industry.

For people in the field, this is unnerving, a little stressful, and makes for uncertain times. When you type into Google, “digital transformation”, the definition is not clear. There are countless articles written on this phenomenon, dictionary definitions, videos and more, but there might not be a clear answer for your organization and your role within it.

Let’s take a quick step back and look at the current state of technology, and how it is impacting a day in the life just a few of the key members of the maintenance business:

- Maintenance planners
- Reliability engineers
- Business analysts
- Asset owners, senior leaders, and managers

Jobs-to-be-Done (JTBD) in the daily life of a Maintenance Planner

JTBD provides a framework for categorizing, defining, capturing, and organizing the daily tasks undertaken by a role. For maintenance planners, JBTD are extensive and time-consuming.

A non-exhaustive list of 15 common JBT undertaken by maintenance planners include:

1. Being **physically present** on site for site inspections and to validate, audit, and check as-built information
2. **Taking photographs** of the as-built information and including those visuals in work packages
3. Gathering the scope for a planned task **from several sources**, both internally or externally
4. **Gathering priorities** that are decided by a team from operations, maintenance, and reliability and maintaining those priorities
5. **Sourcing task** steps from original equipment manufacturer (OEM) suppliers, specialists and operations
6. **Coordinating with quality** if an inspection test or bump test is required
7. **Gathering historical data** of legacy assets available for planned maintenance
8. Managing **closing activities**
9. Producing **constraint free maintenance plans**, increasing **time on tools**, and **reducing safety exposure** on site
10. **Coordinating crews** with access to information of limits of workers in the area, and expected productivity rates that contractors rely on in order to bid for work
11. **Coordinating labor, parts, materials, and access**
12. Participating in simultaneous operations (SIMOPS) management workshop sessions involving multi-disciplined teams of management, safety specialists, engineers, and operations and maintenance representatives
13. **Identifying conflicts** and developing and/or accessing work packages
14. Improving workforce **productivity**
15. Anticipating and **eliminating potential delays** through planning and reacting

> "With VEERUM, team members can co-navigate a detailed 3D visualization of a site to quickly understand current equipment, status and remotely plan for expansion or modifications."
>
> Patrick Elliott - EVP, Jupiter Resources and VEERUM user

Eight reasons the JTBD by Maintenance Planners are very time consuming

01 Communication is stilted and piecemeal, and collaboration is difficult

02 Information is siloed across multiple systems, and is often not available within the maintenance planners network, and tracking information down is tedious

03 Accessing up-to-date, real-time information to ensure cost efficiencies are achieved is a constant challenge

04 Trusting that the information received is in fact accurate and up-to-date is always a concern

05 Excessive time is spent in meetings investigating and coordinating different schedules, priorities and safeguards to mitigate risks with respect to safety, environment and asset damage, and business interruption while managing SIMOPS

06 Lack of as-built information frequently requires travel to site to understand the current status of the asset

07 Spatial awareness of the asset is required as is up-to-date, as-built asset information and procedures that, when available, are themselves located in different siloed systems that are not easily searchable

08 Data and business unit siloes increase the risks of tracking complex conflicts through from identification to resolution, and the challenge is exacerbated when installation work packages cannot be completed due to quality, material or resource constraints

For maintenance planners, this traditional method of completing JBTD takes a significant amount of time that could be used far more productively.

The daily life of Reliability Engineers

Engineering is a cornerstone of the global economy.

Digitization is driving efficiency in the workplace and is changing the way engineers work and make decisions.

Product development, transformation and real-time data management are speeding up.

Engineering is becoming more complex, innovative, and data led as the cloud allows engineers to store all their designs in one, easily accessible place.

SNC Lavalin **says this:**

"The value of cloud computing in ***engineering relies on data capture, 3D modeling, and creating the best possible customer experience.***

Digital transformation and the rise of big data have paved the way for ***digital twin applications, which are hugely beneficial for engineering firms.***

A digital twin is a virtual model of a physical object and it's used to replicate real-world assets to gather and analyze data to predict how they will perform. Therefore, digital transformation has paved the way for ***predictive analysis in engineering and new ways of collaborating and innovating."***

There is a pervasive fear...

There is a pervasive fear that technology will replace humans. Let's break that down:

01

According to the Bureau for Labor Statistics, science, technology, engineering, and math (STEM) jobs will grow by eight percent between now and 2029. For engineering occupations specifically, employment is projected to grow approximately three percent in the next 10 years — adding over 74,800 new jobs by 2029.

02

For engineers, technology should be viewed as a tool, not a threat. Consider a digital twin: This software allows engineers to work more safely and productively, with less travel time and time on site, in a more unified, visual and collaborative way. Yes, it employs machine learning, but it is not intended to replace workers. In fact, it depends on humans for a number of reasons; to provide the data for it to ingest; to interpret the data it analyzes; to leverage the visual data it outputs to enable all the potential gains in productivity, efficiency, and savings.

"VEERUM's Digital Twin allowed us to rig up our frac trees, manifold and connections to wells, safely, efficiently - half the time it used to take - and accurately."

Zeyad Al-Ssalmani - Prod. Engineer, GE and VEERUM user

Jobs-to-be-Done (JTBD) in the daily life of a Reliability Engineer

A non-exhaustive list of 13 common day-to-day jobs undertaken by reliability engineers includes:

1. Working with project engineers to ensure the reliability and maintainability of new and modified installations
2. Ensuring adherence to the Life Cycle Asset Management (LCAM) process throughout the entire life cycle of new assets
3. Participating in the development of design and installation specifications along with commissioning plans
4. Participating in the development of criteria for and evaluation of equipment and technical maintenance, repair, and operations (MRO) suppliers and technical maintenance service providers
5. Participating in the final review of new installations. This includes factory and site acceptance testing (FAT) that will assure adherence to functional specifications.
6. Guiding efforts to ensure reliability and maintainability of equipment, processes, utilities, facilities, controls, and safety/security systems
7. Professionally and systematically defining, designing, developing, monitoring and refining an asset maintenance planDuring mine work, being cognizant and keeping track of ground closure, underground reality and geoscience activities by comparing scans and detecting movements and stresses
8. Collaborating with subject matter experts on certain parts of the asset before troubleshooting
9. Providing input to a risk management plan that will anticipate reliability-related, and non-reliability-related risks that could adversely impact plant operation
10. Developing engineer solutions to repetitive failures and all other problems that adversely affect plant operations.
11. Working with Production to perform analyses of assets including:
    - Asset utilization
    - Overall equipment effectiveness
    - Remaining useful life
    - Other parameters that define operating condition, reliability, and costs of assets
12. Providing technical support to production, maintenance management, and technical personnel
13. Applying value analysis to repair/replace, repair/redesign, and make/buy decisions.

12 Reasons JTBD by Reliability Engineers are very time consuming

01 Communication is stilted and piecemeal, and collaboration is difficult

02 Each of the bullets in a job description are a separate data source. Information is stored in silos and multiple locations, making it challenging to find, access, and share

03 Finding up-to-date versions of required documents can be frustrating and time consuming, and correlating the various sources of information is a challenge

04 Need to access third party data sources to get documents such as non-destructive testing files (NDT)

05 In some cases approvals may be required to access certain documents causing delays, and back and forth exchanges of information between multiple stakeholders takes time

06 Getting specific information to subject matter experts for their opinion

07 The need to constantly reach out to vendors, suppliers and other engineers to access CAD models and update repair/replace information, and receive appropriate approvals and confirmations is tedious

08 Toolings are required for data analysis and for documenting the solutions that an engineer comes up with

09 Keeping track of where new installations are present on site and their attributes (make model etc) is a challenge

10 Testing and ensuring documentation is received/approved/sent out in time to avoid hold ups

11 Send documents across all teams through various document control systems

12 Cross functional team workshops and meetings are held to vet out decisions based upon data. These are frequently on-site and face-to-face, requiring travel time and costs and potentially causing delays while increasing site exposure risk.

All this time spent sourcing, searching, accessing, traveling, and trying to communicate and collaborate using multiple different tools and methodologies including SAP, ERP, Excel, CMMS, Maximo, Primavera, MS Access, PHA, FMEA, C, SPMEA, MI, FTA, ETA, Word, PDF, Loss Control Software, Document control and sharing systems, Sharepoint, UDocs, Meetings, Site visits, emails, Governance Documents, CAD models, Smart P&ID, Tekla, Revit, and more takes a **significant amount of time that could be used far more productively.**

For reliability engineers, the way of the future is digital. Luckily, engineering has always been ahead of the curve when it comes to innovation and digital adoption.

All that's left is to encourage your organization and be a voice for change in your industry to ensure that we all move towards a more productive and sustainable future.

How technology is giving back time to these critical staff within the maintenance business

Digital twins are revolutionizing the day-to-day work life of numerous employees within the maintenance business of thousands of companies within heavy industry. They do so by providing **immersive 3D visualizations of sites and assets at a component level, and on a global scale**. They are virtual representations of an asset that span its lifecycle, use simulation and machine learning to help decision making, and are updated from **real-time data enabling sustainable asset integrity**.

Digital twins allow users to easily search, find all the asset's historic and current computer-aided design (CAD), geospatial, document management, internet of things (IoT), and operational systems **data in a single interface**.

Users are able to understand and view the data in 2D, 3D, and zoomable 360° panoramic reality. **SIMOPS can be managed in a single environment, including work orders, clash detection and existing site conditions**. Users can have conversations in a 3D context within the application. Digital twins are especially valuable when they are vendor agnostic, meaning that the application can ingest data from any vendor, aggregate, verify, and contextualize it at an object level.

Along with **remote visualization**, digital twins also enable **collaboration, labeling, and analysis to the entire asset team**, including sub-contractors.

12 Benefits and outcomes

- ✔ Increased productivity
- ✔ Reduced costs
- ✔ Improved safety
- ✔ Reduce site exposure
- ✔ Reduced travel time
- ✔ Enabled collaboration and time efficiencies in meetings, workshops, and communication
- ✔ Reduced risk of field clashes
- ✔ Improved workflow productivity
- ✔ Holistic access to all available historic and current asset data
- ✔ Real time remote site condition analysis
- ✔ Remote emergency training
- ✔ Time efficiency in tracking down data and supplier information with a single source of truth

Heavy industry Business Analysts: Current challenges and the way of the future

As technology becomes increasingly vital for organizations in today's world, the role of the business analyst plays a foundational part in facilitating transformation efforts. First let's consider what we mean by **'digital transformation'.**

CIO states that:

"Digital transformation marks a rethinking of how an organization uses technology, people, and processes in pursuit of new business models and new revenue streams, driven by changes in customer expectations around products and services."

According to Forbes:

"It generally means the shift away from manual procedures to digital technologies in order to automate new or existing business processes, along with the necessary changes to organizational culture and improvements in customer experiences to meet market and consumer demands. This usually translates to creating faster, more convenient ways of doing things, and we can see it in our everyday lives."

Gartner explains it as follows:

"Digital transformation can refer to anything from IT modernization (for example, cloud computing), to digital optimization, to the invention of new digital business models."

There are five aspects of digital transformation that, for business analysts, carry the most weight.

1. The replacement of manual or partially automated processes and operations with those that are digitized and mostly automated. The efficacy and success of these processes is reliant on the software or technology selected.
2. Technology becomes an integral part of the production process and the end-to-end product or service
3. Many direct human interactions are replaced by digital interactions
4. The unveiling of security, organizational or data issues that are ingrained in the legacy processes and operations
5. The impact on the entire organization due to the shift to digital

If we consider the reasons frequently cited for why companies fail at digital transformation, we are able to better appreciate the difference business analysts can make to the transition and effectively managing the inevitable disruption.

12 Reasons companies fail at digital transformation*

01 Not having the right data in the right place

02 Working with poor onboarding processes

03 Implementing new tech onto a broken outdated tech stack

04 Employee resistance to change

05 Failure to set clear end-user experience goals

06 Miscommunication of the goals of the transformation initiative

07 Not coordinating goals across teams

08 Mistaking digitization for digitalization

09 Lack of commitment

10 Fear of failure

11 Lack of the right skills

12 Overestimating benefits and underestimating costs

* This list is taken from this excellent article from Forbes where they are discussed in detail:

The impact of Business Analysts

Where business analysts make a difference is when they are proactively and consistently allowed and encouraged to engage with internal staff across the organization.

Why?

If they are supported, encouraged and motivated, they will freely share their knowledge of the industry and the company, including the 'who's-who', the systems, the processes, and previous project experience within the organization. This inside knowledge is invaluable.

But business analysts themselves struggle with legacy processes and operations, particularly in tech laggard heavy industry. **Here's a quick (inexhaustive) look at just six of those challenges:**

1. They frequently deal with hidden agendas, changing priorities from upper management, and corporate dysfunction
2. They are required to interpret the needs of others and bring the different data together in a comprehensible digestible manner
3. They are navigating between headquarters and site regularly
4. They are frequently demoralized and even exhausted in their role of advocating for change in an environment where there is no appetite, significant resistance despite the information provided, and a lack of commitment from leadership
5. They frequently have limited resources but are always asked to do more with less
6. They are right at the forefront of dealing with rapid organizational change with little support or buy-in

One of the **root causes of their frustration is the fact that their organizations data is siloed** across multiple systems, out of date, difficult to search and find, and even sometimes not available in their network. Oftentimes they require approvals and permissions for them to access what they need to do their job.

> "When I log into VEERUM and look at our plant visually, I have all this data coming at me at once... but it's contextualized. It makes sense. And it's data I maybe didn't have access to before in own network. It's been extremely powerful for us."
>
> Senior Business Analyst - ExxonMobil and VEERUM user

For Business Analysts data aggregation is the beginning. Access to all engineering, geospatial, planning, scheduling, and operational data in a single web-based interface allows them to find everything they need wherever they may be.

Data contextualization is the next major benefit for business analysts. Data contextualization allows them to bring all aggregated data together and provide context back to the 3D site, providing immediate visual understanding. Business analysts can now easily understand what the data is saying, use data stories to enhance productivity, and deliver better outcomes. Better data drives better outcomes.

> "Having access to all this traditionally siloed data has been extremely powerful for us. This is a foundational tool within our toolset. It's a new visual way of doing work."
>
> Senior Business Analyst - Imperial Oil and VEERUM user

Heavy industry Asset Owner and Managers: Current challenges and the way of the future

The world is changing for asset owners and managers. A key point to ponder is this:

"Technology will not replace you or your people. People using technology will. Adopting a culture of innovation in which you encourage your teams to utilize new tools and technologies to improve how they work is critical."

Founder and President, Reality Capture Network

The landscape of everyday maintenance is shifting, fast. There are many different views on what maintenance will look like in just a few years. Some predict robot-fixers, some espouse augmented reality and self-healing machines, others believe that full automation will be the new norm or advanced warnings via sensors and integrated systems.

What they all agree on is that the conversation will have moved from digital transformation and preventive maintenance to fully predictive and efficient maintenance. **The expectation is that all facilities, new and existing, will be digitized. If you're not on that path, you are now falling behind.**

Asset owners, managers and C-suite executives today are under increasing pressure to not only explore digital transformation through adoption and acceleration of best practices, but to implement it in a way that has a strong and rapid impact on a multitude of key performance indicators including productivity, profitability, safety, cost reductions, asset utilization, mean times to repair - and between failure, annual failure rate, inventory turnover ratio, and more.

They are responsible for monitoring and managing every aspect of the facility at a high level, not just maintenance. The challenge with maintenance specifically for these owners is that **corrective maintenance is significantly higher than preventive maintenance**. There are numerous industry sources citing different values to illustrate this point:

Relative cost

Emergency (corrective maintenance) is 3-5 times as expensive as well-planned preventive maintenance

Total costs

Corrective maintenance costs 70%-90% of total maintenance costs when user costs (e.g. train delays) are included as a corrective maintenance cost

ROI impact

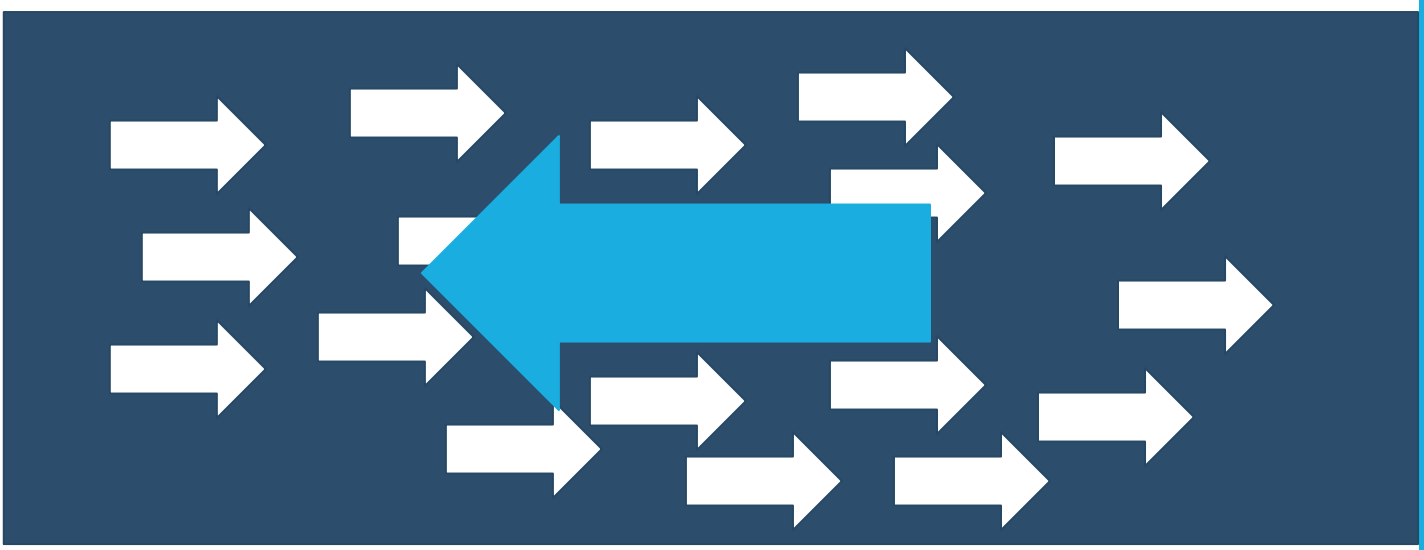
Preventive maintenance at industry-recommended standards led to a 545% return on investment compared to not doing any preventive maintenance

Day-to-day challenges faced by Asset owners and Managers

- Data scarcity has turned into data abundance seemingly overnight, and **lack of transparency along with disparate silos of information are costing** the company time and money
- Tight timelines and budgets constantly place additional pressure on the requirements of **reducing costs, improving effectiveness and efficiencies, and lowering risks**
- Uncertainty about current "**best-practices with technology" combined with a lack of time to educate users on the benefits** of technology. This is further compounded by difficulties in getting **internal buy-in from users** who are satisfied with the status quo
- The **pressure to deliver is extraordinary,** and in the case of tier 2 energy companies, this is exacerbated by the drive to catch up to tier 1 companies who have been using more advanced digital technologies for decades.

These owners and managers are under-the-gun, and the root of their concern is threefold:

1. Projects consistently go **over-budget** and run **behind schedule**. Teams are constantly pivoting and **adjusting the original plan**.
2. Teams simply **do not know what's in the field** and need to constantly **send people out** to plan for maintenance and ensure asset health.
3. Current digital investments are confusing and the team doesn't know **how to use the tools** effectively, they are **resistant to change** and in many cases fear that technology will usurp their roles.



How digital twin technology can help

Data aggregation and contextualization

Data ingestion, aggregation, and unification is a core and critical benefit of a data-rich digital twin. Business information systems and data that is locked in third party systems and applications can be unlocked and made available. This allows for:

- Access to all data attributes and work packages that are normally present on siloed data repositories
- Remote collaboration and communication with different personnel from maintenance and operations to understand equipment history, performance criteria, and more
- The alignment of schedules, avoidance of field clashes, optimal vendor selection, and optimized supply sequencing
- Access to real-time and up-to-date information to create estimates, make forecasts, and keep track of inventories for production goals
- The aggregation of quality exhibits and construction completion records, including outstanding punch items and deficiencies
- Ease in locating, monitoring, recording, collecting, printing, scanning, and uploading information for further analysis and distribution
- Seamless, quick production of reports and sharing information with concerned stakeholders
- Efficient, accurate, safe remote working conditions for the workforce
- Business continuity
- Real time monitoring of progress towards attaining reduction targets

The digital twin enables the **visualization and unification of all your engineering, geospatial, planning, scheduling and operational data in 2D and 3D in a single web-based interface. It also facilitates remote work and collaboration, and contributes to all your efficiency goals including safety, greenhouse gas (GHG) emission reduction, cost reductions, and bottom-line profitability.**

"We have a seat at the table with VEERUM to discuss how their platform can be improved. How can we see our data better. We're not just dealing with their platform; they're actually listening to how we do our business. That's very important to us."

Senior Business Analyst - ExxonMobil and VEERUM user

"VEERUM has helped our development team by allowing teams to inspect and plan operations on both green and brownfield drilling pad sites. This has improved productivity while reducing our costs and unnecessary field exposure."

Patrick Elliott - EVP, Jupiter Resources and VEERUM user

How VEERUM'S digital twin can help

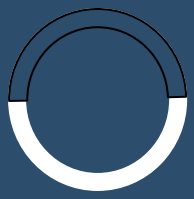
With VEERUM, many asset owners all over the world are already experiencing ROI improvements and cost reductions by helping them: :

- Reduce the requirement for travel for all internal stakeholders and 3rd party contractors by 50%
- Deliver asset information to every stakeholder with unlimited users; reduce existing software license spend by 50%
- Prepare their organizations for AI/ML adoption by aggregating, verifying and labeling current data sets in the context of a 3D viewer. 10X+ ROI for productivity
- Unlock new use cases by delivering a data-rich digital twin to their entire organization with unlimited user access.
- Realize the potential of their existing asset information by aggregating it in the context of a simple to use 3D visualization platform. Democratize the existing data silos (CAD, GIS, IoT, SCADA, ERP)
- Leverage a SOC2 Type 1&2, highly secure cloud application with no software or hardware.

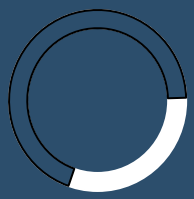
Secondary gains associated with those outcomes include:

- Enabling business continuity
- Empowering teams to work more efficiently, accurately, and safely from anywhere in the world
- Facilitating digital adoption across sites while attracting and retaining a top talent workforce

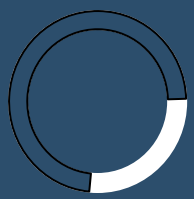
50%
FIELD EXPOSURE REDUCTIONS



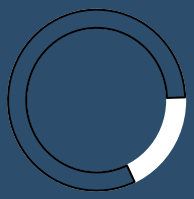
30%
PRODUCTIVITY IMPROVEMENTS



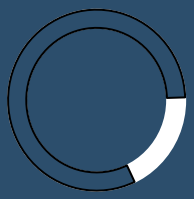
25%
FIELD COST REDUCTIONS



20%
CO2 EMISSION REDUCTIONS



20%
IMPROVEMENTS TO CORE KPI



What's next?

Some organizations have attempted to build their own digital twins inhouse. They have for the most part failed, quickly discovering that it's just not that simple:

- It's very expensive
- It's very time consuming
- It's not their core business (they are producers, they don't build software)
- They repeat mistakes that others have made, learned from, and solved
- If they are successful in building it for one site/location, it's nearly impossible to scale to multiple sites and it doesn't scales "down" to existing facilities, because it's either not cost effective, or the tech they built only works for new sites with 3D CAD, and all the data needs to be pretty near perfect
- It will likely never have as many features and functions, or file format compatibility as a vendor-built digital twin
- Creating value for their personas is difficult and very time- consuming, if they get that far
- Even if, or when they solve all of those challenges, they have found it's too expensive to maintain and update the software

It's not all doom and gloom. This litany of negatives should not prevent you from considering all of the opportunities and advantages of investing in a digital twin to improve productivity, and reduce cost and time inefficiencies.

VEERUM's Solution

Visualize and unify all your engineering, geospatial, planning, scheduling and operational data in a single web-based interface built for the largest enterprises in the world. Transform your asset operations with visual intelligence.

It doesn't matter if your data is disorganized or "not in a great place". In fact, existing facilities don't even need CAD models to realize the benefits of digitization, visualization, in-app collaboration, and business continuity provide by a data agnostic digital twin solution.

Empower your team to work more efficiently, accurately and safely from anywhere in the world with access to the fastest industrial digital twin available.

Transform your asset operations with visual intelligence

The new visual way of doing work

Join a workshop

Join an informal 30 minute workshop focused on energy, mining and utilities use cases

Sign up here > veerum.com/digital-transformation

Book a demo

Book a focused, dedicated demo to discuss your challenges and desired outcomes.

Book here > veerum.com/demo

VEERUM
WORK VISUALLY