The American Journal of Applied Sciences
ISSN 2689-0992 | Open Access

TYPE Original Research
PAGE NO. 48-66
DOI 10.37547/tajas/Volume07Issue07-06

Transforming Preventive Maintenance Operations Through Oracle Cloud Maintenance Automation

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OPEN ACCESS

SUBMITTED 07 June 2025
ACCEPTED 29 June 2025
PUBLISHED 12 July 2025
VOLUME Vol.07 Issue 07 2025

CITATION

Srinivasan Narayanan. (2025). Transforming Preventive Maintenance Operations Through Oracle Cloud Maintenance Automation. The American Journal of Applied Sciences, 7(07), 48–66. https://doi.org/10.37547/tajas/Volume07Issue07-06

Abstract: This paper examines the transformative role of Oracle Cloud Maintenance Automation in modernizing preventive maintenance practices across organizations. By automating asset maintenance workflows, minimizing manual interventions, and incorporating predictive technologies, Oracle Cloud facilitates a shift from reactive to proactive maintenance strategies. Key capabilities—including asset tracking, maintenance forecasting, and work order automation—contribute to enhanced asset reliability, operational efficiency, and cost optimization. The study highlights critical configurations and best practices for establishing an effective maintenance program using Oracle Cloud, positioning it as a cornerstone for asset lifecycle management and long-term operational success. Real-time analytics and data-driven decision-making further align maintenance activities with broader organizational objectives, promoting a culture of continuous improvement. Findings indicate that Oracle Cloud Maintenance Automation significantly improves maintenance resource allocation, reduces unplanned downtime, and increases equipment reliability. As cloud-based solutions become central to maintenance strategies, their adoption reflects a broader industry trend toward maximizing availability, minimizing lifecycle costs, and driving strategic alignment between maintenance and business goals. This transition empowers organizations to enhance productivity, ensure high asset performance, and achieve sustainable competitive advantage.

Keywords: Oracle Cloud Maintenance, Maintenance Automation, Preventive Maintenance, Maintenance Practices, Unplanned Downtime, Cloud-based Solutions.

I. Introduction:

The landscape of asset management and maintenance operations is undergoing a transformative shift, driven by advancements in technology and the increasing demand for operational efficiency. In this context, the integration of Oracle Cloud Maintenance Automation emerges as a critical solution for organizations striving to optimize their preventive maintenance strategies. This innovative platform offers a comprehensive suite of features designed to streamline maintenance processes, enhance asset performance, and align maintenance activities with broader organizational goals.

The importance of establishing a robust maintenance program cannot be overstated—it is essential for ensuring that assets are consistently monitored, maintained, and repaired in a cost-effective and timely manner. By leveraging Oracle Cloud's capabilities, organizations can reduce downtime, lower operational costs, and cultivate a proactive maintenance culture that anticipates issues before they escalate (Petersdorff, 2013).

Oracle Cloud Maintenance supports the creation of structured maintenance programs capable of generating daily preventive maintenance forecasts, thereby reducing the manual burden on maintenance planners. This shift enables planners to focus on auditing and optimizing maintenance strategies, driving continuous improvement. Furthermore, the integration of advanced technologies—such as the Internet of Things (IoT)—enhances real-time asset monitoring, leading to more informed decision-making and efficient resource allocation.

As organizations adopt these automated systems, they are not simply implementing new tools; they are redefining their maintenance philosophy to position maintenance as a strategic enabler of operational success (Lutchman, 2006). By establishing clear protocols, fostering collaboration among maintenance personnel, and embedding data analytics into day-to-day operations, organizations can build a resilient framework for sustainable growth and competitive advantage (Chang et al., 2016).

This paper provides the first technical blueprint for configuring Oracle Cloud Maintenance Programs, offering a detailed step-by-step guide to implementing a scalable and automated preventive maintenance strategy. The following sections explore the platform's core components, recommended configurations, and best practices to help organizations unlock the full value of Oracle Cloud Maintenance Automation.

2.Configuration

2.1. Setup Maintenance Program

A well-structured maintenance program is essential for optimizing asset performance and ensuring that maintenance activities are aligned with the organization's strategic goals (Velmurugan & Dhingra, 2021). This involves establishing clear protocols for preventive maintenance, integrating advanced technologies, and fostering a collaborative culture among maintenance personnel.

Maintenance Programs are designed to define and generate a periodic preventive maintenance forecast for one or more assets within a maintenance organization. (Ariansyah & Pardamean, 2022) This forecast serves as the foundation for creating preventive maintenance work orders, significantly reducing the manual workload for maintenance planners. As a result, planners can focus on auditing, optimizing maintenance programs, and addressing exception-based events.

Preventive maintenance work orders are expected to be executed as scheduled. Once completed, the system increments the next due work order in the forecast. However, if a work order is canceled, the system still considers its original due date in the forecast, which may lead to discrepancies in future scheduling.

While the system supports assigning an asset to multiple maintenance programs, it is generally recommended to associate each asset with only one maintenance program for simplicity. This approach allows each service interval to be modeled effectively using individual work requirements.

Maintenance programs are created and managed within the scope of a specific maintenance organization. As such, any asset included in a program must be associated with the same organization where the program is defined.

This structure ensures consistent forecasting, execution, and management of maintenance activities across the

asset lifecycle. Incorporating a robust maintenance program not only enhances operational efficiency but also aligns with the principles of preventive maintenance, ensuring that assets are consistently monitored and maintained to prevent unexpected failures (Smith & Hinchcliffe, 2004).This alignment with preventive maintenance principles is crucial for organizations seeking to minimize downtime and extend asset life, ultimately leading to increased reliability and reduced repair costs (Smith & Hinchcliffe, 2004) (Elwerfalli, 2012).and improved overall performance. By implementing these structured maintenance programs, organizations can achieve a proactive maintenance culture that not only addresses immediate needs but also anticipates future challenges, ensuring long-term sustainability and operational excellence.

Pre-requisite configurations to setup Maintenance Program

2.1.1. Setup Assets

Assets must be created and enabled for maintenance to be forecasted by a Maintenance Program and have Work Orders created. Enterprise (operator owned) Assets will be defined as having an Operating Organization and can be forecasted by a Maintenance Program. To effectively establish a Maintenance Program, organizations should ensure that all assets are properly configured and aligned with the maintenance objectives, facilitating streamlined operations and enhanced productivity. This includes defining asset types, categorizing them based on their operational significance, and ensuring compliance with relevant maintenance standards to maximize their efficiency and longevity. (Velmurugan & Dhingra, 2021)This foundational setup is critical for ensuring that maintenance activities are not only efficient but also strategically aligned with the organization's goals, ultimately fostering a culture of continuous improvement and sustainability in asset management.

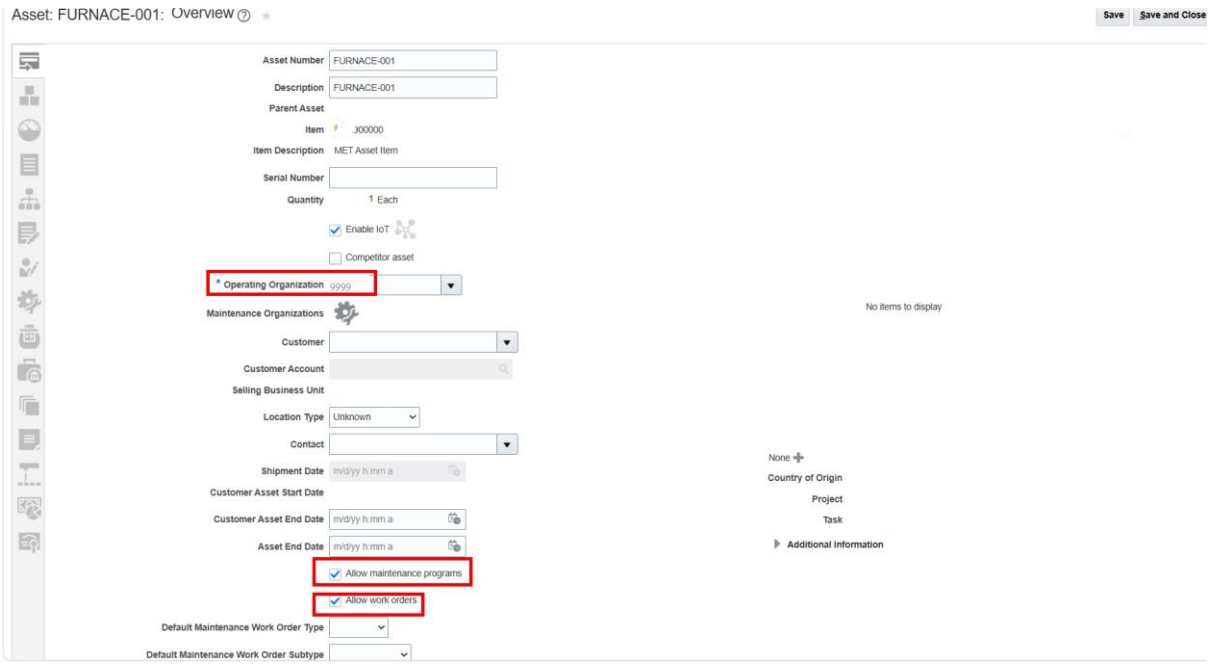

Figure 1: Asset Master

Assets must be created and enabled for maintenance using the overview tab as shown in Figure 1.

Brief overview of some key attributes of an Asset are listed in Table 1.

Table 1: Asset Attributes

S.No	Attribute	Description
1	**Item**	An inventory item must be defined first in order to create an asset.
2	**Serial Number**	Unique serial number assigned to the asset.
3	**Enable IoT**	Enables Internet of Things (IoT) integration for enhanced monitoring and predictive maintenance.
4	**Operating Organization**	The inventory organization where the asset is created, operated, and maintained.
5	**Maintenance Organization**	Based on the item setup; displays associated maintenance-enabled organizations. Defaults to the operating organization.
6	**Allow Maintenance Program**	**Y**: Asset can be included in a Maintenance Program. **N**: Asset will not be available for forecasting in a Maintenance Program.
7	**Allow Work Orders**	**Y**: Allows creation of Work Orders, either manually or through a Maintenance Program. **N**: Work Orders cannot be created for the asset.
8	**Asset Meters**	Multiple meters can be linked to track usage and support meter-based maintenance programs.
9	**Default Maintenance WO Type**	Specifies whether the default Work Order type is **Corrective** or **Preventive**.
10	**Default Maintenance WO Subtype**	Subtype used for Maintenance Program-generated Work Orders, typically set to **Planned** for preventive maintenance activities.

2.1.2. Inventory Organization Setup

An Inventory Organization must be created for each entity where assets are to be maintained. These organizations must be **maintenance-enabled**, meaning they are flagged to support maintenance operations. In addition, they must be configured to support inventory transactions, which is established during the Inventory Organization setup process.

An organization can be designated as maintenance-enabled only, or it can also support both manufacturing and maintenance activities, depending on operational requirements.

For a maintenance program to effectively cover an asset, the asset must be operated within the same organization where its maintenance work orders are created and executed. However, the system also supports the creation of work orders for an asset in other maintenance-enabled organizations outside its primary operating organization. This is made possible through the setup of **organization relationships**, which facilitate collaboration and resource sharing across different maintenance entities.

2.1.3. Inventory Item Setup

An inventory item must be defined before an asset can be created. To support the manual creation of work orders or to include the item in a maintenance program through PIM, specific item setups are required and must be properly configured.

Specifications Tab > Service > Asset

- *Enable Asset Tracking* - Full Lifecycle
- *Enable Asset Maintenance* -Yes
- *Enable Genealogy Tracking* - Suggested to set to Yes
- *Enable IOT* - Should be set to Yes if IOT Asset Monitoring will be used

Specifications Tab > Inventory > Material Control

- *Inventory Item* - Yes
- *Serial number control* should be either -

Predefined serial number

Dynamic entry at inventory receipt

Entry at sales order, transfer order or work order issue

Item must be associated to every Maintenance-Enabled Organization in which a Work Order can be created.

2.1.4. Work Definition

A maintenance Work Definition outlines the tasks, task components, and tools necessary for a maintenance or repair job. Thus, they help convert a suggested service task into a specific list of actions, supplies, and tools needed to finish the job.

The Work Definition Operations are executed following a linear path based on the Operation Sequence. A Work Definition must have at least one Operation and it must be associated to a Work Center. You can either use Standard Operations or you can manually define and enter each of the operations.

For Maintenance, each Operation usually includes a “count point”. This signifies that a technician is expected to perform the Operation, confirming they have finished all the steps involved. During this period, any extra materials, resources, or Meter readings may

be recorded. If an operation is not marked as a count point or an automatic transaction, it is viewed as optional.

2.1.5. Setup Standard Operation

To establish a standard operation, organizations must define the specific procedures and expected outcomes, ensuring that all maintenance tasks are performed consistently and efficiently. As illustrated in Figure 2 and Figure 2.1, set up a standard operation with two sequences: one for removing the air filter and another for replacing it.

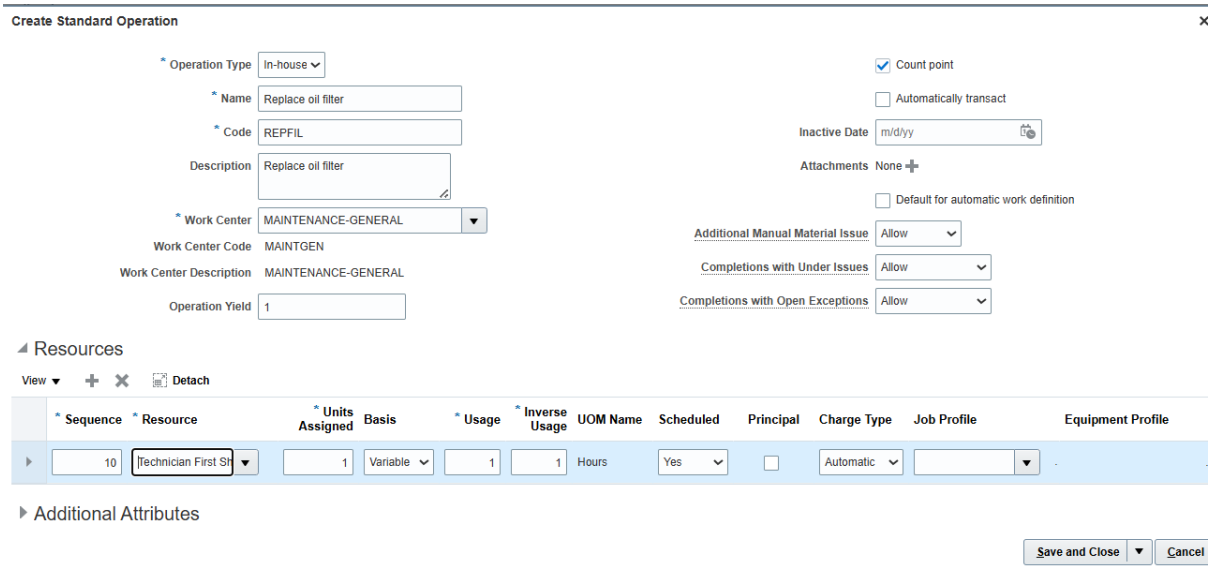

Figure 2: Standard Operation

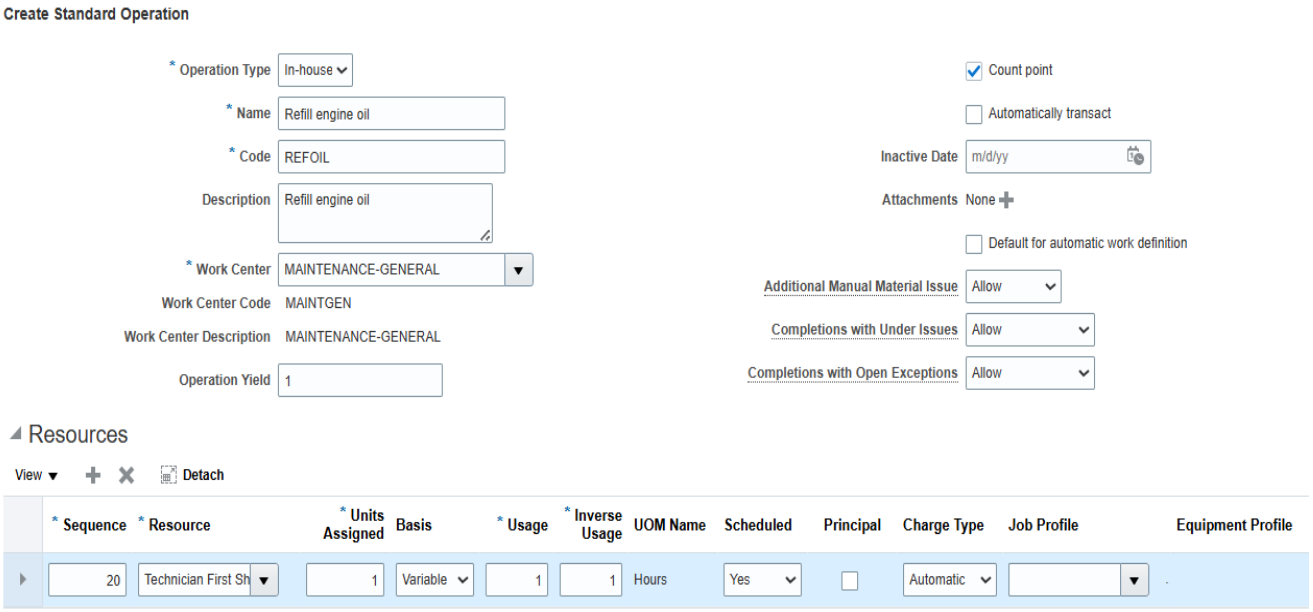

Figure 2.1: Standard Operation

2.1.6. Setup Work Definition

Then the Work Definition would be defined by associated each of the applicable Standard Operations

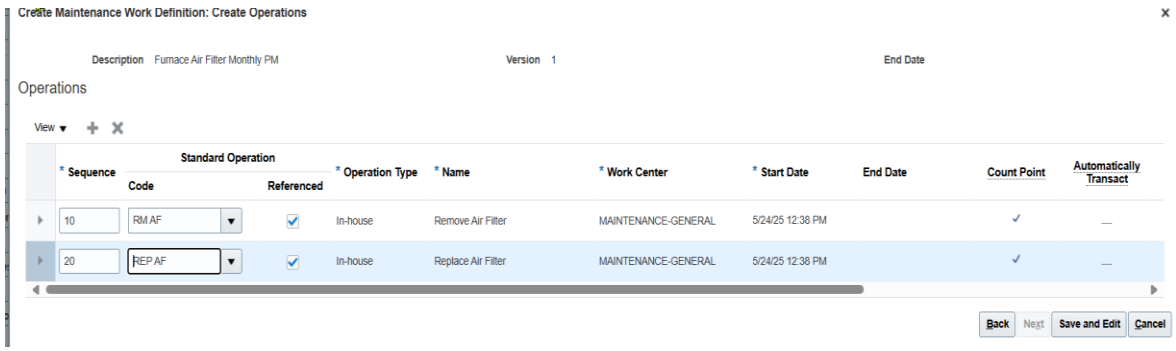

Figure 3: Work Definition-Assigning Standard Operation

Each operation may be examined sequentially within the Editor User Interface. Each operational step involves the specifications of resources as delineated in the Standard Operations. Furthermore, materials may be incorporated into the corresponding steps. The establishment of clear work definitions is vital for ensuring that maintenance tasks are executed with precision and consistency, ultimately enhancing overall operational effectiveness. (Lang et al., 2019) Establishing a well-defined work definition not only streamlines maintenance tasks but also fosters accountability among technicians, ensuring that all necessary steps are completed systematically.

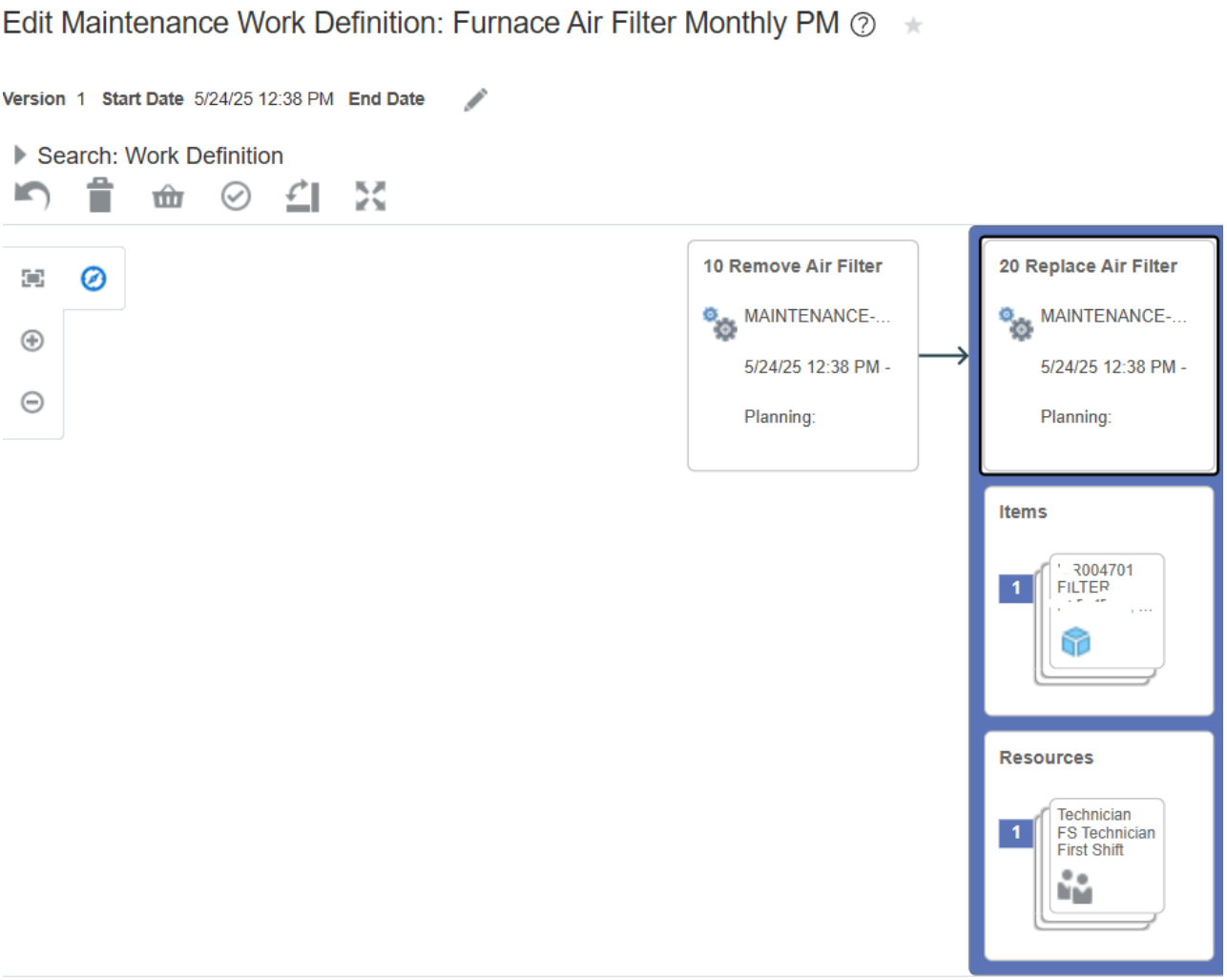

Figure 4: Work Definition- Operation with Resources and Material

Maintenance Program Setup

Once all prerequisite setups are complete, you can begin establishing maintenance programs. These programs also support asset routes, enabling maintenance teams to centrally plan, execute, and document maintenance activities for multiple assets through a single work order.

Typically, maintenance programs are modeled after OEM (Original Equipment Manufacturer) service manuals. These guidelines are adapted to align with the organization's operational needs through the creation of **work definitions**. From these definitions, **work requirements** are established to determine the maintenance frequency. The forecast can be generated based on calendar schedules, day intervals, or utilization meters. This structured approach not only enhances operational efficiency but also supports the development of reliable job standards that are crucial for evaluating maintenance performance and productivity (Duffuaa & Raouf, 2015).

Each Maintenance Program consist of side-tab layout, including header details, Work Requirements, as well as forecast views using a Calendar and Gantt chart component. Actions include *Generate Forecast* and *Create Work Orders*, providing the ability to create,

define, adjust, and forecast a program, before committing to creating Work Orders for an Asset or group of Assets.

The program overview tab also provides infolets with key metrics about the program and its work requirements, allowing planners to understand the current status of the Maintenance Program, the resulting forecast and Work Orders in progres

Here is a view of a Program header and infolets:

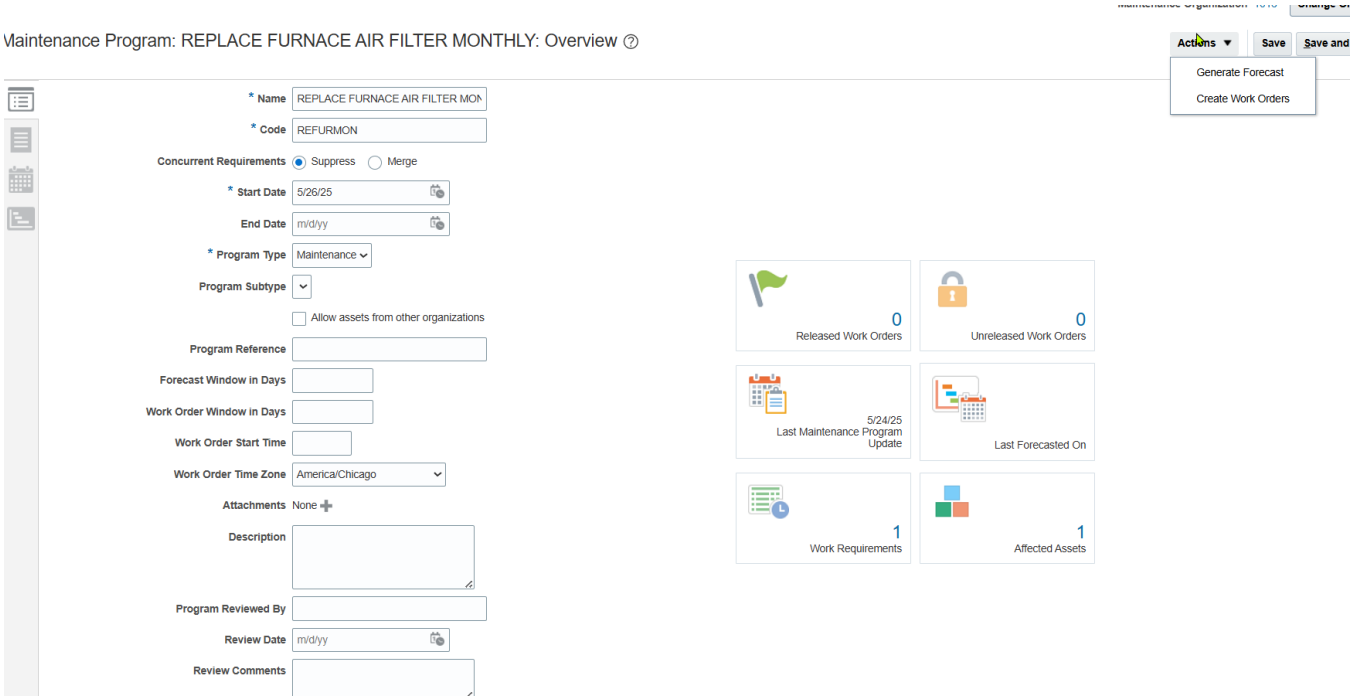

Figure 5: Maintenance Program-Setup

For each maintenance-enabled Organization, there is an Functional Security Management Setup that controls how far into the future the Maintenance Forecast and resulting Work Orders are created.

These horizon profile values are defined in the Plant Parameters for a Maintenance Organization

Here is an example of establishing a horizon to span 1 year for the forecast and 3 months for creating work orders: The period for creating work orders is generally much shorter than the forecast period. This allows the forecast to adjust. The horizon is influenced by how often or how long it takes to create work orders from the preventative maintenance forecast.

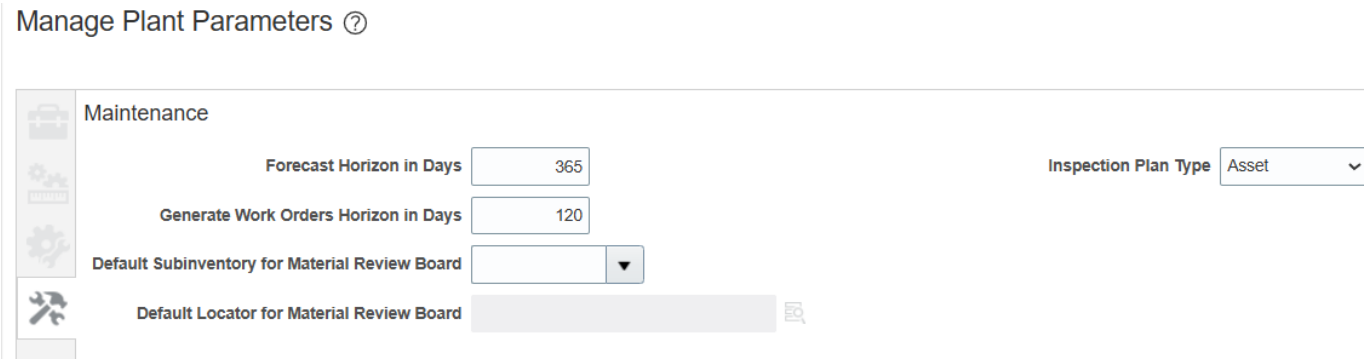

Figure 6: Plant Parameter-Setup for Horizon Days

PROGRAM MODELING

Programs are always created within the context of a specific maintenance-enabled organization. However, before creating any programs, consider whether the program will manage only assets operating within that organization or if it also needs to account for assets used across multiple organizations.

Guidance for modeling maintenance programs is explained in the below Table 2 (n.d.)

Table 2: Program Modelling Guidance source Oracle Document

No	Scenario	Recommended Approach
1	Asset is operated and maintained within the same maintenance organization	Create a maintenance program that manages assets within the same organization.
2	Asset is operated in a non-maintenance organization and maintained by one or more organizations over time	Create a program that is enabled for cross-organization assets.
3	Asset is currently in a maintenance organization but may be operated and maintained by different maintenance organizations over time	Create a program that is enabled for cross-organization assets.
4	Asset is operated in a maintenance organization but may be transferred to another operating organization during its lifetime	Create a cross-organization maintenance program. Define organization relationships to support cross-org work order creation.

Consider the Following Points:

- If you choose to create a cross-organization program, designate a single maintenance organization as the central planning organization. While such programs can be created in any maintenance-enabled organization, modeling them within one central organization helps reduce complexity and enhances visibility.
- Avoid managing preventive maintenance for a unique asset using multiple methods simultaneously, as this can make it challenging to coordinate the same asset across different programs or organizations.

WORK REQUIREMENT

Work Requirement definitions are critical as they detail the necessary tasks and frequency for maintenance activities, ensuring that each asset is serviced according to its specific operational demands and compliance standards. (Swart & Vlok, 2015)

Work requirements can be established for each service interval task or for a set of related tasks across one or more assets. These tasks specify the frequency of service needed, the anticipated resources and materials, and the steps to finish the task.

A work requirement can be established for an asset, an item, or an asset route. An item-based requirement translates to an asset level in the forecast, allowing you to set a shared work requirement for multiple assets.

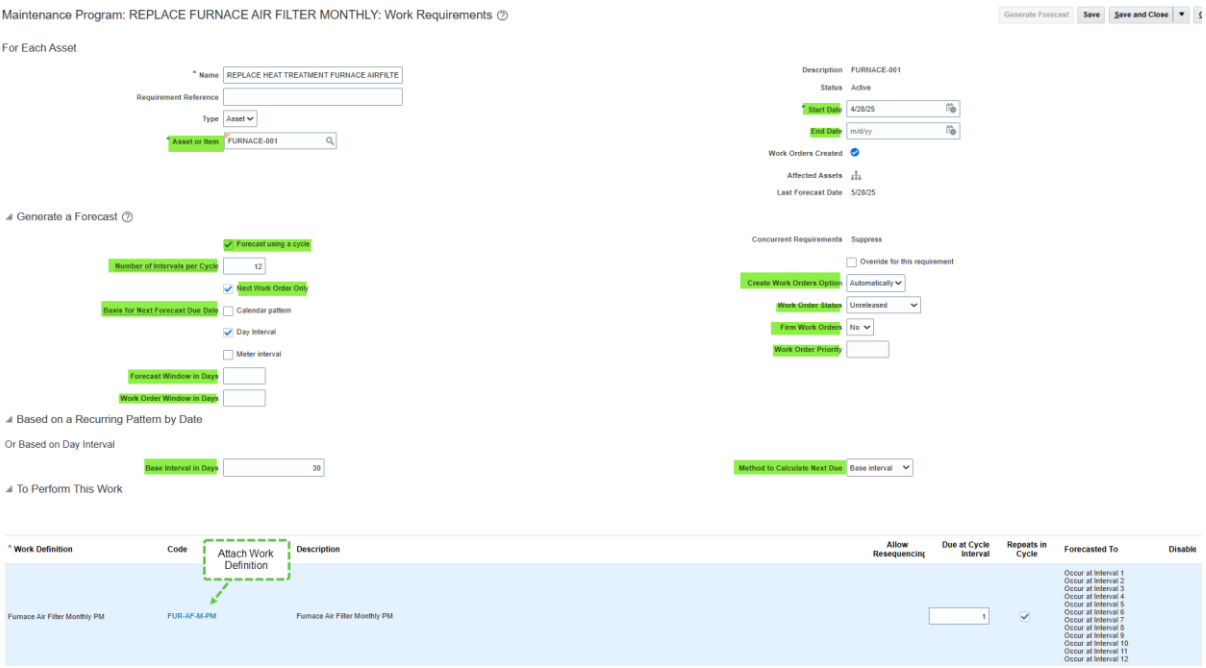

Figure 7: Work Requirement-Setup

Set up the following Attributes as illustrated in Figure 7.

The key attributes of the work requirement are summarized in Table 3.

Table 3: Program Modelling Guidance source Oracle Document

S.No	Attribute	Description
1	**Start Date**	Determines when the forecast begins; drives Interval 1 in a cycle. Without a cycle, sets the first/next due date.
2	**End Date**	The date after which the work requirement will stop generating forecasts.
3	**Create Work Orders Option**	Specifies if work orders are created **Manually** or **Automatically** from the forecast.
4	**Work Order Status**	Defines the initial status of the work order: **Released** or **Unreleased**.
5	**Firm Work Orders**	Indicates whether work orders are firmed (**Yes** or **No**).
6	**Work Order Priority**	Sets the priority level (e.g., 1, 2, 3) used when creating work orders.
7	**Forecast Using a Cycle**	Forecasts are based on a cycle with a defined number of intervals. Users must specify the number of intervals.
8	**Number of Intervals per Cycle**	Total number of intervals in the cycle. The cycle resets after reaching this number (e.g., 12 for monthly PM).
9	**Next Work Order Only**	When enabled, only one work order is created at a time. The next is generated after the current one is completed.

10	**Basis for Next Forecast Due Date**	Can be based on **Calendar Pattern**, **Day Interval**, or **Meter Interval**; follows a "whichever is due first" logic when multiple methods are used.(Calendar vs Meter or Day Interval vs Meter)
11	**Forecast Window in Days**	Forecast horizon in days; uses organization default if left blank.
12	**Work Order Window in Days**	Number of days in advance a work order should be created from forecast; uses organization default if left blank.
13	**Base Interval in Days**	Required if **Day Interval** is selected as the forecasting basis.
14	**Method to Calculate Next Due Date**	Determines how the next work order due date is calculated: • **Base Interval** – uses a fixed interval value • **Last Completion** – based on last WO completion date

Attach Work Definition and choose Repeats in Cycle. It will restart the forecast cycle after the specified number of cycles. Number of Cycles will be displayed based on the settings.

3.Preventive Maintenance Process:

Once all configurations are set, it's time to automate the process for executing the preventive maintenance cycle. It begins with generating the forecast and creating a work order based on that forecast. After the work order is generated, the maintenance supervisor will assess it and approve it for execution. The maintenance technician will carry out the preventive maintenance tasks, report resources and materials in the work order, and subsequently close it. Forecasts are always created based on where an asset is operating at that point in time.

3.1. Generate Forecast

At the maintenance program level, as shown in **Figure 8,** Select Action and generate Forecast.

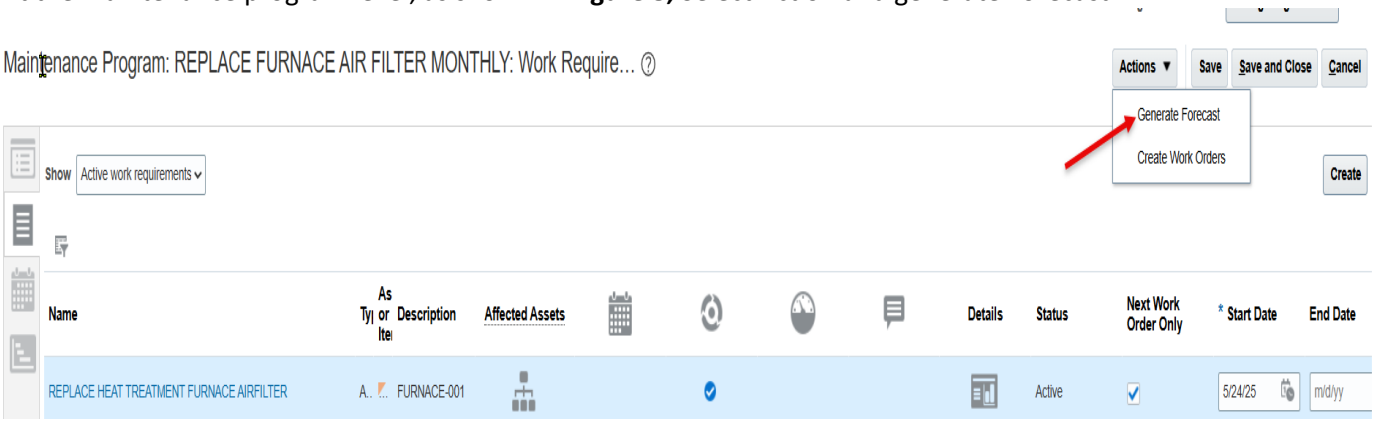

Figure 8: Generate Forecast User Interface

Alternatively, as illustrated in Figure 9, you can totally automate this by setting up the 'Generate Maintenance Forecast' job to kick off at the end of the forecasting cycle or even during it to tweak and create a fresh forecast.

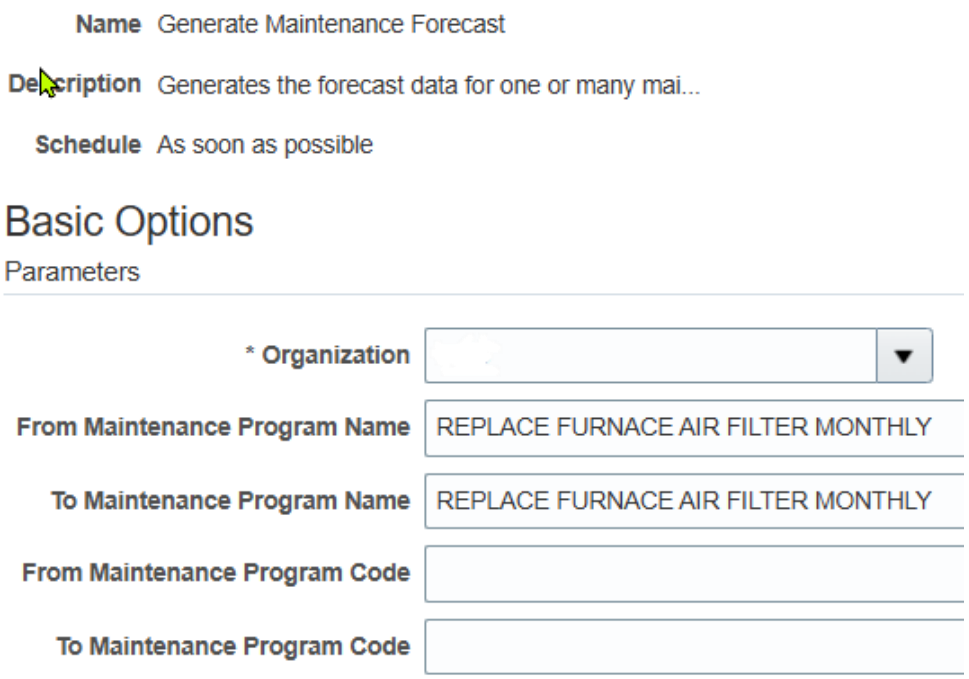

Figure 9: Generate Forecast Job

As shown in Figure 10, The generated forecast can be reviewed using Gant Chart view

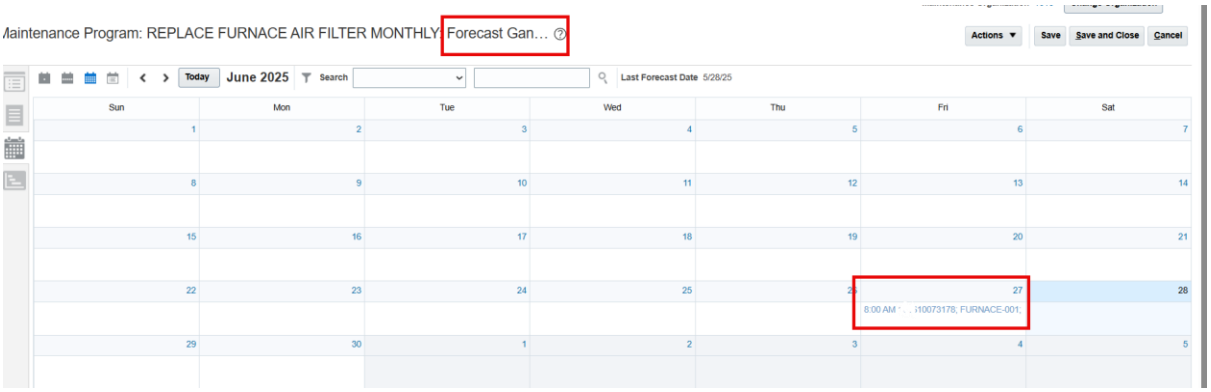

Figure 10: Forecast Gant Chart View

The ability to automate the generation of maintenance forecasts not only enhances efficiency but also empowers maintenance teams to proactively manage their workload and respond swiftly to emerging needs. (Arts & Basten, 2018). This proactive approach to maintenance not only mitigates potential disruptions but also fosters a culture of continuous improvement, ensuring that organizations remain agile and responsive to changing operational demands.

3.2. Generate Work Order

As shown in Figure 11, at the maintenance program level, Select Action and Create Work Orders

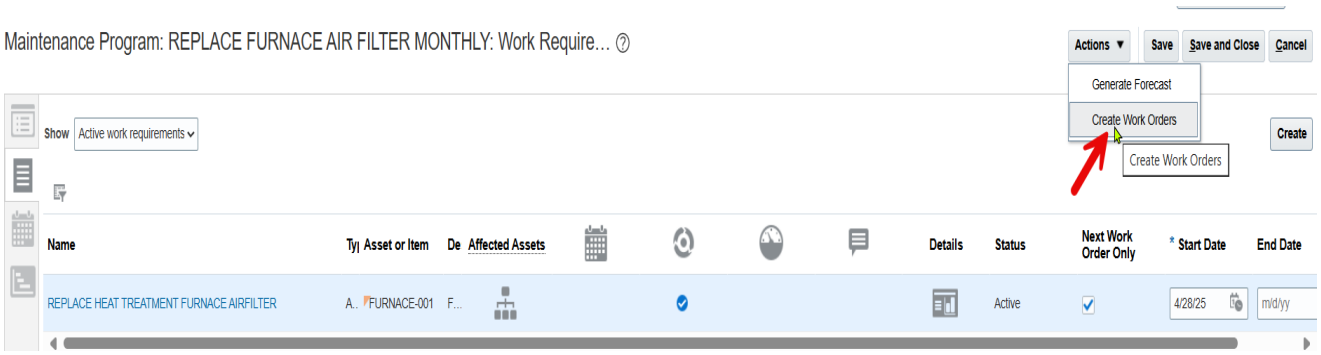

Figure 11: Create Work Order User Interface

Alternatively, this process can be automated by running the **Generate Maintenance Work Orders** job. The parameters for this job are outlined in Figure 12.

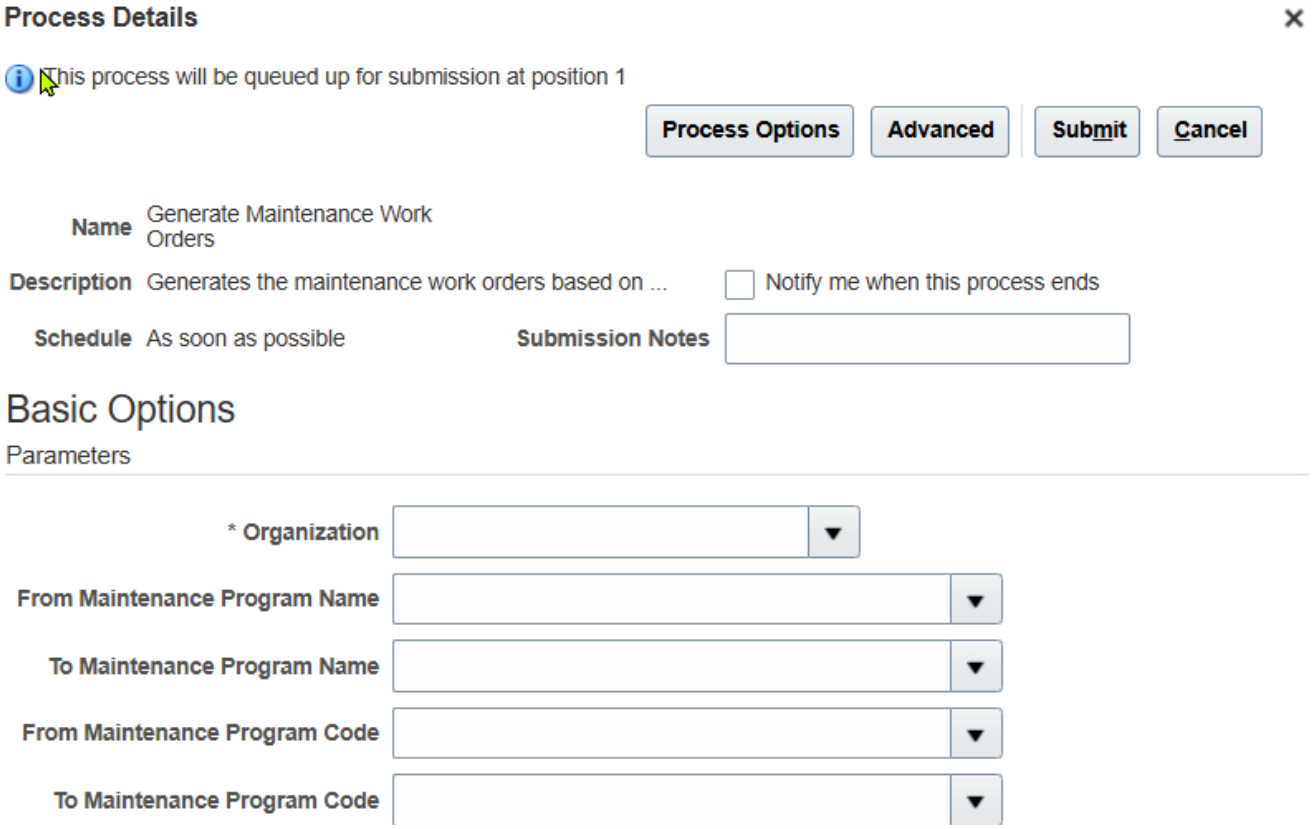

Figure 12: Create Work Order Job

3.3. Execute Work Order

This procedure will generate a Work Order with Type 'Preventive 'and Subtype 'Planned' as shown in Figure 13. After the Work Order is Released, the maintenance technician must complete the task and log the actual hours in the work order before closing it. This process enhances overall productivity by ensuring that resources are allocated effectively and that maintenance activities are executed in a timely manner.

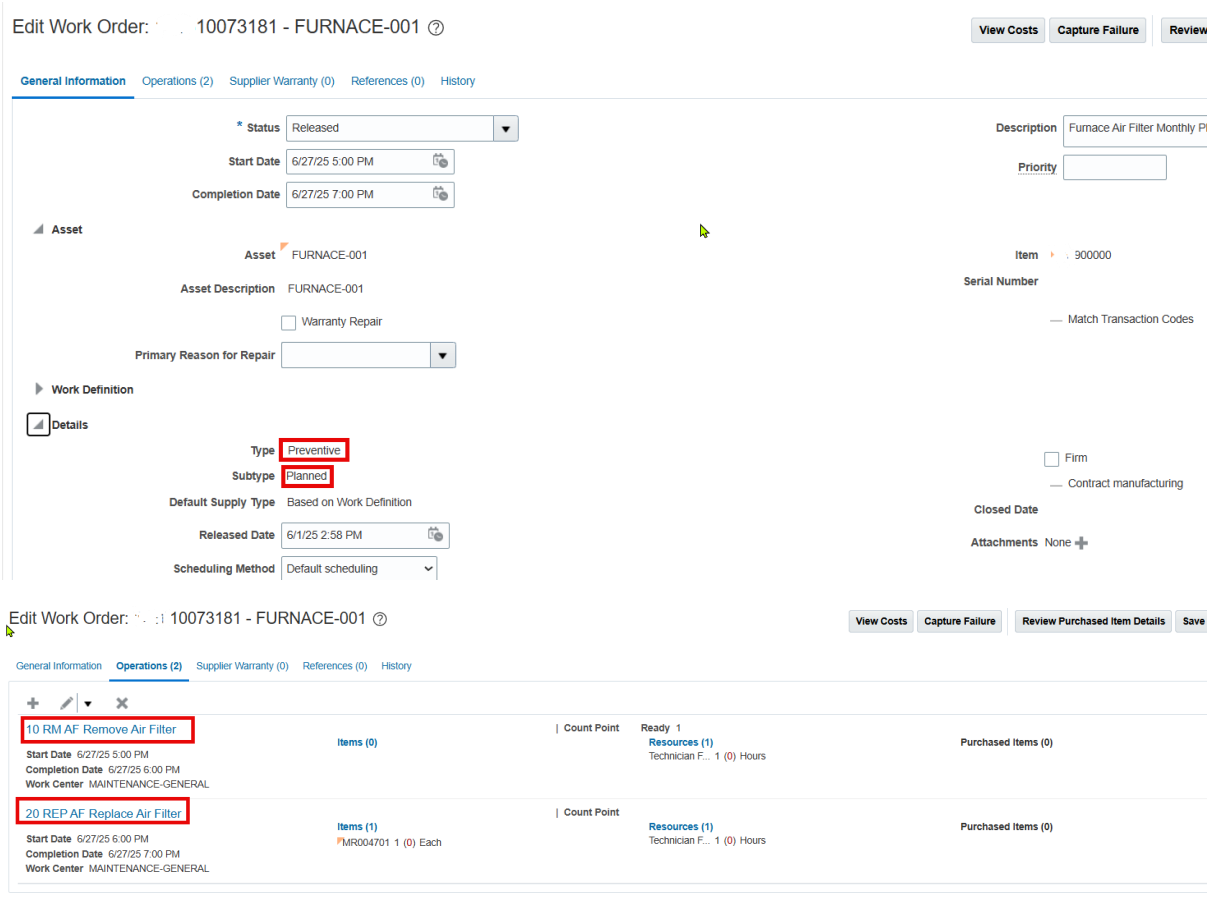

Figure 13: Work Order Operation Details

Maintenance Technician performs preventative maintenance tasks and reports the same in My Maintenance Work. This is Oracle's latest generation intuitive UI and provides a user-friendly interface for technicians to efficiently manage their maintenance tasks, ensuring accurate reporting and accountability in the maintenance process.

Oracle Redwood is a revolutionary design system introduced by Oracle, aimed at redefining the user experience across its applications. It provides a coherent and consistent User Interface (UI) that combines simplicity, elegance, and functionality. Redwood delivers a modern, intuitive look and feel that enhances productivity while ensuring ease of use, both for new users and seasoned professionals navigating Oracle's suite of enterprise applications (Kovaion,2024).

Technicians execute the job and report actual resource usage. As shown in Figure 14, the status of the reported resources is displayed in the Resource section. This action updates the work order and charges the associated resource costs.

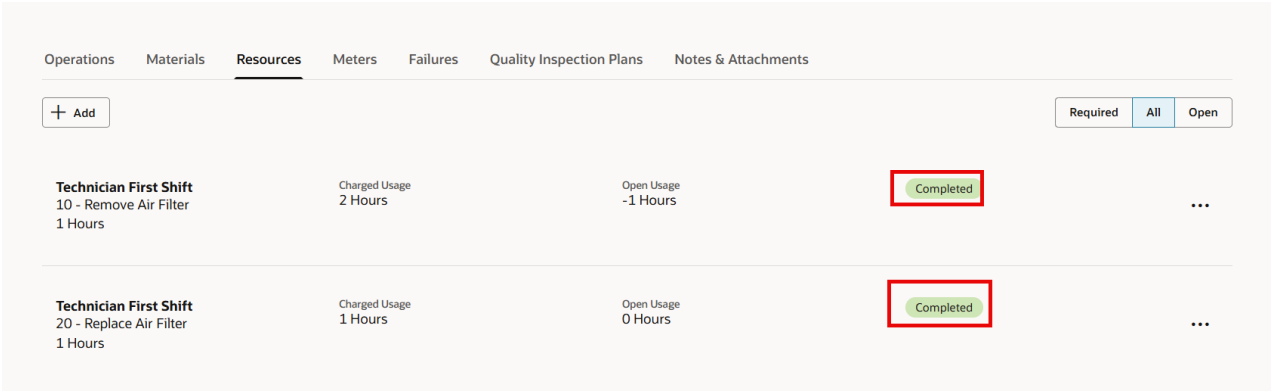

Figure 14: Technician UI- Resource View

Reported materials will be displayed in the Materials section, as shown in Figure 15.

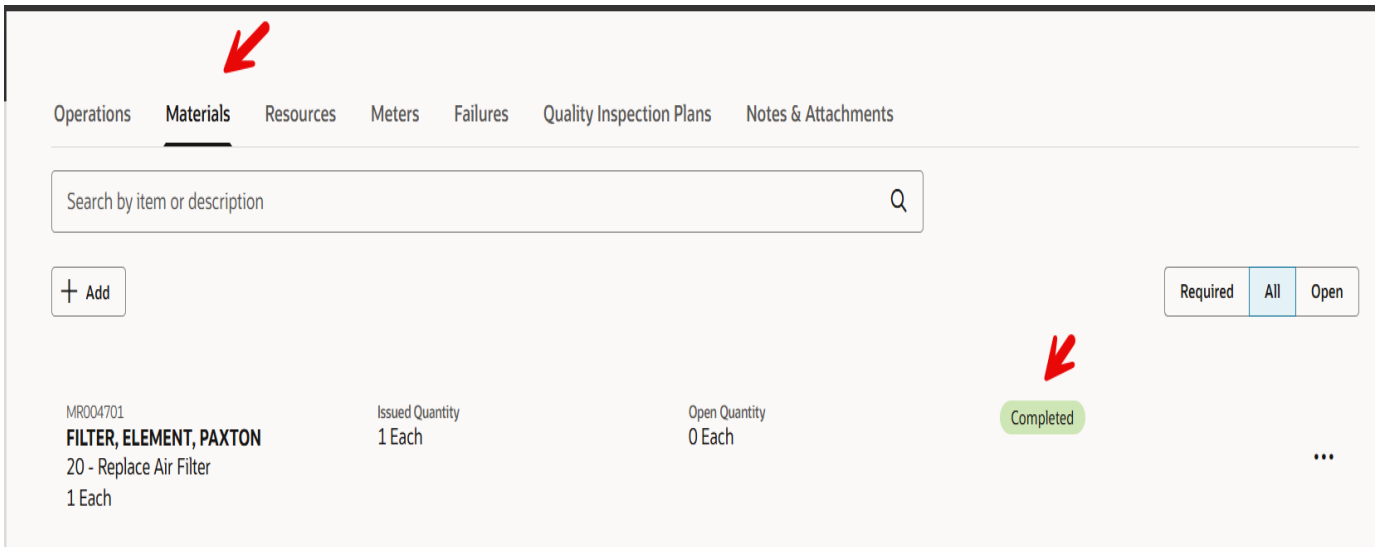

Figure 15: Technician UI- Materials View

Once resources and materials have been reported, the corresponding operations can be marked as complete. The operation status is displayed in Figure 16.

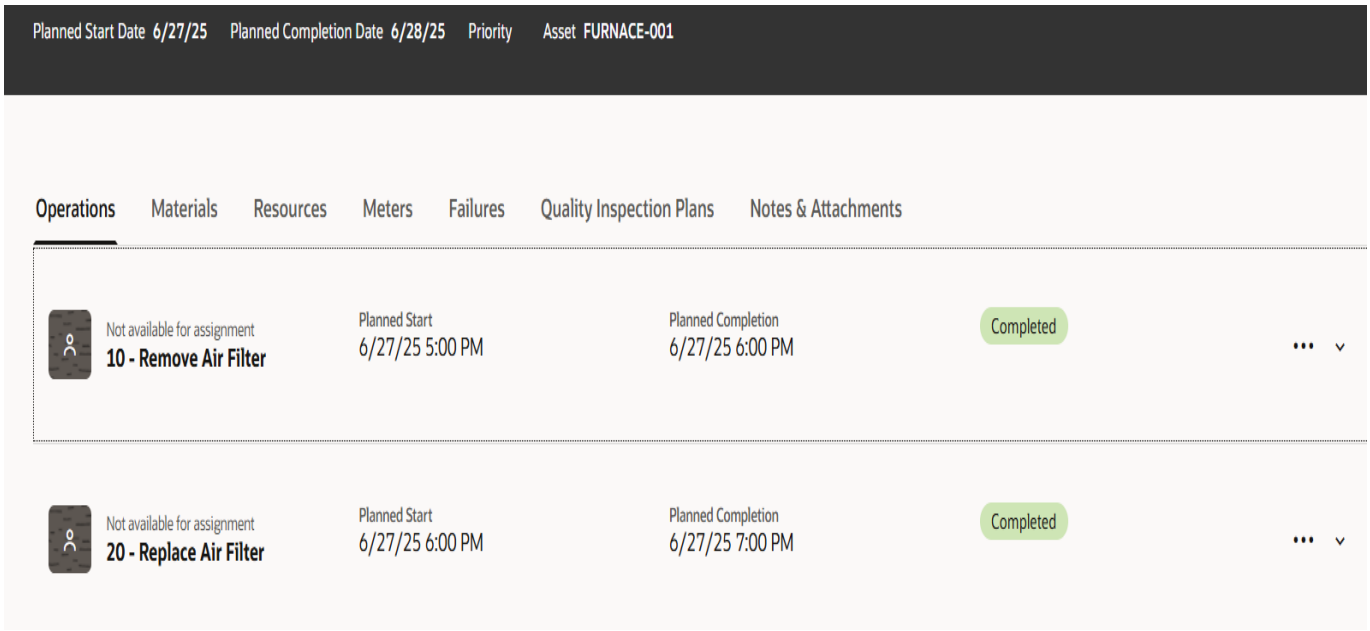

Figure 16: Technician UI- Operations View

The Reporting Overview offers a comprehensive view of resources, materials, meters, inspection results, notes, and more, as illustrated in Figure 17.

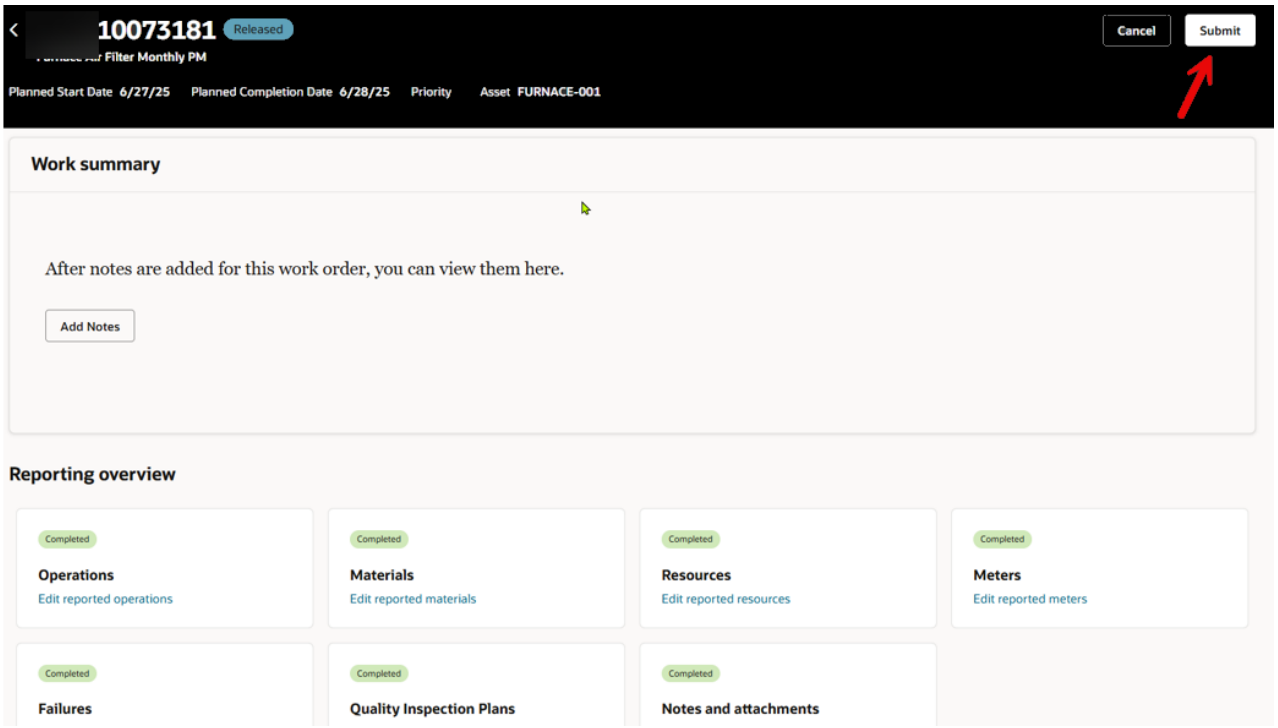

Figure 17: Technician UI- Reporting Overview

Finally, as shown in Figure 18, the work order status will be updated to "Complete" once the technician has performed all maintenance activities.

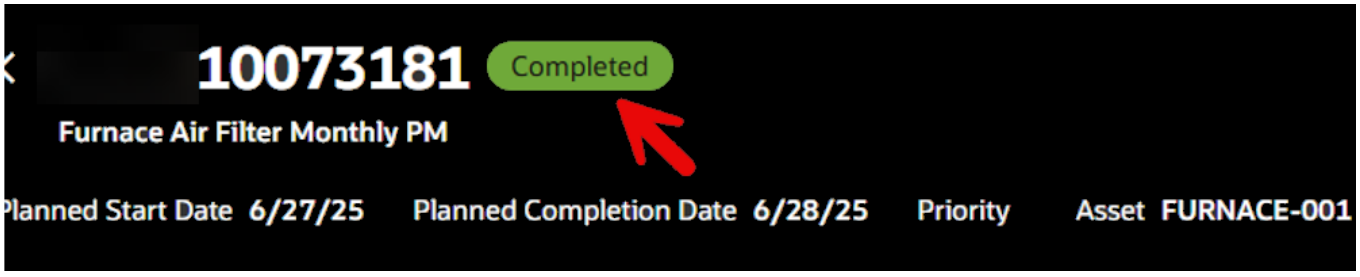

Figure 18: Technician UI- Work Order Status

The integration of Oracle Cloud Maintenance Automation not only streamlines maintenance workflows but also enhances the ability to generate and manage electronic work orders efficiently, thereby improving overall operational effectiveness (Xiao et al., 2011).

Operations can be completed once resources and materials are reported

4.Benefits of Automating Preventive Maintenance:

- **Financial Gains:**
  - Achieve ROI between 300% to 545% over three years (Oracle, 2023; Nucleus Research, 2023).
  - Reduce unplanned downtime by up to 45% (Saini et al., 2024).
  - Save approximately 40% in maintenance labor and related expenses, enhancing asset reliability and lifecycle management (Xiao et al., 2011).
- **Operational Improvements:**
- **Strategic Alignment:**

- Utilize Oracle Cloud's predictive analytics and automated workflows to proactively manage maintenance.
- Align operational maintenance activities with broader business goals, turning maintenance into a strategic competitive advantage (Zhang et al., 2016).

- **Efficiency and Agility:**
  - Streamline maintenance operations for improved resource management.
  - Increase organizational agility to swiftly adapt to evolving industry demands and challenges.

5.Area of Improvement

Identifying key areas for improvement within maintenance operations is essential for maximizing efficiency and ensuring that resources are utilized effectively.

- Review maintenance forecast UI : A primary challenge with the current forecast UI is that when forecasts are spread across the year, users must manually access each individual bucket (monthly/weekly) to view the distribution. This lack of a consolidated view can lead to inefficiencies in planning and resource allocation.

  To address this, forecast data can be exported to Power BI, where a more user-friendly, custom interface can be developed. This approach enhances visibility and supports more informed decision-making.

- Oracle Maintenance lacks a built-in alert or notification system to inform maintenance supervisors when a preventive maintenance work order has been completed, necessitating supervisors to manually check the order to confirm that all tasks meet their standards. This issue can be resolved by utilizing the Oracle Alert Composer Tool and the Alert Type Event Alert, which are designed based on the context supplied by the calling client. These alerts can be set up to trigger notifications when specific conditions are met, such as when the work order completion event takes place within the application. This will greatly improve oversight and guarantee that maintenance tasks are executed promptly.

- Oracle has provided a dashboard specifically for the maintenance program level; nevertheless, a consolidated dashboard that includes the status of all preventive maintenance programs across the organization could be developed to present a comprehensive overview, facilitating more informed strategic decision-making and enhancing overall operational visibility. To fill this gap, a custom dashboard can be created utilizing Oracle APEX (Thokala, 2025),which is a low-code application that can connect with Oracle REST APIs, allowing users to log in through their Single Sign-On. This enhancement would empower maintenance supervisors to effectively manage all programs and proactively address any inconsistencies or delays. By implementing these enhancements, organizations can further optimize their maintenance operations and ensure a higher standard of service.

6.Conclusion

The implementation of Oracle Cloud Maintenance Automation significantly transforms preventive maintenance operations, resulting in notable improvements across multiple dimensions. Key takeaways from this research include:

- **Financial Gains:**
  - ROI ranging between 300% to 545% over three years (Oracle, 2023; Nucleus Research, 2023).
  - Significant cost reductions from streamlined maintenance practices (Saini et al., 2024; Xiao et al., 2011).

- **Operational Enhancements:**
  - Reduction in unplanned downtime by up to 45% (Saini et al., 2024).
  - Savings of approximately 40% in maintenance labor and associated costs (Xiao et al., 2011).
  - Increased organizational flexibility to rapidly adapt to evolving industry demands and challenges (Chang et al., 2016).

- **Strategic Advantage:**

- Enhanced proactive maintenance through predictive analytics and automated workflows (Zhang et al., 2016).
- Improved alignment of maintenance operations with organizational strategic objectives (Petersdorff, 2013).

Despite these considerable benefits, several limitations remain, such as the current system's lack of integrated alerts for completed work orders and fragmented forecast visualization, necessitating enhancements in user interfaces and notification systems.

Future work to further enhance Oracle Cloud Maintenance could include:

- **AI-Based Anomaly Detection:** Implementing advanced AI analytics to detect and predict equipment anomalies proactively (Saini et al., 2024).
- **Digital Twins:** Integrating digital twin technologies to simulate asset performance and optimize maintenance schedules (Ariansyah & Pardamean, 2022).
- **Mobile Field Enablement:** Developing robust mobile applications to support real-time reporting and seamless integration of field maintenance tasks (Lang et al., 2019).

Exploring these advancements would further solidify the role of Oracle Cloud Maintenance Automation as a strategic pillar for operational excellence in asset lifecycle management.

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