The Right Maintenance on the Right equipment at the Right time: Getting it Right the first go around

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Abstract

The Smithsonian Institution (SI) is the world’s largest museum, education, and research complex. SI is a diverse complex of 21 museums, 21 libraries, the National Zoo, numerous education, and research centers, including the Smithsonian Astrophysics Observatory, Smithsonian Tropical Research Institute, Smithsonian Environmental Research Center, and Smithsonian Science Education Center both inside the Unites States and in host countries. SI facilities are managed and maintained by the Office of Facility Maintenance and Reliability (OFMR).

The mission of OFMR is to operate and maintain cultural facilities and provide services that support the SI mission. OFMR is responsible for almost 40,000 individual assets in its Computerize Maintenance Management System (CMMS). Among other functions, the Asset Management Division (AMD) in the OFMR is responsible for developing maintenance strategies, plans, procedures, and task instructions for the preventive maintenance of all the assets owned by the SI. The challenge facing OFMR is keeping the asset records of equipment spanning multiple decades that is required for a good maintenance planning accurate and with complete data in the system.

To get to where we need to be, the OFMR has set to improve its asset management program to focus on the right maintenance plan for the right asset in a timely and effective manner. We are focusing on verifying asset information, developing detailed work plans, job procedures, and schedules to improve the OFMR’s preventive maintenance plan efforts. We have embarked on a journey to verify and improve the asset registry for all assets and ultimately improve PM procedures especially for the those assets that are essential to maintaining operations and achieving the organizations mission. This journey also involves training staff to utilize asset management tools to develop the right strategy and embrace a future of SI OFMR where asset downtime is brought to a bare minimum.

Introduction

The nightmare of all organizations is experiencing downtime of equipment, and lacking the resources to bring the equipment back to working condition in the shortest amount of time. Some of the factors that cause assets to fail is a lack of or over maintenance, age, and operator error. At SI, improving our asset inventory and maintenance work strategies is a priority. Our immediate goal is optimizing our preventive maintenance program to ensure that our assets perform as expected and when needed. However, to develop a good preventive maintenance strategy, it is important to know what we own, where they’re located, asset condition, criticality and what maintenance is required.

The Smithsonian Institution’s approach to a great preventive maintenance program follows a 4-step process. This process includes 1) asset verification; 2) asset condition assessment; 3) asset criticality assignment and 4) maintenance scheduling, monitoring and execution.

A phased approach to achieving our goal

The Asset Management Division of the Office of Maintenance and Reliability started from the basics. Production Schedulers from the Work management Branch located all building assets (HVAC, Electrical and Mechanical equipment) and documented pertinent information. The asset verification exercise was conducted to ensure that OFMR obtains an accurate account of SI’s assets, relevant information and attributes that are used for identifying assets, with the goal of ensuring that we provide the right
maintenance to the right equipment at the right time. Existing data from the CMMS was downloaded to mobile spreadsheets where updated information was recorded for each asset.

The following data improvements were made as a result of the verification:

- Equipment previously classified as main assets were reclassified as components following the new Asset Hierarchy guideline.
- Duplicate assets were removed from inventory.
- Asset information was updated to ensure we capture pertinent information in our CMMS. This included the date of installation and life expectancy, condition, pictures, and O&M manuals, updated legible asset tags and the correct CSI Codes.
- Assets that weren’t located or didn’t exist due to replacement or decommissioning of asset were removed from our CMMS.

The inventory verification process is an important step to ensuring the accuracy and integrity of the museum’s inventory records. The process will ensure that the CMMS is less cumbersome and allow us to utilize resources in the most efficient manner. Following the verification process, asset hierarchy was developed for the electrical, plumbing and HVAC systems to create a logical structure that will inform the right preventive maintenance for each asset/component in the structure. The verification exercise also included a visual inspection of the assets. The assets were inspected based on the OFMR/AMD condition assessment guidelines and documented the condition, age, and life expectancy of the assets. Assessing the condition of the assets is a huge step in identifying the assets that need to be replaced, repaired, retired, or disposed of. The results of the verification will be used to make recommendations for future improvements to our facility systems.

The third step in the phase was assigning criticality to the assets. This approach employed a 3-tier management level approach. Assets that were categorized into Tier 1 management level are the highest risk to life safety and sustaining operations. Failure of Tier 1 assets could result in death, injury, loss of collections, environmental non-compliance, or building(s) closure. These assets may have a single point of failure and repairs are difficult (time, skill, expense). These assets are considered the most critical and preventive maintenance will be performed on 100% of all proactive tasks annually. In the event of a failure, root cause analysis (RCA), and failure reporting analysis & corrective action (FRACAS) will be conducted for these assets.

Assets that fall within the Tier 2 management level are of moderate risk to sustaining operations. Failure of Tier 2 assets could result in minor injury, have minimal to major impact to collections and manageable impact to behind-the-scenes operations. Failure of these assets is detectable and there is redundancy, or temporary solutions are available to keep the building in operation. Preventive maintenance will be applied as identified or as required. Assets in the Tier 3 management level have minimal impact to collections or buildings. These assets are maintained as required and often replaced than repaired.

Our Strategy

With improvement of the asset inventory database, we will be able to improve work scheduling, monitoring and execution. Our aim is to drastically reduce unplanned/unscheduled work and minimize asset downtime while improving the lifecycle of our assets. However, with over 40,000 assets in the CMMS, this endeavor will take several years to accomplish. The SI has a goal of completing the verification of all the assets in its 600 facilities by FY26. Upon the completion of the asset verification for each building, generic PM plans that already exist in the CMMS will be utilized for maintenance
scheduling to keep our assets running. The second phase of our strategy will be a more tailored PM strategy for each asset. Early detection of failure using predictive technologies and monitoring will make up 45% of total Maintenance Work carried out on our assets.

Our Target Condition

It’s important to develop a vision of where we want to be in the short term and in the long term. Our short-term target condition is where we would like to see SI assets in the next two (2) years as it relates to our asset inventory, maintenance work scheduling, monitoring and execution.

- Accurate asset information and required PM developed.
- Reduce Unplanned and unscheduled work
- Prioritize preventive maintenance and corrective work for all facilities
- Follow a standardized procedure for work scheduling at all facilities
- Educate facilities teams on work task flow, responsibilities, and their role in the process.
- Reduce downtime through preventive maintenance and identification of any corrective work required.
- Eliminate defects through work execution
- Ensure assets receive the needed maintenance at the right time.
- Collect accurate feedback on completed tasks, improve data quality, failure reporting analysis.
- Develop the use of predictive technologies by maintenance technicians.
- Incorporate use of internal CMMS for maintenance performed under central contracts.
- Establish KPIs for work scheduling, monitoring and execution (Schedule compliance, data collection and accountability)
- Audits and continuous monitoring

Our Challenges

The Smithsonian has more than 600 facilities and 14 million Sq Ft of space to maintain throughout our facilities portfolio. Each area/building having their own maintenance team, that overtime have developed their own ideas of how maintenance should be done due to lack of standards.

As with any large organization, especially one with a purpose, vision, and a customer base as great as the SI’s, we continue to face challenges every day with the greatest of these being time. Our assets continue to age, and time is against us even in the face economic pressures and inconsistent supply chains. We lack consistency of standards across our buildings and facilities. We are navigating a major culture and mindset shift with our staff towards implementing standardized maintenance routines.

What we stand to benefit

We are confident the established target conditions will provide the following benefits for our facilities.

- Maintenance and repairs will be performed efficiently and effectively to decrease downtime and increase the life cycle expectations of our assets maximizing our facilities operation in a sustainable / cost-effective manner.
- Resources will be utilized in the most efficient manner (avoiding delays and down time).
- Historical data and record of work completed will be stored and used in enabling decision making and continued improvement of the Asset Management Program.