



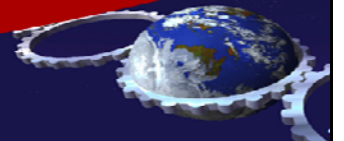
White Paper

Enterprise Asset Management (EAM) for Mobile Assets

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This whitepaper discusses some of the challenges which present themselves in tracking, managing, and monitoring mobile equipment. Several solutions and requirements for successful EAM implementation and utilization are discussed.

Introduction

Mobile equipment presents unique challenges to maintenance and operations personnel in utilizing EAM systems to support reliability and cost optimization.

Problem Statement

There is significant difficulty in tracking repairs, PM's, and the condition of mobile equipment associated with their transient nature, rotating and sequential "ownership", and lack of mobile computing support in many organization.

Previous Options

Equipment history documentation has frequently been fragmented, incomplete, and underutilized by field personnel.

Optimum Solution

This white paper proposes several approaches, and organizational support requirements, to full leverage the power of EAM systems to support mobile equipment and provide reliability and availability to the field organizations which use and maintain them.

Assets can generically be classified as:

- **Fixed** - Meaning they are fastened in-place, and are not typically moved during their operational use.
- **Portable** - Meaning they are not fastened in-place, and can routinely be moved during their operational use, but not usually under their own power.
- **Mobile** - Meaning they are not fastened in-place, and are typically powered to move during their operational use. Mobile equipment can operate in different environments:
 - **"Locally Operated Mobile Equipment"** - Stationed to move locally at an operational base or facility,
 - **"Remotely Operated Mobile Equipment"** - Field operated away from an operational base or facility.

Today's major Enterprise Asset Management (EAM) software systems have both the capability and flexibility to support various asset types. Unfortunately, many implementation strategies do not leverage these features. This often results in mobile assets not achieving the same level of reliability and cost optimization as their fixed counterparts.

Some major industries and agencies that have special requirements for Mobile Assets are:

- Utilities (Public and Private)
- US Government/Military
- Transportation
- Aviation
- Mining (Large scale surface)
- Construction

Unique challenges for Mobile Assets include:

- Field operations require additional safety and regulatory considerations:
 - The US Military has determined that maintenance-related accidents are responsible for 20 percent of all military on-duty injuries. A great percentage occurs during mobile operations.
 - A high probability of environmental excursions during operation and maintenance.
- Communication systems requirements.
- Access to historical data and technical manuals.
- Scheduling/coordinating operational support.
- Scheduling/coordinating asset care requirements.
- EAM systems need unique parameters and interfaces with other systems (GIS, External Procurement, Drawings, Document Control, etc.).
- Equipment operates far from maintenance/logistical support.
 - Generally high criticality without redundancy.
 - Equipment usually operates in extreme environments.
 - Routine Preventive Maintenance not totally effective reducing "road calls".
 - Repair parts/materials reliability during transport and remote storage.
 - Repairable/rebuildable components require special consideration.
 - Organizations are tempted to create separate systems rather than integrating with existing ones

Solutions must be developed to deal with the distance and time separating remote workers and their equipment from subject matter experts and other technical resources.

EAM Systems must support these solutions by providing the ability to locate/track assets and crews, stream live video, share real-time images, enable direct multi-participant discussions, and onscreen drawing to enable based experts and remote workers to collaborate in real time.

EAM Systems can be configured and used to:

- Provide the needed interface between the main base and field-service organizations.
- Reduce costs of labor and mileage.
- Increase the life cycle of remotely operated equipment.
- Capture lost revenue of equipment rentals and services.
- Reduce management time spent on dispatch scheduling and coordination.
- Increase the uptime and availability of remotely operated equipment.

Continuous monitoring of the asset operating parameters allows base maintenance support to be automatically notified of asset care requirements outside the cyclical scheduled service. This allows maintenance to be based on regular schedules, runtime hours, and/or problems detected during operation.

Remote access to the EAM System provides the ability to look at equipment history (failure information), diagnose the problem (remedy objects), and request specific services to remedy the problem (remedy actions).

Maintenance support must have the capability to find the nearest available service base or mobile technician, communicate the needed service/repair to the technician, who then has an understanding of the problem and the necessary repair parts as they arrive, or on the next field visit. GPS location services can also provide the field technician with the nearest medical facility, parts supplier, and listing of opportunity work within a geographic radius.

EAM interface with multi-node mesh networks is the ideal solution for providing universal data connectivity in remote operations. Self healing and automatic configuration provides reliable and continuous connections with fixed and mobile platforms in rugged terrain, for monitoring and controlling:

- Vehicle Telemetry & GPS Location
- Sensor Networks
- IP Video Transport - Health, Safety & Surveillance
- Email & WEB Access
- Network Analytics
- Voice Communications (VOIP)
- Appliance Network Devices
- Vehicular condition monitoring & dispatch/routing
- PLCs & HMI Automation
- Local area GPS augmentation
- Personnel Location Tracking

A properly configured EAM System coupled with GIS location technology can help provide a "Visual Firewall", to prevent mobile asset incursions into active and/or dangerous areas. This can include active taxiways, blasting areas, active track and roadways, etc.

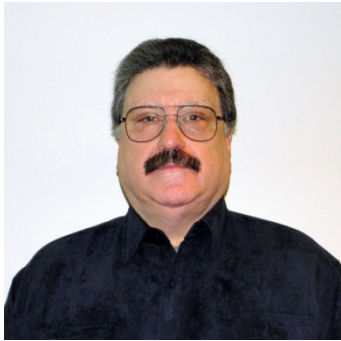
Digital data transfer devices are readily available to include optical and electromagnetic scanners, radio frequency identification (RFID) devices, and electronic contact sensors. These devices use automated data transfer to capture data from equipment that is being maintained, serviced, and repaired. This data can then be uploaded to the EAM System (real-time or batched) where it can be alarmed and trended. This can occur at a nearly error-free rate (one error every 10,000 uploads). When compared to a skilled typist at a keyboard (one error every 300 keystrokes).

Current cost constraints and advanced technological sensitivities have made it essential to identify and then provide immediate rectification of equipment failures. This must occur as early in the P-F (failure) curve as possible. At the same time organizations have been cost constrained in providing maintenance support. Over the past few years even the US Military has been required to operate within these same constraints. It has moved from a 4-tiered approach to a 2-tiered approach. A flatter organization requires that field operations become more autonomous. Accomplishing this requires a different logistics approach. Basic asset care and maintenance support must exist at the point of operation. One key factor is to empower the operating crews to become better asset care providers as well as reliable operators.

The US Military has determined "To have a successful unit maintenance program that supports mission accomplishment, leaders must start with their operators and crews. Operators and crews must know how to detect and report malfunctions as well as operate equipment properly and safely. An atmosphere of pride and "ownership" of equipment on the part of operators and crews enables that to happen. A disciplined routine and self-motivated pursuit of excellence help to ensure operators and crews perform PMCS [Preventive Maintenance Checks & Services] to achieve the Army Maintenance Standard." Achieving this requires organizations to ensure that the operating crews are incorporated into all asset care strategies, whether locally or remotely supported." A properly configured and deployed EAM System allows operating crews to:

- Know their responsibility in achieving the appropriate level of reliability and operating cost for their assigned equipment, and how it contributes towards those same goals for all like organizational equipment.
- Have access to instructions and SOP's for:
 - Proper operational/good-run settings
 - Basic preventive checks and services
 - Proper cleaning and transport requirements
- Ensure that all equipment faults are identified and corrected in a timely manner.
- Follow established safety procedures when operating and maintaining equipment.
- Have current licenses and training to operate all assigned equipment.
- Ensure that equipment is kept in a clean and secured condition.
- Have access to the necessary facilities, instructions, tools, and time for maintenance.
- Participate with maintenance personnel during services.
- Have adequate supervision by technically competent support leaders.
- Properly execute repair-and-return-to-stock programs.

The Author:



M. Bruce Gill is a recognized and award-winning reliability specialist. He is the winner of both the Best Maintenance Organization award and the Facilities Management Excellence Award during his tenure as maintenance manager for General Electric's Aircraft Engine Division. His career as a reliability specialist and consultant also includes Six-Sigma and Lean certification, Statistical Process Control, and several other bodies including ISO, OSHA, and MSHA.

Bruce is currently the Director of PCA's Reliability Focused Maintenance Teams and assists his clients in the identification and execution of significant projects to improve equipment reliability, longevity, and availability.

In this role at PCA, Bruce has personally managed reliability projects for companies like:

- U.S. Gypsum
- IMC Agrico
- PaperWorks
- Bowater
- CSX Transportation
- Newmont Gold
- Harley Davidson
- St. Gobain

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