

## Case Studies: Deploying CMMS Systems on Mobile Devices

### Robert Garbus, PMP, CMRP

As part of the 'Work Management' pillar of information, effective use of a Computerized Maintenance Management System (CMMS) is essential to an effective maintenance organization. As wireless networks have become more prevalent throughout manufacturing and processing facilities and tablet devices have become more affordable, there has been a move to access the CMMS system in the 'field' or near the equipment rather than accessing the application back in an office on a traditional desktop computer. This document discusses the consideration of moving the CMMS from traditional desktop to mobile devices.

Based on real life implementations by the author, there are a huge number of factors that must be considered when deploying this technology;

1. What are the organizational goals in providing mobile access to the CMMS system?
2. What devices are best for the environment?
3. What are the costs and benefits of the different types of devices available?
4. How will the ability to access the CMMS system impact the efficiency of skilled trades with respect to wrench time, job travel time, parts search time and time using the system?
5. How will the devices be secured?
6. If internet access is now available to skilled trades, will this create a work diversion?
7. Is barcode functionality possible and if so, how will the equipment and stock be labeled?
8. Will the device and software allow for uploading photographs taken with a phone or tablet?

As this list indicates, the deployment of mobile CMMS devices is no small task. This paper will discuss lessons learned from deploying software in many different types of organizations including manufacturing, universities and power generation. After working with several customers using tablets, laptops and phones, it seems as the most favored mobile device is the handy cell phone accessing the CMMS via an APP however some customers prefer the lower cost of a small tablet using a browser based application or an IOS/Android app.

### CMMS Basics

Computerized Maintenance Management Systems (CMMS) date back to the days of mainframe computers. Today, CMMS deployment options include the following;

Type of Deployment	Description
Client Server	Software installed on Windows workstations accesses the database on a server
Application Server	The software is installed on an application server which access the database server. Client computers may require a small program to run.
Browser Based	Program runs under browsers such as Internet Explorer, Edge, Mozilla, Chrome or Safari accessing a webserver which in turn talks to the database server.
Virtualized Application	Similar to Client Server and Application Server, software is installed on a Citrix or VMWare Server which communicates with the Database Server.
iOS or Android App	App Software is installed on an Android or iOS device allowing access to either a hosted cloud server or a local Webserver and database server.
Cloud Based	When a CMMS software product and database is run completely on the software provider's servers.

	Options include 100% web based and 100% App based.
AS400, Mainframe or Unix Based	Might still be a few older technology applications in existence.

Many CMMS providers allow for a combination of different technologies. For example, Work Requests may be entered via a simple web page but the resulting work orders are completed by the maintenance technicians using a Windows client or a phone app.

Most current CMMS users have the program and database running on corporate servers however there has been a growing trend to have the CMMS hosted in the Cloud. This means the data and programs reside on the servers of a software provider and the system is accessed through a web browser, virtual application utility such as VMWare Horizon or Citrix, or an iOS/Android App. The deployment method will dictate how the devices will connect to the CMMS system. For example, connection from a cell phone to a local webserver will require careful security analysis as opening up the corporate network to the World Wide Web introduces vulnerabilities.

### Device Considerations

A 'Mobile Device' for the purposes of this article is simply a device you can take with you out of the Maintenance area to the equipment that is maintained. Back in 2000, Weaver Popcorn in Van Buren, Indiana issued every maintenance tech a Windows laptop which accessed the CMMS through a plant wide wireless network. Techs were able to close work orders, look up parts, view machine history and access linked schematics through the laptop. The plant was in one building so the wireless network reached everywhere and the techs could place their laptops on a clean surface while they worked on the machine.

However, even today, many organizations do not have wireless or cellular access throughout their asset base. This is an important consideration when determining the requirements for CMMS deployment on Mobile devices. In these cases an app or web application with offline capability is warranted. Offline capability means that the device holds pertinent data locally for update while the device is not connected to the network. When the device is once again connected to the network, the data will usually synchronize without user intervention.

In the past, Windows Mobile or CE type devices were popular in CMMS applications however they required some technical expertise to load software and keep the data synchronized. They are still commonly used for inventory applications and rental car return applications. The most popular Mobile devices for the purposes of Maintenance are as follows.

Device	Cost	Benefits	Minuses
Cell Phone	Moderate	Very portable, Easy to use. Quick CMMS startup time. Runs iOS or Android Apps and has web browser. With Apps, camera can scan 1D and 2D barcodes. Can make a call too. Will fit in pocket. Long battery life.	Small screen size. Monthly cost.
IPad Tablet	Moderate	Multiple screen sizes. Quick CMMS startup time. Runs iOS Apps and has Safari browser. With Apps, camera can scan 1D and 2D barcodes. Good battery life. Rugged cases available some with keyboards.	Larger size means it has to be carried.

Samsung Galaxy Tablet	Low	Multiple screen sizes. Quick CMMS startup time. Runs Android Apps and has web browser. With Apps, camera can scan 1D and 2D barcodes. Good battery life. Rugged cases available some with keyboards.	Larger size means it has to be carried.
Windows Tablets	Moderate to High	Multiple screen sizes. Can run local Windows applications or browser based systems. Moderate to good battery life. Rugged cases available some with keyboards. Would be capable to adhere to most corporate security policies.	CMMS startup times might be longer die to Windows login and lack of an App. Barcode scanning is more limited and may require a Bluetooth scanner. Battery life might be shorted that other devices. Pinch to zoom capability may be limited when running Windows apps. Battery stylus is challenging. Larger size means it has to be carried.
Surface Pro	Moderate to High	Multiple screen sizes. Can run local Windows applications or browser based systems. Moderate to good battery life. Rugged cases available some with keyboards. Would be capable to adhere to most corporate security policies.	CMMS startup times might be longer die to Windows login and lack of an App. Barcode scanning is more limited and may require a Bluetooth scanner. Battery life might be shorted that other devices. Pinch to zoom capability may be limited when running Windows apps. Battery stylus is challenging. Larger size means it has to be carried.
Laptop	Low to Moderate	Can be ruggedized. Windows laptops would be capable to adhere to most corporate security policies. Can run Windows applications and browser based CMMS.	May require Windows login as well as login to CMMS. Larger size means it has to be carried. May not have a camera.
Notebook	Low	Low cost. Quick start times. Can run browser apps and Android apps.	Larger size means it has to be carried. May not have a camera.

Table 1: Device characteristics

Device	Initial Cost	Monthly
Cell Phone	\$200-\$1000	\$50-100
iPad 7"	\$400	0
IPad 10"	\$400	0
Galaxy 8 Tab	\$200	0
HP Windows Tab 7"	\$400	0
Surface Pro	\$800	0
Laptop	\$300	0
<b>Notebook</b>	<b>\$200</b>	<b>0</b>
Galaxy 10 Tab	\$300	0

Table 2: Device Entry Level Cost Comparison

Many factors need to go into the device selection. Since many organizations already have a CMMS system, the first place to start would be with the existing vendor and find out which modules can run on what type of devices. For example, if the CMMS vendor offers an app with offline capabilities, it must be installed on an iOS or Android device which can connect to the CMMS app server, either on the corporate network or on the World Wide Web. Next, determine the target functionality for the maintenance users. Maintenance Process considerations are discussed on the next sections.

At this point it is essential to work with the IT department. Depending if the CMMS is local or hosted, IT will have to provide and support connection of the device to the appropriate server(s). It is important that the security on the devices adheres to corporate standards and does not introduce vulnerabilities. The IT department can also limit or eliminate internet browsing to reduce work distractions.

Once the type of device is selected, the end users should be brought in to discuss screen size, type of case, location for chargers, use of a stylus and potential for Bluetooth keyboards. 2 or 3 different pilot devices may be purchased and tested for durability, ease of use, response time and other selection criteria. Some of the other considerations for device selection are listed below.

#### Environment Considerations

- Are the devices ruggedized?
- Is there a hazard or explosion-proof requirement for electrical devices?
- Can the devices be charged easily?
- Can they be secured?
- Are dirt, grease and moisture going to harm the devices?

- Wireless connection availability where the devices are used?
- Is the connection speed sufficient to not slow down the staff?

#### User Considerations

- Can they see the screen?
- Is the application easy to use?
- Are the icons sized appropriately to the finger size of the staff?
- Will the devices be assigned to individual users or shared?
- How long does it take to go from device off state to CMMS functionality?

#### Other Considerations

- Use of Bluetooth Keyboards for easier typing
- Availability of dropdown lists when closing work orders to minimize typing
- Spell checking
- Secure the Stylus or it will be lost forever
- Stylus with Battery
- Housing/Case
- Grant access to World Wide Web or restrict to avoid diversions
- Speech to Text capability to reduce typing
- Ease of taking photos
- CFR 21 Part 11 compliance requirement
- GMP/SQF Compliant
- Kindle Type Device Slowness

Many devices also offer barcode scan capabilities through the onboard camera or a Bluetooth connected scanner. This would allow a barcode scan of stock numbers, asset numbers, etc. Keep in mind, a Bluetooth connected 'Sled' type scanner offers the same one handed scanning as an onboard camera would allow but separated Bluetooth scanners would require one hand for the device and one hand for the scanner; somewhat unwieldy.

Device	USB Scanner	Bluetooth Scanner	Device Camera Scan
Laptop	Yes	Yes	No
Tablet Web Application	If USB Equipped	Yes	Maybe
Tablet Citrix App	If USB Equipped	Yes	No
Tablet IOS/Android App	If USB Equipped	Maybe – Sled Issues with IOS	Yes
Phone	No	Maybe – Sled Issues with IOS	Yes

Table 3: Scanning Comparison

**Maintenance Process Considerations**

The objective in deploying the CMMS on mobile devices is to provide valuable information and functionality to maintenance personnel while they are where the equipment is located rather than the office where the traditional workstations are located. This eliminates the time traveling from the work location back to the Maintenance office. Many Maintenance organizations seek to maximize ‘wrench time’. In optimizing the wrench time it is help to list the possible distractions from wrench time in each case. Potential distractions may include.

- Travel time from base to the work location
- Closing out work orders on CMMS
- Filling out checklists associated with PM Procedures
- Researching Parts in the manual
- Ordering Parts
- Travel back to office to research
- Travel to stockroom to look through parts
- Recording Parts Used
- Returning parts taken but not used

- Production people asking Maintenance to look into other issues
- Waiting for access to equipment
- Returning to Maintenance area for tools
- Returning to Maintenance for new assignments
- Checking Craigslist for a good used car for college student

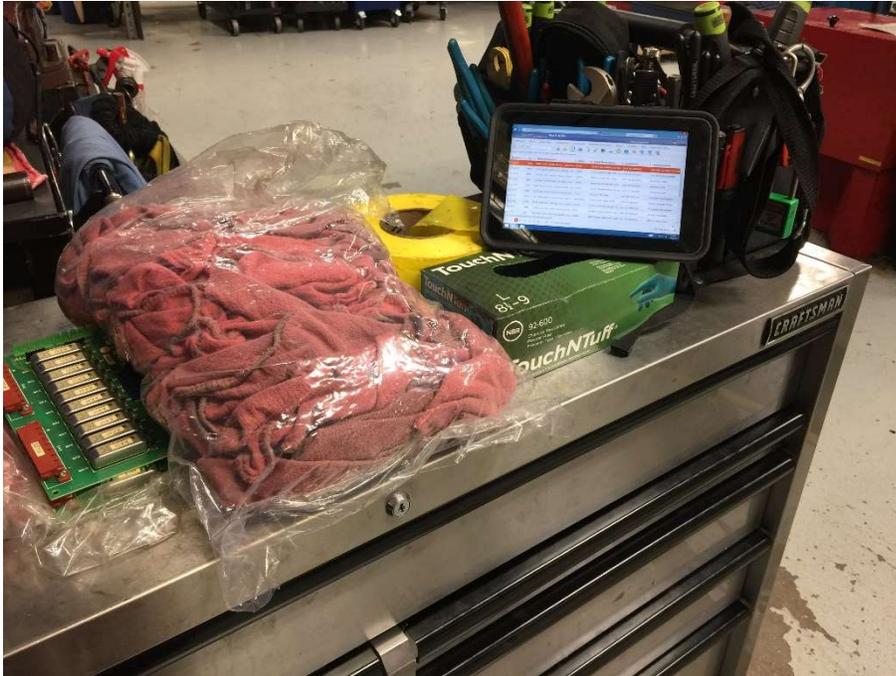
Many of the aforementioned distractions may be minimized by providing a device to the Maintenance techs. The most common success stories of mobile deployment usually include the techs completing or closing work orders in the field and creating new work orders when they see other issues that need attention. In addition, the ability to view spare parts and quickly determine if the part is in stock and the shelf location eliminates lengthy research.

However, the deployment of a mobile device should not introduce a burden to the maintenance techs. Some will view the device as another 'thing' that has to be carried around all the time which is easy to leave behind or get lost. The login time should be kept to a minimum and response time should be minimized to prevent user frustration. For example, if a Windows tablet requires a Windows login with a strong password, then a second login to the CMMS application, the entire process can take up to a few minutes.

## **Case Studies**

### **Eaton Aeroquip**

Rolled out a browser based module of their current CMMS using 7" HP Tablets running Windows 10. Conducted 2 hour training sessions on looking up assigned work orders, completing work orders and finding parts. Battery powered stylus was often not working so users had to move around using their finger. Eventually, IT removed the tablets from the plant as there were network security compatibility issues. iPads were considered however IT would not allow these on the corporate network. Maintenance techs are using the web application on desktop computers now.



### **Nucor Steel**

A few techs carry Panasonic Toughbooks or Toughpads (ruggedized Windows 10 laptops and tablets) and can access the CMMS whenever connectivity is good. In a steel mill, due to the volume and orientation of large machinery, it is difficult to get wireless coverage everywhere.

### **Padnos Recycling**

Primary objective was to use a mobile device to issue parts utilizing a barcode scan. Selected the iPad Mini and added a Honeywell sled type barcode scanner running a web based extension of their existing CMMS. Initially, they found that the barcode scanning input to a web entry form clashed with the iOS operating system. They use a different browser (Enterprise Browser from Dryrain Technologies) to get better scanning results.

### **Occidental College**

Initially tested Kindle devices accessing their web based CMMS module however the processing speed of the Kindle with not sufficient. Purchased 8" Samsung Galaxy tables with rugged cases with integrated keyboards. When training users to perform the initial Bluetooth connection from the keyboard to the tablet, it was difficult to determine which device was connective to which keyboard since we had many in the room. Since this is generally a clean environment, Maintenance techs take their tablets when performing repairs and PMs and close the work orders when complete.

### **Wild Turkey Distillery**

Prior to moving to the SAP Plant Maintenance module, this distillery used the Megamation App on company issued cellphones. Operations personnel were able to use their phones to enter work requests complete with photos. Maintenance personnel were able to look up assignments, complete work orders and add new work orders on the Phones. Additional benefit was that since the techs took the cellphones home, it was easy to find techs for evening and weekend call-in issues.

### **Summary**

Introducing mobile devices requires much planning, testing and evaluation. The software and hardware must work properly and securely and not detract from wrench-time more than conventional CMMS workstations. If properly planned, the devices can provide real time valuable information that provide a benefit to the maintenance tech.

### **Lessons Learned**

1. Everyone in the plant is extremely busy including IT. Every step of evaluating devices, training and implementation such be carefully planned and minimize the time demand placed on resources.
2. 'Lean' out the process. The software and device should provide benefits in the process of work management in the plant, not delays and wasted time. Ensure the software can be accessed quickly and minimize keystrokes. Do not provide slow devices with dangling peripherals.
3. The process of selecting devices should be a team effort between IT and Maintenance. The technicians should have strong input into the device selection.
4. Android and iOS Apps seem to best satisfy the requirements of offline capability, quick uptime and availability on a broad spectrum of devices.

### **About the Author**

Robert Garbus, PMP, CMRP, has been implementing and maintaining CMMS installations with Mainsaver Software for 19 years and has been a SMRP member for several years. He has written an article for the SMRP publication *Solutions* entitled 'CMMS Material Inventory Cleanup'. The majority of his time is spent onsite helping customers reach their goals relative to work management and reliability. Prior to that, he spent 12 years with Mobil Oil in various positions. Rob holds a Bachelor of Science degree from Drexel University and an MBA from Indiana Wesleyan University.

### **Sources**

In development of this paper, the author self-imposed the following guidelines;

- No Google Searches
- No Internet Articles as Sources
- 1<sup>st</sup> Hand Experiences with Mainsaver Customers
- Discussions Directly with Maintenance Practitioners
  - Wayne Knabel, Plant Manager – Wild Turkey Distillery
  - Tom Steveley, CMRP, Maintenance Process Coordinator - Nucor Steel
- Any Photos Were Taken by the Author
- Convey Experiences and Lessons Learned

### **Keywords**

1. CMMS
2. Work Order
3. Wireless Communication

4. Wrench Time
5. Spare parts
6. Scheduling
7. Preventive Maintenance
8. Maintenance Process
9. Completion

Windows is a trademark of Microsoft Corporation. All other trademarks are the property of their respective owners.