STEPHEN J. THOMAS

NO PENCILS REQUIRED

FROM THINKING TO KNOWING™ THROUGH MOBILITY

Table of Contents

Dedication

For Debbie
my sister

About the Author

My name is Stephen Thomas and I have spent my career working as an engineer in the Maintenance Department for leading oil refining companies. I hold an electrical engineering degree from Drexel University, a Masters Degree in Systems Engineering, and a Masters Degree in Organized Dynamics from the University of Pennsylvania. When I first entered the workforce, we did our work longhand since computers were just emerging as a valuable tool for industry and not widely used. While most of the people I worked with were content doing things in this manner, I and others could see the immense value computers could add. The ability to use a computer as an integral part of a work process is not something that happens without a great deal of hard work. Over time the combination of my education and extensive maintenance and reliability experience has enabled me to add value to firms with whom I worked. In *No Pencils Required*, I discuss how using only a desktop or laptop computer carries many inefficiencies. You will learn how mobility solutions coupled with a robust Digital Data Management System (DDMS™) can solve those issues. The questions you might ask are:

- **Why should you embrace a mobile platform?**
- **How do I make the change to a mobile platform?**
- **What benefits can mobility offer?**
- **What applications can a mobility solution deliver?**
- **What is the business case for mobility?**

To try and answer these questions, or others you may have, I wrote *No Pencils Required* as a free book sponsored by **PK Technology**. I need to add that I chose **PK Technology** because in my opinion they are the "thought leaders" in this area. Mobility is our future and those who embrace it will reap the benefits.

Foreword

The world is a different place when you compare it to when I started working over 45 years ago. Computers and the Internet have helped create the vastly different world in which we now live. People have immediate access to enormous amounts of information that I used to spend considerable time acquiring from the public library—if I was even able to find it. Not only do people now have ready access to this information, but in many cases they even have the ability to interact with it by adding or changing the information based on input they provide.

If you look around at the emerging workforce, however, you can see that we are on the cusp of another major shift. People now don't want to have to find a terminal and log in or return to their desktop computer to have access to information. They want it wherever they are and whenever they decide they want or need it, with no delay. This is the world of laptop computers, tablets, and cell phone access. These devices are carried with us wherever we go to satisfy this incredible need for information and the ability to interact with it.

This is the world of mobility. This trend isn't just on the personal level. You can see the need being satisfied in all aspects of everyday work life where the workforce requires immediate access to data to drive improved effectiveness and efficiency.

Within the process and manufacturing industries, there are firms that have embraced the concept of mobility. Unfortunately this embrace doesn't seem to be as widespread as other sectors of business. This lack of involvement with mobility will soon be a problem as younger people enter the workforce.

The reason is obvious. Their world is one of mobility and near or real time access to information. They are not going to accept anything less. To make matters even more difficult for those firms who are not mobile, mobility is how the new, younger

members of the workforce learn and interact with their environment every day. To train or work with them otherwise is going to be extremely difficult, if not impossible.

While you could try to force these younger employees to work in a less-than-mobile work environment, you will invariably face ineffectiveness, inefficiency, and a very high level of frustration. You could almost compare it to removing all of the desktop computers from your office and telling people everything now had to be written by hand, with all data handled with manual spreadsheets. Not a pleasant picture, is it?

These challenges bring me to the reason for this book. Many decision makers do not understand the critical need to create a mobility-based work environment. They don't like the idea of change. They are cost adverse or simply don't understand the significant positive impact mobility can provide to their business and to their workforce. What I hope can be accomplished through this book is awareness of the issue, recognition of the benefits, a desire to change, and increased knowledge about what a mobility-based work environment can bring to your organization.

If you take some time to read through this book, you will quickly understand how mobility has the potential to improve almost every aspect of your business, your existing employees, and the future generations.

Steve Thomas

Chapter 1

What is Mobility in a Business Context?

I have worked in the petro-chemical industry in the area of maintenance and reliability for over 45 years. When I started—believe it or not—we actually did things longhand. We worked on paper spreadsheets. I realize that I am dating myself, but that was the only way to get work accomplished. The reason was that computers to assist with our work simply did not exist where they could economically be applied.

The next phase of my career saw the advent of large computers where we sent in input and usually got the results back the next day. No monitors were available for system interaction, just canned reports that had been preconfigured. Certainly this was much better than the longhand approach, but there was a lot to be desired. After a while, computers connected to a monitor became available. They provided us with the ability to interact in a more real-time manner with our computers. Largely due to cost, however, they were not immediately provided to a large portion of our workers. In fact, the planning department in which I worked had one computer that was shared. Over time, as prices declined and functionality increased, computers became an integral part of the tools everyone used to conduct their daily work, resulting in what you see today—a computer on every desk.

As advanced as having my own computer was after suffering through the days before they were available, there still was a problem. How could we access the information we needed in order to perform our jobs? For a maintenance and reliability orga-

nization, this problem occurs in many shapes and sizes no matter the industry in which you happen to work. There are many examples, but I believe handling a corrective action work order clearly identifies the issue. Let's track a request for maintenance service from start to finish so I can elaborate.

1. Operators in the field identify maintenance problems, but have to make field notes and then return to their office or control room to enter a repair ticket. Errors occur related to what was identified in the field vs. what ultimately gets entered on the work request. Examples include poor note taking regarding the problem, failure to correctly identify the equipment having the problem, or simply forgetting to enter the request due to other pressing matters. The time difference between when the problem is identified and when a work request is created and actually entered causes lost productivity for the operator and difficulty when maintenance attempts to initially identify what is required.

2. When planners receive the work ticket, they have to go into the plant and look at the job in order to create a valid work plan. They usually take with them a notebook to record information. At the work location, they have no ability to take photos or, if necessary, review past jobs and equipment information that would help them to create a better plan. Once the field visit is completed, the planners return to their office and enter the information into the computer system.

3. Next, supervisors receive the work ticket, usually in hard copy, so that they can assign the repair crew. If they are not at their desk, they have no access to the plan details, equipment details, or the parts list—unless this information is printed as part of the ticket. If they don't have this information and need it, they must return to the office where the information is available in their computer.

4. Next, the mechanics arrive at the job. Unless they have a hard copy of the work order with all pertinent data, they often are lacking critical information that, once again, is only available back at the office.

5. At the end of the job, the foreman arrives to approve the work. Following the review of the work completed at the job site, the foreman then must return to the office to formally complete the job in the computer system.

6. Finally, when the repair is completed to the supervisor's satisfaction, the operators need to approve the work. They go out the work site. However, without a piece of paper describing the job, they often do not have the information needed to actually assure themselves the job has properly been executed. Additionally, in order to formally approve completion of the work, they must return to their office and log in to the computer system.

There is a common thread running through the description of the above process. At every step of the way, someone has to return to their desk and access or enter information on their desktop computer.

The first example addresses the problem of accessing and updating information. Now let's look at a second serious problem—how to acquire error-free data in a timely manner. This second example describes piping inspection, where qualified inspectors go out in the field to monitor the wall thickness of process piping. The purpose of this inspection is to identify areas where the piping may be thinning and require replacement. Here is how this inspection works;

1. The field inspectors get a list of areas where they need to take thickness readings. This list is typically on paper and originates from software that monitors these issues.

2. Next the field inspectors go to the plant and take pipe thickness readings, which they transcribe manually onto the list they were given of the areas that needed monitoring.
3. The field inspectors then return to the office where the readings they acquired in the field are manually input into the software for pipe wall thickness monitoring.

The potential for error comes from the time it takes to enter accurate data into the pipe thickness monitoring software. In some cases, the inspector who is taking the readings is the same one entering the data, but often they are two different people. In many facilities, the field readings taken on hard copy are handed to an inspector who then reviews the information before entering it into the system. If the original data is incorrect, it will be entered as such, causing future problems.

The other issue is the time between the reading in the field and the data entry into the system. Many profess this effort requires little time delay. However, in many cases, due to the workload of the inspectors reviewing the field data, there is a significant time delay. Under normal circumstances where there are no piping thickness issues, their workload just delays the data getting into the system. However, in cases where there are thickness issues, these delays could cause serious plant-related problems resulting in equipment failure and unwanted safety, health, or environmental exposure. In these cases, the field reading has identified a potential problem, but the time delay of data being entered and evaluated can contribute to the occurrence of a serious event.

The common thread running through this process—and typical of many similar manufacturing processes—is the time delay of entering field information into a system where corrective action can take place, if needed. The potential for errors through data handoff and transposed number can add further problems for the organization.

What if these processes didn't have to work as described above? What if personnel did not have to constantly return to the office to acquire or update information? What if data acquired in the field could immediately be processed into the company's software program for monitoring, analyzing, and reporting? If these improvements were possible, there would be immense time and cost savings as well as increased effectiveness and efficiency for everyone involved.

Years ago, when I worked with manual spreadsheets, I had difficulty envisioning a different future. Fortunately for me, others could conceptualize and bring desktop computers to the workplace. This same process is happening again in all phases of the work we do. This is mobility—tools that seamlessly connect the user at the point of the work to computer systems that are designed to help support the work effort. Those organizations that can embrace the concept of mobility and take advantage of everything it has to offer will undoubtedly see significant advantage over their competition.

Chapter 2

Data, Information, and Documentation

Before we can get into a detailed discussion about mobility, it's important that we take a moment and clearly define the key elements that ultimately make a mobility initiative worthwhile. These elements are *data* and *information*. These two terms are often used to mean the same thing, but they don't. Let's get the difference clear.

In our book *Asset Data Integrity Is Serious Business*, Robert DiStefano and I provide the following definitions for data and information. **Data** is "the elemental information about a plant asset," whereas **information** is "a grouping of data elements in such a manner that they can effectively and efficiently be used by various levels of management for decision-making and action." As you can see, these two terms are quite different where the data elements, when properly combined, provide actionable information.

Let's take a minute and list the elements that comprise good data and, ultimately, good information. Data and its related information have the following attributes: the data is complete, it is consistent, it is accurate, there are no duplications, it is maintainable, it is fit for purpose (meaning that it is applicable to supporting the current business processes), and it conforms to the current taxonomy (data formatting).

There are two other important attributes that are often lacking in many information systems and business processes. The first is timeliness, which means that the data and its related in-

formation are available from the plant computer systems in near or real time to the users. The second additional attribute is integration, which implies that all the relevant data is integrated into a single source for those who need it. We're going to discuss both of these elements further in our discussion about mobility.

But we are not done yet. All of your data—even when organized into information that you want to use in managing your business—is useless if it's wrong! **Dirty data** is the term applied to this problem by Jonathan Martinez in his white paper, *intelliSPEC™ Revolutionizing the Industry by Introducing the World's First Digital Data Management System*. In this paper, Martinez defines dirty data as "data acquired by taking readings or visual inspections, which might be flawed and recorded into paper files or standalone spreadsheets." Essentially any incorrect data entered into your systems in any manner, regardless of how it got there, is dirty data. Using this data in the form of information to make decisions is going to cause you serious problems.

Let's take this discussion one step further because information is typically presented to those who use it as documentation. The definition of documentation is "material that provides official information." For example, collectively, a set of data elements about a pump is information. When that information is understood to be official, we can then consider it as documentation and confidently use it in our decision-making process.

Documentation can originate from many sources. For a piece of equipment, it can come from the manufacturer in the form of specifications, from plant engineering as project plans, and from those working with the equipment in the field as historical records.

Many plants have a documentation problem. It results from documentation being generated as hardcopy, from organizations working in information silos and not sharing, from data not being logged into our systems, and from independent applications storing data that is not available outside of that application. The result is that people save information where it is available when-

ever they need it. The failure is that they do not recognize that others may need the same information as well.

There are many reasons why this occurs; each is a problem in its own right. However, the problem for the organization is that all of this documentation is uncontrolled. Although it may have been correct when you stored it away, it may not be correct now or in the future when you use it in your decision-making process.

Part of the solution is a single digital database management system with procedures in place to avoid retaining and using uncontrolled documentation. If you recall how people in today's business world want access to their information, whenever and wherever they want it, then a mobility solution tied to a digital data management system solves the problem of access to controlled documentation. Over time, as people become more used to having access to accurate information that is shared among workgroups, the uncontrolled documentation—whose use places your organization at risk—will diminish and ultimately disappear.

The key is to create a work environment where you have data integrity. DiStefano and Thomas define data integrity as "a collection of points or facts about a plant asset that can be combined to provide relevant information to those who require it in a form that is entire, complete, and trustworthy." I am guessing that a large majority of plants, if asked about the integrity of their data, would say that it is suspect in many cases. With mobility applications properly configured and connected to a single digital data management system (DDMS), you have a greater potential of having total data integrity. Integrity of the data enabling reliability-based decisions is the ultimate goal.

Chapter 3

Mobility Defined

The Webster Standard Dictionary defines mobility as "the ability to move freely away from the source." Although that definition is a good, basic one, I want to give you a visual that lets you really consider what mobility is all about. Then we can begin to look at this concept as it applies to the work we do every day and our desire to make that work more accurate, less time consuming, and certainly more effective and efficient.

Those of you who are older will be able to relate to this example. Those of you who grew up in the world of the cell phone will find what I am going to describe difficult to believe—to think that we ever lived and worked in this manner!

My visual is not about mobile, it is about being immobile. The dramatic nature of the example will show you the true value of mobility in our day-to-day world.

Years ago when the phone rang, you had to rush to the wall or table phone to answer the call before the caller hung up—or the phone rolled over to a tape recording that was the older version of voice mail. Once you answered the phone, you were tethered to it by a cord that connected the phone receiver to the phone itself. How far you could go away from the phone was restricted by the length of the cord. I once installed a six-foot cord so I could wander around, but not beyond the six-foot radius allowed by my tether. I was essentially immobile.

Today, of course, these phones are the thing of the past. We can now talk on the phone and be virtually anywhere in the world. We are not tethered to any cord or restricted by any boundary. We are mobile.

Now let's turn our attention to a true business definition of mobility. This definition is the foundation for the many various ways we can apply this concept. For our purposes, we will define mobility as:

> *"Having the ability to access, update, evaluate, share, and analyze data in real or near real time, anywhere or anytime, where access is a remote extension of the source whatever the source may be, and the work is conducted often at the point of the actionable task."*

To fully understand this definition it's important that we break it down and describe each of its components.

- **Access.** The ability to access information as well as input data whenever and wherever you want is a paramount component of workplace mobility. Many organizations do not have in-plant Internet. However, there are many current and emerging solutions that do not require in-plant Internet in order to provide application access.
- **Update.** It is one thing to be able to access information. Another key component of workplace mobility is the capability the system provides to update information from the field, thereby, avoiding the need to return to your desk.
- **Evaluate.** The ability to access and update information truly provides value to the users by enabling them to quickly evaluate their data and take corrective action. This capability—evaluating information without taking additional time to return to your terminal to enter the relevant data—truly adds value. Having access to historical data through your mobile tools can further enhance your evaluation.

- **Share.** Once your evaluation is completed and corrective action is required, mobile tools allow you to share that information quickly with those who need to take the corrective action or address the problem.
- **Analyze.** Applications within your mobile device can help you move beyond data evaluation to sophisticated analysis, providing you with results that would normally be handled through complex desktop applications.
- **Real or Near Real Time.** Many applications provide real-time access to information. I've also included the term "near real time" to indicate that everything is not instantaneously available. Certainly with a mobility tool, information is available far more quickly than the time you would need to return to your office computer.
- **Remote Extension of the Source.** Your mobile tool is truly a remote extension of your desktop computer. This concept of remotely extending access to software and related databases is central to the mobility approach.
- **Point of Action.** Mobility lets you take action through your mobile device while you are located at the point of the actual work. This ability is one of the major benefits.

Through the use of mobile tools, we seek a work environment that allows people to be untethered from their desktop computer, but having the same access to the information and analytics as if they were at their desk.

Chapter 4

The Business Case for Mobility

Senior leadership needs to provide funding and resources for any new effort that develops and deploys mobility solutions throughout the organization. Because they are not intimately involved in the details of what you are planning, the leadership expects you to provide them with a business case to justify the effort. Mobility delivers benefits that address two basic elements: effectiveness and efficiency. Both elements are key to your business case. They must be adequately explained if you expect leadership to support your effort fully.

Being effective means that you "do things right." Being efficient means that you "do the right things." A mobility initiative can help you deliver on both of these.

Let's start with the concept of doing the right things. Your workforce is skilled and you expect that these skills will be used in an optimum fashion. What you seek is for your organization to have the capacity to deliver value-added work on a consistent basis. However, if you consider the typical process for gathering data, entering it into the system, writing reports, and conducting analysis aimed at proactive corrective action, you can see that all aspects of this process are not truly value added. Instead, many are administrative tasks that take time away from your personnel utilizing the skills for which they were hired.

Figure 1 shows a typical inspection process in which the activities in blocks labeled 4, 5, and 6 are highly administrative. These blocks take time away from inspectors performing more value-added work. Several steps in this process are ineffective; they take up valuable time, costs unnecessary expenditure of

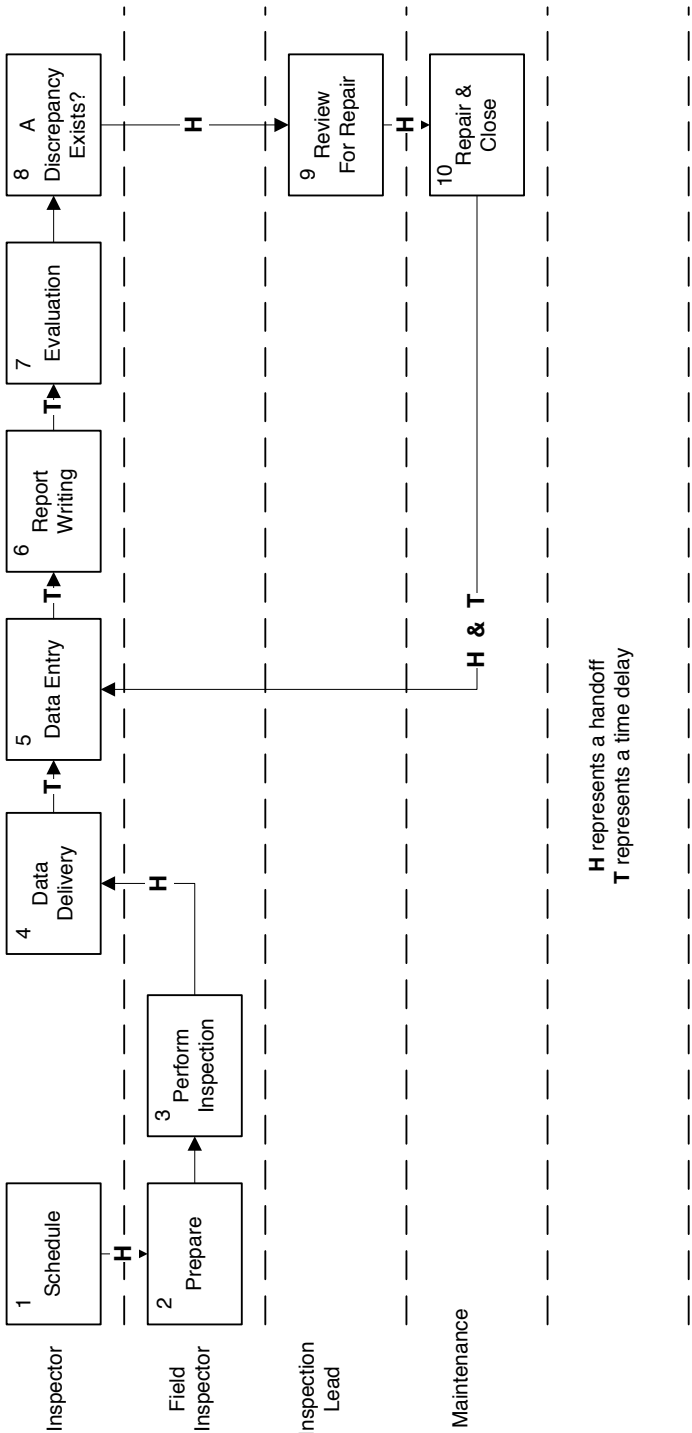

Figure 1 The Problem with Multiple Handoffs and Time Delays

money, and have the potential to introduce errors and dirty data into your system. Having a mobile solution in place can streamline the gathering of the data. It also automatically enters the data into your system, automatically creates reports, and provides you with timely information for analysis. Doing the right things is a significant aspect of the mobility business case because you're freeing people up to utilize their skills.

Now let's examine the concept of doing things right. Again look at Figure 1. In proceeding from gathering data to developing actionable reports, most firms currently have multiple handoffs of the data (in manual form) from one person to another. At some point, this data does get entered into the system. However, due to the handoffs (labeled "H" in the figure), there is a high likelihood that errors will be introduced.

Errors can occur for a wide variety of reasons. In order to avoid having dirty data in your system, they need to be avoided. A mobility solution—where the data is captured at the point of action and immediately entered into your database by the same person who acquired the data—goes a long way to reducing the potential of errors caused by handoffs. Having data entered at the point of origin into a software application, which immediately creates reports for analysis and action, falls into the category of doing things right; it also has many secondary benefits.

Implementing a mobility solution improves your ability to do things right and do the right things. The solution can be developed by your personnel into a business case showing savings of time and money.

A mobility initiative delivers far more benefit than simply doing things right and doing right things. These secondary benefits also have significant value for your company and further justify deploying mobility solutions within your organization.

One of these benefits is helping the company address the significant time delay (labeled "T" in Figure 1) between the acquisition of data and the generation of a report for analysis and, as needed, corrective action. This delay, which I refer to as "time delay to action," can be found throughout businesses in areas

such as inspection of equipment and piping, machinery vibration and lubrication, safety, health, and environment as well as many other areas.

These often significant time delays occur between the time that data is acquired and the time the organization recognizes a serious issue that needs to be addressed. These issues can have serious consequences for the business. It is essential that they are identified and addressed in a timely manner, but there is the possibility that this may not happen due to time delay. Mobility initiatives can severely reduce and even eliminate the time delay to action. They could easily save an organization significant cost due to lost production that results from a failure not corrected in time.

Another benefit of a mobile solution is improved data accuracy. This improvement is due to data entry at the point of action and the reduction in data handoffs. If the data in your system is accurate, over time the workforce will begin to recognize, trust, and rely heavily on the information to make reliability-based decisions.

This process of placing accurate data into your system and utilizing it for your decision making has a reinforcing consequence. Once individuals recognize the value of the data that exists in the database, they will add more of their own data, thereby, making the total system more robust over time. This process also will support the organization as it moves away from storing data in personal files (such as Excel or Access or file cabinet) and making it more available for the entire organization. Accuracy is another efficiency benefit because current and accurate information will be readily available to everyone.

As part of the development of your business case, you should be able to monetize all of the secondary benefits because they both save you time and money. It may be a little more difficult to include in your business case the improvements to your bottom line from avoiding a major plant failure due to lack of actionable data. However, with a little research, I would suspect that you will find specific examples within your own history where lack

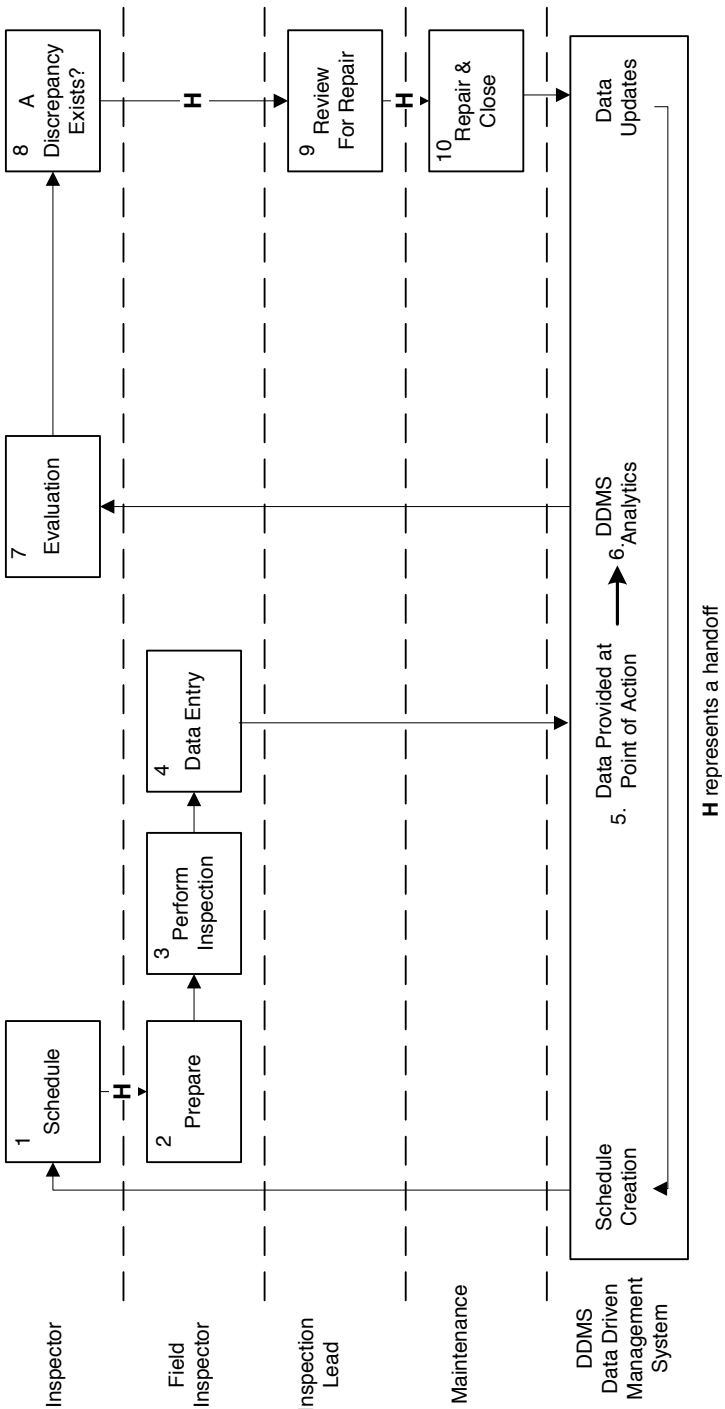

Figure 2 The Elimination of Multiple Handoffs and Time Delays with Mobility

of actionable data resulted in unplanned downtime and excessive repair costs.

Figure 1 showed the inefficiencies of a typical inspection process or, for that matter, any process that requires data handoffs, manual entry, and time delay in obtaining results. But since a picture is worth a thousand words, let's look at Figure 2 to visualize the benefits of mobility.

Figure 2 shows a model of the same process as Figure 1, but with mobility applied. Notice the reduction of handoffs (H) from 5 to 3. Also notice the reduction of time delays (T) from 4 to zero. You'll also see that Blocks 4, 5, and 6 have been eliminated. These blocks add time, but not value, to the inspector's work.

The bottom line is that if you prepare your business case for mobility, taking into account all that we have discussed, the value to your organization will be so significant that you should receive the funding and resources that you require. In fact, I would suspect that those who have the responsibility to authorize funding are going to have a hard time understanding why they waited so long to undertake this effort.

Chapter 5

Prerequisites for the Mobility Journey

The journey to plant mobility is not a project, but a process. Projects have a beginning, a defined set of steps towards completion, and an end. Once you embark on a mobility journey, you're starting down a road that never really ends. The journey is a process because as you develop mobility tools and apply them to the work, you gain additional knowledge about how to apply them better. At the same time, the software is being upgraded and new applications are being developed to further support your journey.

While it is a process, implementing mobility is also a set of initiatives from the point at which you decide to mobilize to a point in the future where you actually implement the mobile solution. Unfortunately, over 70% of the initiatives that industry tries to implement end in some form of failure. First, they fail to get properly developed. Second, if they are developed, they fail to be properly implemented. Third, if implemented, they fail to sustain themselves over time.

The question that needs to be asked and answered is why initiatives envisioned by highly intelligent people fail in this manner. There is recognized data that supports the belief that the reason for failure is the organization's culture.

Suppose I asked a group of practitioners at a conference how many of them had ever been told that to improve they needed to change the organization's culture. The response would indicate that the vast majority had received this message from their

management at one time or another. The next question is quite revealing. "When you heard this message, did you really understand what was required?" In this case, the vast majority of the respondents would indicate that despite hearing the message, they really had no clear-cut idea of how to achieve an organizational culture change.

In his book *ADKAR: A Model for Change in Business, Government and Our Community,* Jeffrey M. Hiatt identifies five elements that can have a great impact on changing organizational culture from non-mobility to mobility. The first letters of these elements are in the book's title: **A**wareness, **D**esire, **K**nowledge, **A**bility, and **R**einforcement.

You can make the organization aware of the deficiencies that come from working in a nonmobile environment and also show everyday examples of how working in this manner negatively affects effectiveness and efficiency. Once the organization is aware of the problem, it can desire to move to a better work process by providing mobility tools to address all the issues discussed in the business case. Once the organization has created awareness and desire for a mobile solution, it can obtain the more specific knowledge about mobility which then will generate funding to initiate this effort. With training as part of the deployment, the organization will attain the ability to work in a mobile environment. The improvement generated from working with mobile tools will certainly provide the reinforcement to continue and further the efforts.

Understanding how you can support the ADKAR model to address cultural change adds value to the organization; however, it is insufficient. What also needs to be addressed are what I call the Eight Elements of Culture. Without addressing these elements individually and collectively, the initial effort to bring mobility to the workplace will ultimately fail.

The eight elements of culture are leadership, work process, structure, training, technology, communications, interrelationships and rewards. Let's take a moment to examine how each

of these elements supports the culture change for incorporating mobility as a primary work tool.

- **Leadership.** If awareness and desire exist within the leadership team, there is a high likelihood they will champion the use of mobility tools as a way to improve the overall work effort and equipment reliability. Without support from the leadership driving this change, the likelihood that it will be successful is limited.
- **Work Process.** Among the major elements that will change with the implementation of mobility solutions are the work processes. Work tasks that were completed manually or through multiple handoffs will essentially disappear. However, people don't easily give up the work processes that have served them well throughout their careers. Therefore, with the implementation of mobility solutions, work processes need to be carefully redesigned in a way that those being asked to give up their former processes can see the benefit.
- **Structure.** A shift to mobility generally means that the company's former structure will need to be altered. As I described in the business case for mobility, many of the tasks that were completed before implementing the mobility solution will simply no longer be required. This change doesn't necessarily mean that jobs will be lost. Instead, jobs can be repurposed to add additional value to the organization.
- **Training.** Training is one of the most important aspects of achieving success with mobility. As I noted in the ADKAR model, ability is a key aspect of any change. To improve ability, training will be required to enable the workforce to use the new tools with which they are being provided. An often-made mistake with training is that once the initial training is finished, too many people believe the job is complete. This is definitely

not the case. New applications and new uses of mobile technology will create ongoing changes to the business. Training of the workforce needs to keep pace with these changes so that the use of mobility tools is always being optimized.

- **Technology.** Technology —which includes the hardware and software that's part of the mobility application— is the key. In order to take optimum advantage of it, individuals within your organization must stay current with new developments. Additionally, the organization, as a user of the mobility tools, has the ability to identify new functionality that will support their business processes that might not even exist. When you have knowledgeable people within your organization who understand both the mobility tool and the business process, you can bring these ideas to the attention of your vendor partner and support development to add significant value.

- **Communications.** A problem in business is the silo effect. It describes how people work within their own organizational silos and tend to communicate poorly outside of them. Initially some of these barriers can be broken down by assembling a multidepartment mobility team. The very fact that people will have mobility tools in their possession, enabling them to automatically share information, will vastly improve communications. No longer will people have to rely on others providing them the information they need. Instead, the information will be available at the touch of a button.

- **Interrelationships.** One thing I always enjoyed about working in industry was the fact that very little is able to be accomplished individually. People need to work together to accomplish the end result. Building good interdepartmental relationships is very important to the support of the mobility effort and this element provides the leverage.

- **Rewards.** As the changeover to mobility takes place, people will see how their work processes are vastly improved. Information that may or may not have been readily available in the past is now at their fingertips. At this point, reinforcement of the change process takes place. However, people may not easily believe these have taken place and the proof is not immediately available following implementation. Therefore, for this sort of change effort to succeed, there needs to be a great deal of upfront publicity that highlights the advanced rewards that come with implementing the effort.

Embracing the concept of ADKAR and paying careful attention to the Eight Elements of Change will go a long way to providing your organization with a successful mobility implementation.

Chapter 6

DDMS: The Heart of the Matter

Many mobility solutions are currently utilized in industry. The vast majority are single focused, meaning that they gather, analyze, and report with respect only to a single function. For example, a mobility tool might be used specifically to gather vibration data for your plant's rotating equipment. With a tool of this fashion, an operator or technician takes vibration readings at the equipment, the result being a notification or report of the vibration status. Many of these devices also enable users to set alert and alarm points so that the system can provide feedback related to impending equipment problems.

Single-focused mobility tools have drawbacks. Suppose a tool such as the one just described indicates there is a vibration problem and failure is imminent. A single-focus tool does not alert operations that they may lose rate or experience a plant shutdown. Nor does it alert either maintenance (that they may have an emergency) or the warehouse (who would be responsible for maintenance material acquisition). Still others are out of the information loop including; business planning, safety, environment, and many others who need to know of this issue in a timely fashion in order to take the necessary corrective action, but won't be informed by a single-focused application.

As much value as single-focused mobility tools can add, they have one significant drawback: they cannot easily share critical business-related information with those who may need it. That is where a digital data management system (DDMS) coupled to these mobility tools can solve the problem.

Figure 3 shows the current structure of data and information flow and their availability. Software that is fed information by mobility tools unfortunately provides limited plant-wide availability. Usually it is only available to the subject matter experts using the tool.

Nonmobility-related software, such as computerized maintenance management systems, also has limitions in that it provides data only to its user base. In most cases, access to the information contained in these systems is limited by job role and license cost, or as a result of inflexible management controls over data access.

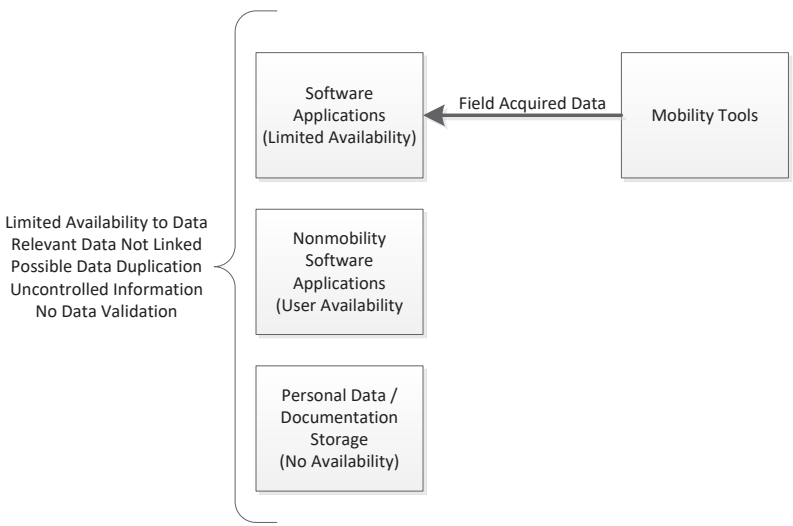

Figure 3 The Disconnected Application Model

Another information access issue of even greater importance concerns all the data stored in personal files. Not only is this information not available to those who may need it, but it also falls into the category of uncontrolled data. Although the information that you filed in your desk may have been correct when it was obtained, it may not be correct now, leading those who use the information into serious problems

The solution to the problem of multiple databases and personal files is to implement a digital database management system. Essentially, a DDMS is a digital hub connected to all of your previously stand-alone applications. A DDMS has the ability to import and export data, link and unify related data streams, field validate data against data stored in functionally specific applications, analyze the information, and provide customized reports to all those who require the information for their everyday business decisions. Figure 4 illustrates a DDMS.

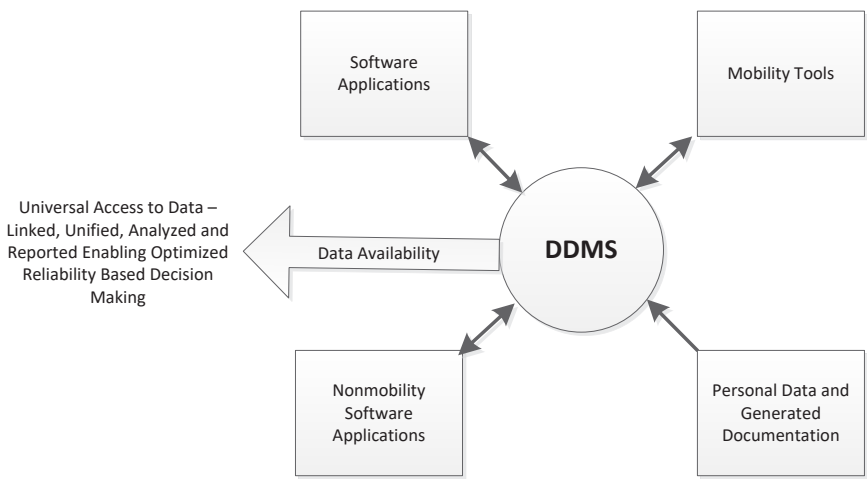

Figure 4 A DDMS Model

Without a digital database management system, the organization is stuck in a world of separate data streams, with limited ability to recognize how negative results from one set of data can potentially have serious consequences in other areas.

A well-developed DDMS can do even more to address these problems. What I described above is typically called "information pull" in that all of the various applications and systems have data pulled into the DDMS for verification, analysis, and reporting. However, a DDMS also has the potential for "information

push" where data acquired in a mobile tool is pushed through the DDMS to other relevant applications where the information is important. Consider a piping inspection system where data is acquired in the field on a mobile device, automatically uploaded to the DDMS, and pushed out to a piping software tool that stores, analyzes, and creates reports.

In the case of information push, many benefits can be realized through the use of a DDMS. First, the upload from the mobile device eliminates manual handling of the data. It can eliminate errors by reducing manual entry and saves both time and money. Furthermore, with a DDMS, the same data can be pushed to other applications with no additional effort and can be separately analyzed by other functions, outside of the inspection software, that may be impacted.

There is a further benefit in that the data acquired in the field can be validated against what is already present in the parent application. With this information, discrepancies can be identified, requiring further review and possible corrective action. In this way, the hub is a storage location. Because data is synchronized with the external applications, the hub can show real-time differences between what is presently in the database and what is in the field.

A DDMS brings to the table data integration, defined via Wikipedia as "combining data residing at different sources providing a wide group of users with a different view."

This all seems so simple on the surface, but of course it isn't. The incoming and outgoing data may have format issues that need to be addressed. User-enabled customizations need to be developed because no two organizations want to see the same information in the same fashion. Ongoing training needs to be identified and met both in the short and long term. Additionally, developing the interfaces between the hub and the applications can often be a daunting task. Although difficult, if you have the right people involved both internal and external to your organization, these obstacles are really opportunities that will provide value to any organization utilizing mobility tools coupled to a DDMS.

Chapter 7

Required Basic Functionality for Success

In addition to identifying different functionalities related to mobility, this chapter outlines the significant elements that must be part of any mobility effort.

- **Digitization of Mobile Data.** Mobile solutions already accomplish convert data into digital format for use within the DDMS. The real issue is the ability of a DDMS to import all of this data from various sources into the DDMS hub. Many stand-alone applications store data differently. Typically when moving to a DDMS, you need to make certain that for whatever DDMS is selected all of the incoming data is compatible or can be made compatible. The hub also needs to be able to push data that it has acquired from one application to other connected applications in order to share relevant data across the organization.
- **Digitization of Nonmobile Data.** Digitizing nonmobile data is a much more difficult task. In most organizations, a large amount of data is stored in personal spreadsheets or in hard-copy files. This data is uncontrolled and cannot be easily used throughout the organization. The accurate data stored in these various fashions needs to be part of the DDMS and the data that is not accurate needs to be destroyed. Further procedures need to be in place to eliminate holding on to uncon-

trolled data. Digitizing all relevant information will be difficult to ingrain into the organization's culture.

A challenge that invariably rises is how to get all of the relevant hard copy data, as well as the data stored in personal files, into the DDMS. You could hire a consulting company to handle this effort, but it would be cost prohibitive. Funding most likely would never get approved. The key factor needed to accomplish this monumental task is time. As efforts arise that require use of data stored outside of the DDMS, the organization needs to validate it and have the accurate material included. This may take years, but it is a process that will ultimately eliminate data and information outside of the DDMS while establishing an ongoing product call for data storage.

- **Integration.** While it is fine to have all of your mobile solutions integrated to the DDMS, this can also be initially costly—and even more costly to sustain it. I am not suggesting that you throw away the applications that you have in existence. However, as new ones are added, you might find a DDMS vendor that can provide you with applications that are directly part of the DDMS or easily integrated.

- **Customization.** No two companies typically want the same application to work in the same manner nor do they want the output in a universally standard format. For this reason, you need a DDMS and its connected applications to be highly customizable based on individual organizational requirements. This flexibility also applies to the questions asked as part of the application's data input.

- **Agility.** Whatever vendor you select must be agile. This means that, unlike larger suppliers, they are able to develop custom applications to address your requirements in a cost-effective and timely manner. Needing some-

thing right away and instead possibly getting it in six months or longer is not what you need. There are firms that can provide this service with internal, highly skilled application developers.

- **Key Performance Indicators (KPIs).** While reports serve a purpose, a digital dashboard is a far better way to present the results of the data taken by the applications feeding the DDMS. A digital dashboard presents the data and associated problems in real or near-real time, in the format that the organization desires, enabling rapid corrective action.
- **Universal Availability.** This key element of a DDMS is the whole reason behind digitizing your data and making it available to all those who need it, regardless of what "it" is, when they need it, and where they need it.
- **Timeliness.** Universal access is a noble attribute, but without it being available in a timely manner, it doesn't serve our purpose. In industry, the dissemination of data in a timely manner is often critical to avoiding plant problems. The use of an integrated mobility tool eliminating many unneeded manual steps goes a long way toward solving this problem.

Obtaining a DDMS with linked applications that fit all of these requirements is not unattainable. There are firms who can provide this level of service as part of how they do business.

Chapter 8

Mobility Applications and More

8.1 Applications

Before discussing mobility applications, consider this story. When I was younger, there was a newspaper cartoon about a fictitious police detective named Dick Tracy. He communicated with his team via "a wrist-mounted communicator, letting people talk to one another right through the device attached to their wrist. In the 1990 film, the technology was little more than a walkie-talkie, but in the comic book series, the device would later go on to include a built-in digital screen." Does this device sound familiar using today's technology? When invented, it was the stuff of dreams, but dreams have a way of becoming reality.

My point is that there is no limit to the types of mobility applications that can be developed with the right vendor partner, the right vision, and, even more important, a connected DDMS.

Let's examine some mobility applications. Some already exist at various levels of development and others are just possibilities. Although the may not exist yet, once created, they will provide a major contribution to mobility in the maintenance and reliability arena. As you read this list, remember all of these need to be linked by the DDMS so that there will not be any restriction for data access by those who need it.

- **Safety, Health, and Environment.** An application of this type would include auditing tools, investigation processes and protocols, access to plant procedures and guidelines, job safety analysis (JSA) capabilities and oth-

er related forms, regulatory reporting forms, information dashboards, and performance indicators. It could also include safety-equipment inspection checklists for safety showers, fire extinguishers, and anything that is OSHA-related or must meet state and federal regulatory requirements, and insurance carrier requirements.

- **Operator Rounds.** This application already exists in many forms. There are operators throughout industry who do their rounds everyday using handheld devices. I have personally seen this application used, not just for rounds, but also to check on the health of the plant's rotating equipment. In the vast majority of cases, this information flows in a single direction—from the operators in the field to a database for access by their immediate supervisors. I have also seen this type of system provide the field operators with equipment alerts if there was a problem. But what if via a DDMS the field operator had access to equipment history, the ability to enter work requests at the point of action (along with pictures and real-time video capability), access to operating parameters and detailed diagnostics, and procedures explaining how to immediately address identified operating problems? What if the information could be shared with others who could utilize it for improved decision making?

- **Daily Maintenance.** Mobility could make a significant improvement in daily maintenance throughout all levels of the maintenance organization. Planners could plan their jobs while standing at the problem equipment with immediate access to the equipment operating conditions, equipment historical data, material availability, and time available on the maintenance schedule. Supervisors could interact with the repair crew, order materials, and close out jobs without ever having to return to their office. Technicians could access equipment drawings, repair videos, and historical data to make their

work more effective. Mobile maintenance also has benefits in many other areas making repair-related information immediately accessible.

- **Lubrication.** Mobility applications in the area of lubrication have received a lot of development, but there is even greater potential when coupled with a DDMS. An application of this sort could include a lubrication schedule, analysis, proper procedures, and historical lubrication information. Coupled with other lubrication strategies, such as the use of acoustic lubrication, the application could streamline predictive and preventative maintenance practices.

- **Rotating Equipment.** A mobility solution, coupled to a DDMS that manages details related to the plant's rotating equipment, could provide great value for the technicians working in the field. An application of this sort could manage machinery inspections as well as preventative and corrective maintenance activities, and could be interfaced with the plant's work order and document management systems.

- **Electrical Equipment.** This module would be similar to that of rotating equipment except it is specific to electrical components. This module could identify, analyze, and predict issues with electrical components. It could also schedule inspections, and actively document historical data, current repairs, and replacements.

- **Turnarounds** (also called outages and shutdowns). The use of mobility for turnarounds has many potential benefits including daily plan updates interfaced with the plant's primary planning and scheduling tool, manpower, material and equipment availability and tracking, drawing and document access, and many more. Another significant benefit comes from the use of electronic forms and approval routing. A mobility tool that is able to handle the administrative aspects of these

often large work efforts can vastly improve effectiveness and efficiency when compared to conducting these tasks in a nonmobile work environment.

- **Turnaround Blinding.** Every turnaround requires extensive blinding of piping systems prior to execution of the work. Blinding of equipment is often tracked on large boards where the blinds are listed, operations and maintenance sign off to indicate blinds are installed, and, at the completion of the job, blinds are removed. This process is very cumbersome and inefficient; it could easily be streamlined using mobility solutions to track the blinding of piping and equipment.

- **Equipment Health (Reliability).** Many mobile applications currently exist, including tools to monitor lubrication, vibration, temperature, and other parameters. But there are issues. Typically, but not always, the data flows in one direction—to a database for analysis and reporting. Further, the tools for acquiring this data are application specific, meaning that the tool was purchased from a vendor for this particular purpose and often is accessible only to the subject matter expert.

  How much better would it be if the tool was tied to a DDMS so that the users, when encountering an equipment problem, could access a broad range of information and initiate immediate corrective action? How effective would it be if the users, via real-time video, could show the problem to their supervisor who was not at the job site, to a rotating equipment engineer 50 miles away at their home, or even to an equipment vendor who specializes in addressing equipment problems?

- **Flanges.** In order to assure that pipe flanges are properly bolted together, plants employ very strict torque requirements. Having a mobile device available to monitor the torque settings, as well as record historical torque data, can go a long way to preventing leakage. A

mobile solution allows this information to be recorded and accessed directly at the job site.

- **Other Bolted Connections.** In addition to flanges, the vast majority of process equipment involves bolted connections. These connections, just like piping, require specific torque settings. These connections are much more complex; they involve detailed bolting techniques that can easily be accessed in the field with a mobile device, vastly improving this process.

- **Inventory.** The area of inventory has seen mobility applications applied for many years. In fact, even in production plants, it is common to see inventory controlled by utilizing bar codes and handheld mobility devices. An aspect of inventory that is not typically seen is the ability of field personnel to remotely access the warehouse stock and order material while at the job site, as opposed to returning to their office to access the warehouse through their desktop.

- **Inspections.** Many types of inspections are conducted within the plant. The purpose of each is to identify issues that, if left unattended, could cause serious problems in the future. Many of these inspections are regulated; the results and any corrective action must be documented. The remainder of this section describes some areas where mobility coupled with a DDMS can deliver value through improved data capture, analysis, and timely reporting in order to implement corrective action.

  - **Piping.** Piping inspection includes gathering data, completing forms, conducting the analysis, and reporting. The inspection effort is looking at potential issues for pipe systems, pipelines, connections, and tubing where continuous monitoring is required to assure plant mechanical availability. These efforts also occasionally must be reported to various over-

sight agencies such as the Federal Environmental Regulatory Commission (FERC), U.S. Department of Transportation (DOT), and the Pipeline and Hazardous Materials Safety Administration (PHMSA), among others. A module such as this could include various guidelines used to track compliance with current mechanical integrity standards structured around the American Petroleum Institute (API) 570 code, among others.

- **RBI™ Tracking.** Risk-based inspection is an integral part of the inspection process. A comprehensive mobility module that creates and tracks these inspections for fixed equipment would be very helpful.
- **Coatings.** The area of coatings involves paint and fireproofing systems and their integrity. The ability to use mobile devices to conduct plant surveys and capture photographs of potentially failing systems enables the acquisition of funding to maintain these systems.
- **Corrosion Evaluations and Surveys.** Mobility applications can be used for inspections of corrosion under insulation (CUI) or corrosion under fireproofing (CUF). The application can be used for in-the-field identification of piping and insulated vessels that are experiencing under insulation corrosion problems. It also reduces the typical lag time of reporting activities and obtain corrective action.
- **Tanks and Vessels.** Modules for tanks and vessels are similar to the one developed for piping, but are structured around standards and guidelines for above-ground storage tanks, particularly API 653 and, for processing vessels, API 510 and 576.
- **Fireproofing.** A fireproofing module can be used to predict, track, direct, and schedule passive fire proof-

ing on vessels, structures, and other equipment. The module can also provide details about which equipment should be fireproofed, and the level of damage that fire proofing has experienced in the past.

8.2 Enhanced Functionality

- **The Concept of the Geo Fence.** Once your employees enter your plant, you will want to know where they are and what they are doing. Are they productively performing their jobs or have they been delayed for a multitude of reasons? Having this knowledge allows you to better schedule your resources. However, one problem has always been that, once inside the gate, their exact location is not always known. This is where the concept of the Geo Fence comes in to play. A Geo Fence is an electronic boundary that can be used to locate personnel within the plant or within subsections of the plant. It can also be used to show movement from one Geo Fenced location to another, providing you valuable insight as to what takes place in your plant on a daily basis.
- **People Tracking.** It's important to know where the people who work in your organization are on a continuous basis. This information gives you insight into their productivity, the need for them to travel to acquire tools or material, and also possibly delays in their being able to perform their work. Having the work force with devices that can be picked up by the Geo Fence provides you with this capability. Many would say that this is intrusion on a person's privacy, but, in order to properly manage the workforce, you really need to know what they're doing and where they are on a continuous basis. There is a secondary benefit to tracking individuals within the Geo Fence boundary. If there are safety-related issues, knowing where people are gives you

the ability to make sure that they are extracted from a dangerous situation or area in a safe manner.

- **Equipment.** Tracking your owned or rented equipment also works within the concept of the Geo Fence. All too often, owners who rent equipment realize that it has been sitting idle for extended periods of time, costing them a lot of money without getting any value from their being on site. Tracking equipment using a Geo Fence provides insight as to what your mobile equipment is doing, where it's located, its use, and its movement. Using this method, if you discover that a piece of equipment has not moved for an extended period of time, you can determine whether to remove it from the plant, thereby, ending your rental payments and saving you considerable amounts of money.

- **Cascading Questions.** We've discussed using mobility tools for a wide variety of applications. Many of these involve filling out forms that record valuable information related to operations, reliability, and other aspects of plant performance. However, a better type of question to you is a cascading question. For these types of questions, each answer can lead to a further question that enables users to provide great detail about the issue they are recording. Asking cascading questions removes the human error from the equation because the sequence of questions will not allow you to move on to the next question until all the answers have been properly completed.

- **Real-Time Video.** With today's technology, many industry operators and inspectors are utilizing airborne drones to inspect equipment. Typically, drone-based inspections are conducted during 30-minute to one-hour intervals. However, an average of only 10 seconds to 1 minute of footage is useful to the inspectors and their clients. By capturing the live video on a mobility device,

the inspector can ask the drone operator to stop, reverse direction, go forward, or turn slightly in any direction. This flexibility allows the inspector to capture and record only those images and data that are relevant, as opposed to capturing the entire video and then going through it frame by frame to find useful images. The result is an efficient 1-minute video and perhaps five pictures acquired in real time.

As a result of real-time video and recording options, an inspector can essentially cut out at least 2 to 3 hours of reporting time for that one inspection. Meanwhile, because that report and inspection form is attached to a specific piece of equipment for a specific inspection, an inspector can generate an inspection report very quickly, even automatically. The videos can easily be digitized, organized, and integrated in real time with other software. The optimized result is efficiently collected, organized, and analyzed data that produces actionable intelligence, so operators can make safe and cost-effective decisions in a fraction of normal time.

The list of applications just presented only scratches the surface of how mobility tools, coupled with a DDMS, can improve safety, reliability, productivity, effectiveness, and efficiency. As we enter this new industrial revolution, we are limited only by our wildest dreams.

Chapter 9

Let's Get Started

In conclusion, it should be obvious that change is in the wind. Just look around at all of the uses of mobility currently available. For those industries that have not yet embraced the concept of mobility and deployed these tools throughout their plants, the time is now. You can't afford to not have mobility solutions available to improve the effectiveness and efficiency of your organization on many levels.

Many mobility solutions are available on the industrial landscape for you to choose to bring your concept of mobility to fruition. However, you need to pay careful attention to whatever solution you select. It cannot be a standalone application. Instead, you need applications that can be integrated throughout many areas of your business, sharing information through the DDMS. Your choice must seamlessly import the data from all of these related applications. It also needs to be created in a way that all of the data acquired throughout multiple functions of the organization can be brought together and presented as a unified body of knowledge for timely access and accurate reliability based decision making.

There are firms that can provide some or all of the services. My sponsor for this book, PK Technology, has the mobility solutions you need coupled with an advanced DDMS. They can provide you all of the relevant functionality in a fashion that can be customized to your business needs.

So don't waste another minute. Become part of the New Industrial Revolution!

Chapter 10

The Work Goes On

Just when you thought you came to the end of the book in Chapter 9, I have a surprise. I would be interested in the efforts you have undertaken to get mobility initiatives in place in your plant, their success or failure, and why. Emailing me with your comments and thoughts may help others in their quest to implement mobility processes. I will respond to questions and incorporate your thoughts and ideas into the next release of this book, with your approval.

I would also be interested in your ideas of where mobility and mobility-related applications and tools could be applied. Many applications have been identified and implemented to improve effectiveness and efficiency through mobility, but there is more out there. I'm interested in learning what they are and sharing them.

You can contact me via e-mail at:
changemgt999@yahoo.com or sthomas@pksti.com.

Thanking you in advance for your support and input.

Regards,
Steve Thomas

Bibliography

DiStefano, Robert and Stephen J. Thomas. *Asset Data Integrity Is Serious Business*. Industrial Press, Inc., New York, NY, 2011.

Hiatt, Jeffrey M. *ADKAR: A Model for Change in Business, Government and Our Community*. Prosci Learning Center Publications, Fort Collins, CO, 2006.

Martinez, Jonathan, intelliSPEC™: *Revolutionizing the Industry by Introducing the World's First Digital Data Management System*. PK Technology, 2017.

Stallard, Bob (Senior Consultant, Viziya). *The Benefits of Mobility for Maintenance Before, During and After Work* (Blog).

Thomas, Stephen J. *Improving Maintenance & Reliability through Culture Change*. Industrial Press, Inc., New York, NY, 2005.

Wache, H. et al. *Ontology-Based Integration of Information: A Survey of Existing Approaches*. IJCAI'01 Workshop on Ontologies and Information Sharing, 2001.

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TECHNOLOGY

PK Technology is the developer of the industry's first Digital Data Management System (DDMS). **PK Technology** partners with clients to provide customized business solutions by combining enterprise-scale technology, in-house industry experts and a world-class development team to offer the only true business solutions in the industry allowing companies to move from "thinking" to "knowing." **PK Technology's** solutions allow:

- Complete transparency and comprehensive knowledge of data
- Better data-driven business decisions
- Digitized and optimized work flow processes
- No burden on IT workload - fully extensible

intelliSPEC DDMS combines the power of a robust, integrated and secured database with innovative mobile technology to provide world-class, intelligent, enterprise-scale digital business solution available anytime and anywhere.

With the ability to capture and feed data in real-time, **intelliSPEC DDMS** is the only solution with true digital intelligence that allows corporate members the ability to remotely view the overall health and status of a facility and assets.

For more information, please visit www.pktechnology.com
or call 316-866-2955.

Stephen Thomas has spent his career working as an engineer in the Maintenance Department for leading oil refining companies. He holds an electrical engineering degree from Drexel University, a Masters Degree in Systems Engineering and a Masters Degree in Organized Dynamics from the University of Pennsylvania. He is the author of numerous books that address topics such as organizational change, data integrity, goals improvement, productivity, and logistics.

In *No Pencils Required,* you will learn how mobility solutions coupled with a robust Digital Data Management System (DDMS™) can address a variety of inefficiencies in your company.

- **Why you should embrace a mobile platform?**
- **How do I make the change to a mobile platform?**
- **What benefits mobility can offer?**
- **What applications a mobility solution can deliver?**
- **What is the business case for mobility?**

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