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- The contributors to reliability
- How to bring the whole team on board

Brian Underdahl



***Reliable
Transportation***

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by Brian Underdahl

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Reliable Transportation For Dummies®, IBM Limited Edition

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Introduction

Transportation is the backbone of modern society. People, raw materials, and finished products all depend on reliable transportation to move them from where they are to where they need to be and when they need to be there. But reliability doesn't just happen. It takes planning, processes, and follow-through to make sure that these vital transportation systems are dependable, on-time, and economical.

Transportation providers invest heavily in their vehicle fleets. Maintaining those fleets is both business critical and a major expenditure. But not performing needed or scheduled maintenance can be quite costly because breakdowns, accidents, or other failures not only take resources out of service, but also they disrupt the entire organization. These disruptions are so major, in fact, that most organizations own multiple major assets and many extra parts to ensure against major schedule disruptions. This is an expensive way to assure schedules though and is simply unsustainable in the challenging economic environment we live in today.

About This Book

Reliable Transportation For Dummies, IBM Limited Edition, shows you what you need to know about what it takes to keep a fleet operating efficiently while keeping maintenance expenses in check. In other words, this book provides information and ideas about what you can do to have a reliable fleet operation that doesn't break the bank with either unforeseen breakdowns or out-of-control maintenance expenditures.

Icons Used in This Book

This book uses the following icons to call your attention to information you may find helpful in particular ways.



The information marked by this icon is important and therefore repeated for emphasis. This way, you can easily spot noteworthy information when you refer to the book later.



This icon points out extra-helpful information.



This icon marks places where technical matters, such as jargon and whatnot, are discussed. Sorry, it can't be helped, but it's intended to be helpful.



Paragraphs marked with the Warning icon call attention to common pitfalls that you may encounter.

Chapter 1

Introducing Reliable Transportation

.....

In This Chapter

- ▶ Getting to know what reliable transportation is all about
 - ▶ Looking at the costs of not being reliable
 - ▶ Considering the contributors to reliability
 - ▶ Bringing the whole team on board
-

Society's reliance on transportation is no longer an option — transport providers are responsible for moving people and goods as a critical piece of commerce and security. The constant pressure to provide these services safely and within budget is greater today than at any time before. It takes flexibility, planning, and forward thinking to ensure that transportation schedules are met safely and cost effectively. You simply can't afford to have major assets fail when businesses and consumers are counting on you to deliver reliable service.

This chapter looks at what reliability means, what it costs when your systems aren't reliable, and what it takes to deliver on the promise of being there when and where you're needed.

Understanding Reliable Transportation

Transportation is a critical piece of many industries and businesses. You don't have to be a traditional transportation provider to require reliable service. You can be a national

retail chain with trucks delivering inventory to stores, a regional hospital with ambulances on call, or a city utility with meter readers and repair crews out in neighborhoods. The focus of your business may lie elsewhere, but your fleet of vehicles is one of your core assets. And optimizing those operational assets often drives your success.

In today's world, vehicles and their component parts are more instrumented, integrated, and intelligent than ever to provide operational data. Because of this intelligence, optimizing your fleet of assets can be more achievable and more effective than ever before, resulting in greater business impact.

An enterprise asset management system must be at the core of this optimization capability. Such a system provides the visibility, control, and automation essential to addressing risk of failure and day-to-day operational tasks associated with your vehicle fleet.



With capabilities such as intelligent, on-board sensors, actual operating conditions feed data to systems that monitor conditions against actual performance. Trending differences can trigger alerts that notify technicians when and where intervention is due. These trending differences, when recognized as anomalies, can automatically trigger work activity in your work management or enterprise asset management system. An effective enterprise asset management system can help optimize processes to address these risks resulting in reduced fleet downtime. This sort of automation enables end-to-end management of the fleet life cycle, and reduce operational expenses and asset maintenance budgets.

Reliable transportation can be interpreted differently, but some common themes across industries do exist:

- ✓ **On-time performance:** Customers simply expect people and goods to arrive at their destination based on a predetermined schedule.
- ✓ **Safety:** There's no margin for error when it comes to safe transport of people or things.
- ✓ **Cost control:** Budgets often are limited; there isn't enough funding to maintain everything in pristine condition. Priorities must be assigned to high-risk assets and safe operations.

None of these objectives can be met unless your fleet is properly maintained; however, in a competitive marketplace, watching operating costs is paramount. It's no longer reasonable to assume that a one-size-fits-all approach to maintenance will deliver the reliability you need at a cost you can afford. Fortunately, the world is changing as a result of something known as the *Internet of Things* (IoT). With more and more intelligence built into sensors on board operating assets, you now possess real-time information about what needs maintenance and when.



The IoT isn't just about new devices, productivity improvements, or even connectivity. It's about the creation of new insights from all the data that connected devices generate. More than three billion people are using the Internet. Everything transmits data. But without the use of intelligent (or newer cognitive) analytic modeling, terabytes of streaming structured and unstructured data will be unusable. Gleaning wisdom or insights from this intelligence is where your business can benefit.

Considering What Unreliability Costs

There's certainly no question that reliability isn't free, and for most transport providers, it's not an option. In most transportation industries, maintenance procedures are mandated by regulatory agencies. Not only is maintenance a major operating expense, but also many industries face ongoing pressure due to skills shortages, especially for maintaining highly specialized assets.



The best way to extract productivity and efficiency from smaller pools of resources is to use them smartly. Any opportunity to automate a business process creates additional capacity from limited resources and must be considered as part of business continuity planning.



Unreliability carries many costs. For example, if your fleet isn't as reliable as it should be, here are some potential issues you may experience:

- ✔ **Breakdowns:** If a vehicle experiences a breakdown while in service, emergency crews are dispatched, usually at high cost. Some breakdowns have the potential to cause accidents and, possibly, the loss of lives. Unfortunately, there are thousands of lawyers out there just waiting for a chance to file expensive class-action lawsuits at the slightest hint of liability in the hopes of having a gigantic payday!
- ✔ **Loss of business:** Let's face it; people have many choices about where to take their business. If the public perceives your organization as being unreliable, you may never get a second chance to earn its trust. That's especially true with social media where a single dissatisfied customer can quickly spread the word to thousands of people about what he or she sees as poor, unresponsive, and unreliable service.
- ✔ **Unexpected replacements:** Unreliable equipment may need to be replaced sooner than expected, leading to budget-busting capital expenditures. Properly maintained equipment generally has a much longer service life than poorly maintained items.
- ✔ **Regulatory burdens:** Depending on your industry, being unreliable may bring unwanted government regulatory attention. You could be forced to bear extra costs to prove that your fleet can operate safely in the public space. Failure to provide adequate proof could result in a loss of your fleet's operating privileges.
- ✔ **Excess labor costs:** Drivers, mechanics, schedulers, and even managers can all be drawn away from doing something productive when they're forced to respond to breakdowns or delays. With the shortage of skilled labor, few options may exist to cover emergency work (for example, without sacrificing mandated maintenance). The options remaining often are time-consuming and expensive.

What Contributes to Reliability

Reliability doesn't just happen. It takes systematic effort and investment across the entire organization to create and maintain reliable systems.



An effective asset management solution can collect, consolidate, and analyze information on all of an organization's assets. This process includes such things as identifying excess spare parts inventory, managing pools of expensive sub-assemblies, and scheduling repair labor, tools, and repair bay time. Unifying processes is a critical step to creating efficiencies and applying technology to manage the complexity. The insight provided by a unified asset management solution can help:

- ✓ Ensure that required maintenance doesn't "fall through the cracks"
- ✓ Standardize processes and assure compliance to mandated procedures.
- ✓ Manage complexity of mobile and stationary assets.
- ✓ Align maintenance investment with the requirements of the fleet and the company as a whole.

You don't have budgets simply to replace assets rather than repair them. You also can't risk liability or regulatory non-compliance. To meet the operational requirements and reap the business benefits of reliable service, you need to take steps to

- ✓ Optimize processes to improve the reliability and availability of fleet assets, reducing downtime by
 - Implementing industry-specific transportation solutions with capabilities for managing campaigns, contracts, depreciation, inventory, asset configuration, meter history and adjustments, and service level agreements.
 - Supporting all aspects of transportation that you control; for example, if you're a rail operator, the integrity of the rail infrastructure affects your rail cars. If your vehicles use petroleum, monitor the quality of the fuel and changes in consumption rate. Often these factors are indicators that other components in the engine aren't operating correctly.

- ✓ Enable end-to-end asset life cycle management by
 - Including early life information such as design specifications and set up details as part of information available for maintenance teams
 - Automating work management processes to integrate views of “risk of failure” into prioritization methodology
 - Capturing and sharing staff knowledge, especially as long-term employees approach retirement
- ✓ Reduce operational expenses and maintenance budgets by
 - Carefully integrating maintenance time into operational
 - Improving productivity by ensuring that work is ready to go when the asset is in the maintenance bay; gather drawings, prekit parts, prepare tooling in advance of when they’re needed so you don’t waste valuable time reserved for work
 - Providing automated compliance and audit tracking for work related to regulated activity
 - Implementing best practices and continuous improvement strategies to extend asset life, optimize parts management, reduce road repair calls, and increase planned maintenance

Making Sure Everyone Understands

Reliability has to be a team effort. One person or even one group within an organization can’t succeed in bringing about necessary changes unless everyone understands the goals and does his or her part.

Getting your entire organization on board often means facing some challenges:

- ✓ **Organizational culture:** People need to understand that just because “that’s the way we’ve always done it,” doesn’t mean that the results are good enough. You need

to make sure everyone sees why changes are needed, understands their role in creating reliable and safe transportation, and that improvements aren't optional.

- ✔ **Overcoming objections to the costs:** While any new system incurs start-up costs, increased reliability will almost certainly drive lower costs over time. Breakdowns and downtime may not be listed as line items in your organization's budget, but they impact top line and bottom line elements and won't go away simply by being ignored.
- ✔ **Priorities:** It's difficult to see the forest for the trees when you're operating in emergency mode all the time. Without prioritization of critical work on critical assets, it's impossible to move out of emergency mode. There's never enough budget to maintain everything in pristine condition.
- ✔ **Current capabilities:** Implementing any new system means investing in enhanced capabilities. Workers may need to be trained in new procedures and techniques, but those investments will pay off with more reliable systems.



Look for people in your organization who really understand the need for reliability and designate them as team leaders. Their enthusiasm and vision will build success.

Chapter 2

Reliability and Inner-City Transportation

In This Chapter

- ▶ Seeing what your customers expect
 - ▶ Considering what's needed
 - ▶ Getting the most of your resources
-

Urban areas are growing rapidly, but while the demands for safe and reliable public transportation are higher than ever, transportation budgets are increasingly limited. Managing the thousands of public-transit assets, including light rail, subways, and intermodal transit, along with supporting infrastructure, can create a significant challenge for any municipal or national government. That's why, as public transportation organizations attempt to meet changing demands of enhanced safety and reliability and reduction of costs and environmental impact, many of them are looking for ways to meet the challenges of inner-city transportation management.

This chapter looks at the expectations, needs, and resources in play when considering the subject of reliability and inner-city transportation.

Understanding Customer Expectations

As population growth continues to explode within urban centers worldwide, the need for effective inner-city transportation systems is more urgent than ever. Today's businesses and

urban communities all depend on a healthy transportation infrastructure to grow and succeed. Large numbers of people must be able to move reliably and affordably from point A to point B.

A number of different types of inner-city transportation systems exist:

- ✔ **Commuter or passenger rail:** A type of rail transit that primarily operates between and within a city center and suburban areas
- ✔ **Light rail and light-rail transit (LRT):** A type of train that typically uses steel-tracked, fixed guideways that run primarily along exclusive rights of way and have vehicles capable of operating as a single train or as multiple units coupled together
- ✔ **Trams and trolleys:** Rail vehicles that typically run on tracks along public urban streets or separate rights of way
- ✔ **Subways and rapid transit systems:** A type of high-capacity transit generally found in urban areas, typically using multiple electric units on rail tracks, guided rubber tires, magnetic levitation, or monorail
- ✔ **Ferries:** A boat or ship used to transport primarily passengers across a body of water and operate on regular, frequent, return services
- ✔ **Buses:** City, suburban, and express bus services used to transport large numbers of people in urban areas, as well as between suburbs and cities

Transportation organizations face significant challenges in managing infrastructure as urban populations and congestion have increased. Even cities with strong transit networks still must deal with aging assets and infrastructure, while growing communities struggle to develop new or expanded transit systems. You must make the most of your existing assets, while revitalizing current systems or creating new infrastructure.



The demand for effective inner-city transportation isn't slowing down. Nearly 70 percent of millennials use multiple travel options several times per week, and they rank public transportation as the best way to move within the inner-city. Because urban dwellers depend on public transportation as their main means of transportation, they expect transit organizations to do the following:

- ✓ Provide predictable transport schedules
- ✓ Push out updates and notifications via mobile technology
- ✓ Keep them safe
- ✓ “Be Green” — practice sustainable operations
- ✓ Promote a desirable quality of life for workers and residents

Meeting the daily demands for service is critical to maintaining transit system ridership. Otherwise, city leaders may look irresponsible, and many riders may switch to other modes of transportation to fill the void. Riders are especially aggravated by delays due to operational problems. They depend on — and demand — reliability. By performing more preventive and predictive maintenance, rather than reactive, and by integrating expected maintenance into operational schedules, you can better meet customer expectations for service and motivate riders to continue using public transit.

Predicting the Needs

An enterprise asset management system can help you make strategic decisions about maintaining assets across the entire inner-city transit system. The ability to schedule preventive maintenance when it may least impact other schedules can significantly impact reliable operating schedules. By tracking assets at a component level, as well as understanding the relationships across the entire system, you can pinpoint root causes of failure, which extends the useful life of all assets and improve operational excellence across the network.

A variety of new technologies can help support your initiatives. These range from predictive analytic maintenance solutions to real-time diagnostics leveraged through telematics. In addition, the use of smart cards to replace traditional transit tickets or tokens can not only increase ridership convenience but also allow you to more quickly identify changing travel patterns and control the size of your fleets (for example, based on ridership data). These initiatives can also help reduce fuel use and minimize the environmental impact of keeping unnecessary assets in operation.



One of the best ways to increase the public's use of inner-city transit systems and to help reduce congestion is to actively inform them of the reliability and availability of transport assets that connect neighborhoods and commercial centers to each other. Transit riders value consistent travel times and reliable transfers between stops even more than shorter travel times.

Maximizing Your Resources

No modern transit agency can afford to waste resources. You also can't risk the liability or regulatory noncompliance associated with dangerous and improperly maintained equipment.



Using an enterprise asset management system, you can capture the myriad details needed to manage all the elements of a single- or multi-modal transportation system — buses, trains, trams, ferries, tracks, and roads — with a single central solution. Such a system can help collect valuable knowledge about asset performance, predict and control appropriate maintenance investment to optimize capacity and assets, improve the end-to-end traveler experience, and increase operational efficiency without sacrificing reliability or safety. By managing all your transportation assets in a single system, you can more efficiently address the challenges of managing asset life cycles, retiring workers, infrastructure development, inner-city congestion, carbon emissions, and regulatory compliance. And, most importantly, you can help continually increase the satisfaction of transport customers.

The ability to gather and analyze asset operations data allows you to maximize the effect of maintenance on your fleet.

Each phase of an assets life cycle creates information useful to those responsible for follow on phases. For example, technical information developed during the design phase of an asset may be altered when the asset is put into commission. Maintenance teams need this information to effectively maintain the asset during operation. When the asset is sold, the quality of the maintenance history enhances its value in the aftermarket.



An enterprise asset management system also helps capture the best practices, policies, procedures, and lessons learned by seasoned workers. By incorporating into business processes and applications the information that long-time skilled employees possess, you can help ensure that capabilities are not lost while providing a top-to-bottom alignment of functions in support of ongoing operations.

When it comes to managing rolling stock, all the assets must be inspected, maintained, and repaired at the right time to help ensure quality of service. Both utilization and schedule frequency drive maintenance costs and activities for these units — and the costs typically increase as these units age. In addition, maintenance activities may require special facilities and tools. Both single- and multi-modal transit organizations need an integrated, system-wide view of asset performance to help reduce costs and achieve a maximum return on investments.



Typically, the largest expense for the operation of inner-city transportation fleets is fuel. Understanding fuel consumption can help you minimize the total cost of operations. For example, a combination of low tire pressure, a faulty oxygen sensor, and a clogged air filter can dramatically reduce fuel economy on buses. Seek a fleet management solution that can trigger work based on the interrelationship of these conditions to reduce fuel consumption and maintain optimal performance of the fleet. Plus, the solution should assist in grouping work orders across sub-components of the asset to optimize the time spent in the maintenance bay, creating less disruption to operating schedules.

While you must invest in services to attract and retain travelers, you also need to prolong the life of aging infrastructure. If your assets are reaching the end of their life cycles, the expense of maintaining and upgrading these assets increases

and can significantly impact daily operations and safety. A solid asset management solution can help you efficiently maintain infrastructure assets, without having to sacrifice other key initiatives.

The provider you choose should be able to support the full breadth of your asset management requirements. Ideally, you will also want one who can partner with you throughout implementation and deployment, as well as one who can provide long-term, ongoing support. Look for vendors who understand the challenges facing the transportation industry and can support your unique goals. The solution should include support for managing different types of assets with expedited response time for addressing changes in transportation equipment, infrastructure, and regulatory requirements.

Chapter 3

Reliability and Rail Services

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In This Chapter

- ▶ Considering commitments to customers
 - ▶ Understanding what failure costs
 - ▶ Getting the most reliability from your assets
-

Today's long-haul rail transport operators seek to extract maximum capacity for their transport services within existing infrastructure of rail assets. Operators with strong transit networks continually must address aging assets and infrastructure and where to invest for expansion. Track and rail assets are expensive to operate and maintain — an investment in growth today could affect operational budgets for decades. The critical balancing act? Making the most of existing assets while revitalizing or creating new infrastructure.

This chapter looks at the challenges faced by rail system operators, providing some key insight into addressing those challenges.

Looking at Commitments to Customers

As rail operators try to balance capacity with demand, optimizing asset performance is mission-critical to successful operations. And yet, optimizing performance of all the assets for a rail transit system has historically been next to

impossible. The distinct management needs of different assets, such as locomotives, rail cars, trams, metro or underground, tracks, rail controls, rolling stock, and roads, have traditionally resulted in a fragmented patchwork of disconnected systems. In the past, multiple systems and processes to manage maintenance and operations contributed to the lack of an integrated view to asset capacity and scheduling. As a result, much of the coordination of maintenance and scheduling was manual and paper-based, serviced and managed by large teams of experts who depended on communal knowledge to stitch together complex schedules. These processes had no comprehensive way to increase reliability across different assets, improve returns on investment, or ensure a state of reliability.

Enterprise asset management systems, however, can help organizations knit together disparate information to give a broader, more consistent and thorough view of the fleet readiness to meet the reliability, availability, maintainability, and safety (also known as RAMS) of their assets and related infrastructure.

As a central element that applies to all rail asset types including rail cars, rails, and infrastructure, RAMS covers the following:

- ✔ **Reliability:** The capability of equipment such as a rail car to continue functioning as it was intended to do when it left the factory
- ✔ **Availability:** The capability of a system to be kept in a functioning state

The availability of a system depends on the system's design reliability, maintainability, and maintenance support.
- ✔ **Maintainability:** The ease at which the product or system can be repaired or maintained

The maintainability of a system depends, among other things, on the accessibility, standardization, and modularization of the system.
- ✔ **Safety:** Adequate if the product doesn't cause harm to people, the environment, or any other assets during its life cycle



To maintain your commitment to your customers, you need a system that can help you monitor key performance targets, such as service availability, asset reliability, mean time between failures (MTBF), and mean time to repair (MTTR). The data can help rail operators control and avoid problems, such as delays in scheduling, breakdowns in operation, and mistakes in providing the correct capacity or functionality, which can impact both a route and future ridership.

Considering the Costs of Failures

Today's rail operators depend on a wide range of assets; central among these is rolling stock, comprising all the vehicles — both powered and unpowered — that move on a railway, including locomotives, carriages, and wagons. These assets must be inspected, maintained, and repaired at the right time to help optimize quality of service.



A comprehensive asset management solution can help achieve longer equipment service life, reduce cost-per-mile or cost-per-hour, and increase the residual value of all rolling-stock assets. Rolling stock is highly complex — components and subcomponents designed for interchangeability also carry unique fit-form-function requirements; each has unique maintenance schedules. Managing configuration of these complex assets is the focus of great effort in maintenance departments. Enterprise asset management can help manage the complexity of these multiple configurations and related maintenance responsibilities.

In addition to rolling stock, rail operators must also manage the railway infrastructure that connects everything together. Because many assets are aging, there's an increase in the expense of maintaining and upgrading them.

Assets such as railways, catenary wires, and roadways are typically categorized as *linear* assets because they have a start and end measure. Additionally, a system of linear assets can contain a combination of linear and point assets

(the individual pieces that together make up the whole linear system), all of which can be managed together or separately. For the purpose of management, you need the ability to understand multiple layers of linear assets in order to manage their health. For example, a rail is built on a roadway, which has a substrate and is provisioned with lights and signals. Large geographical areas require proper understanding of these relationships so that work at any one point can be optimized and effective.

Linking Your Assets for Reliability

To create a truly reliable rail system, strategy is needed to gather data from existing monitoring and telemetry systems, such as supervisory control and data acquisition (SCADA), signaling systems, and rolling stock sensors. These data elements range from the rotation and temperature of wheels to the thickness of the overhead wire from which the train draws its power. Actively monitoring these performance metrics provides baseline signatures that define “normal” readings within the context of the operating environment. For example, is the temperature of an axle bearing normal for the grade being traveled or the weather conditions? Once “normal” is known, abnormal can be monitored.

In the event of a deviation on a particular parameter, such as excessive brake wear, an onboard monitoring system can automatically send an alarm, which generates the appropriate work-order request (designated as inspection, preventive maintenance, corrective maintenance, or emergency repair). To prioritize the request and determine the best way to fulfill it, the system takes into account the specific maintenance parameters of the asset in question (for example, is the component critical to operation or is the deviation within a tolerable range) as well as the availability of parts inventories, maintenance personnel, and existing work requests.



Perhaps the best way to measure the safety impact of a new solution is to look at the operational risks that a rail system faces every day. One dimension is the rail and switching infrastructure, including tunnels and raised viaducts distributed

over miles of track (some of it possibly passing through earthquake-prone areas). Then there are the trains themselves, moving over the tracks at high speeds. Given the intense physical stresses and the complex array of variables that need to be monitored at every moment, automated, condition-based monitoring of parameters that can indicate trending failure is critical in ensuring passenger safety.



The deadly 1998 crash of a high-speed train in Germany — caused by a single fatigue crack in one wheel that went undetected — illustrates the importance of pervasive asset monitoring in maintaining passenger safety.

While the importance of safety is paramount, a management system can be an important tool to lengthen the life span of your assets and thereby minimize spending on unscheduled maintenance. A significant part of the savings results from more efficiency and automation in every part of the asset management process. Higher uptime translates into greater asset efficiency and a more holistic and proactive approach to maintenance helps optimize your human resource planning, parts inventory management, and purchasing practices.

Data from instrumented rolling stock can facilitate real-time monitoring and enable a predictive maintenance approach. You can proactively initiate alerts, notifications, and inspections that allow for planned removal from service.

Whether your current service maintenance strategy is reactive, preventative, or condition-based, analytics and development of predictive models enable you to implement a predictive, proactive strategy. Such a strategy helps create lead time by identifying related factors that impact asset availability and the quality of products and services. It can also lower maintenance costs while optimizing spare parts inventory.

Each system can become its own interactive, adaptive, and intelligent network of not only things but also places and people. By leveraging predictive analytics and sensors, you can gain valuable insights and proactively manage your system. This means that even before your crew discovers a problem, you've dispatched maintenance personnel to inspect, repair, or replace it. The potential is virtually unlimited with the incredible volume and types of data now available.

Chapter 4

Reliability and Aviation

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In This Chapter

- ▶ Meeting the mandates
 - ▶ Understanding scheduling and profitability
 - ▶ Understanding customer satisfaction
 - ▶ Getting lasting value from reliability
-

Multiple aircraft, owners, and operators; multiple part types across global locations; and multiple sets of government and industry regulations offer unique challenges to operators in the aviation industry. For years, maintenance, repair, and operations (MRO) providers have invested heavily in custom software applications and legions of people to manage them to handle the huge volumes of information the complex aviation industry creates. Regardless of how an MRO organization works — whether as a division of an airline, an independent third-party contractor, or the service arm of an aircraft manufacturer or supplier — it's operating in a rapidly changing and growing marketplace.

This chapter looks at the special needs aviation system operators have and how reliability is such a large part of this segment of the transportation industry.

Meeting the Mandates

There's little doubt that the aviation industry is highly regulated. No matter where you operate, you need to comply with

numerous and often complex governmental mandates. Just to name a few, these include

- ✔ **Safe operations:** All aircraft require periodic inspections to ensure that they can be safely flown. The content and scope of these required inspections is highly regulated and often the product of years of study before deployment to the field. Each component carries their own set of required work and must comply and be certified as complete.
- ✔ **Complex assets:** Every aircraft consists of complex configurations of subcomponents and software used to run them. Component improvements undergo years of testing and certification. Changing component combinations requires extensive review processes within the Federal Aviation Administration (FAA) or other governing bodies. When these changes are finally delivered to field maintenance teams, the process of adapting and updating configurations is highly complex (but absolutely required for safe operations).
- ✔ **Data ownership:** The controversy around continued airworthiness (ICA)/technical content/level 2 and 3 repair procedures over who owns data continues to rage — with the FAA weighing in several times over the past couple of years — to the benefit of airlines and MROs and to the frustration of original equipment manufacturers (OEMs).
- ✔ **Data standards:** While the ATA and ASD and ISO standards exist for data, process, and interoperability, most MRO IT solutions do not comply internally — and charge for external APIs. Due to the high risk of failure, aircraft operators operate in a world of intensive analysis and review, which in itself slows down incremental improvements in process.



Meeting these mandates is expensive, and the never-fail requirement hinders incremental improvements. But the challenges to the status quo are causing aircraft operators to reconsider their options — that's because the age and expense of existing legacy systems are driving change. While this evolution occurs in a world of tight restrictions, recent technology improvements have made these changes possible.

These changes affect core functions, including the following:

- ✔ **Line maintenance:** With handheld devices for accessing information at and on the aircraft
- ✔ **Technical document management:** The ability to convert OEM mandates into Operations Maintenance Procedures (OMPs)
- ✔ **Aircraft health management:** While streaming data from aircraft has been analyzed for decades, new capabilities in analytic models create opportunity for enhanced understanding of asset health
- ✔ **Supply chain management:** With technologies to help increase inventory utilization
- ✔ **Subcomponent management:** Tracking maintenance requirements and current configuration requirements

Scheduling for Profitability

As the aviation industry grows, providers face pressures that range from increasing overhead and eroding margins to competition for specialized maintenance skill sets, outdated management systems, the need to monetize services without alienating customers, and requirements for better insight into equipment and operational performance. To relieve these pressures, the adoption of modern systems provides an opportunity to address the challenges and to take advantage of new innovation. Many providers faced with skills shortages in global regions will rely on technology to close the gap between retiring worker knowledge and less experienced replacements.



The need for a trusted arbiter of information to support time-critical operations and equipment uptime is especially important because it benefits many participants, from manufacturers who provide engines or other equipment to the airlines themselves. Such a system must offer rich functionality with a demonstrated track record supporting high risk industries like aviation, nuclear power generation, and pharmaceuticals. Look for a solution that supports the following:

- ✔ Complex configuration management
- ✔ An analytics based approach to scheduling
- ✔ The ability to manage pools of assets in a global theater

This type of solution automates the exchange of information among equipment, physical locations, and collaborative personnel, helping ensure they have the information they need when its needed.

Keeping the Customers Satisfied

An appropriate solution will help keep your customers satisfied because it provides an information-exchange platform that supports aircraft safe operations and reliability, regulatory compliance, and operational efficiency. With visibility into data, you can, for example, prepare the MRO team with the information it needs to quickly upgrade an airplane's software to ensure accurate fit-form-function, service landing gear that shows signs of wear to ensure reliability, or replacement of a broken coffee maker to improve passenger satisfaction.

Customer satisfaction depends on the success of maintenance. Maintenance depends on the power of analytics to manage pooled assets, from individual parts to complete subassemblies of major airplane components. With time for maintenance impacting aircraft utilization and on-time departures, asset availability and time in the maintenance bay must be managed carefully. Efficiency is improved if critical maintenance for subassemblies can be carried out while an aircraft is in the bay. Similarly, outstanding service bulletins and airworthiness directives must be applied in the context of a mobile fleet because safe operations depend on the accurate updates driven by these mandates.



A satisfied customer is a loyal customer. If you have issues with customer satisfaction, customer loyalty is impacted. Issues also may create a social media onslaught that could negatively impact the value of your brand.

Efficient management of your resources enables you to provide better service, thus improving customer satisfaction. Keep your customers happy, and look for a system that provides the following range of MRO services:

- ✓ **Planning and scheduling:** Applying analytics to optimize scheduling for components to optimize work forecasting and management of crews, components, and locations.
- ✓ **Engineering:** Managing service bulletins and airworthy directives and helping manage their implementation to minimize flight disruptions and cost

- ✔ **Version-based task management:** The ability to transform maintenance planning documents (MPDs) into operators maintenance programs (OMPs) to automate work package preparation, ensuring the link to technical changes is efficiently delivered to the field
- ✔ **Configuration management:** Helping ensure that correct components are installed and properly configured using analytics-based validation of aircraft hardware and software
- ✔ **Resource management:** Integrating work stream information about pools of assets, skills and certifications, electronic log books, and supplier contracts
- ✔ **Materials management:** Optimizing the purchase and pooling of components to minimize inventory costs and maximize availability
- ✔ **Maintenance management:** Using analytics to optimize aircraft maintenance schedules based on planned usage; improving management of labor, skills, qualifications, and training

Understanding the Lasting Value of Reliability

In the aviation industry, reliability is not only vital, but also it can be quite profitable. In fact, most large aircraft manufacturers have estimated that proper maintenance can increase the resale value of an airplane.



Of the MRO capabilities made possible by big data and analytics, predictive maintenance can yield some of the most significant results. Predictive maintenance goes well beyond other maintenance approaches, such as

- ✔ **Reactive**, which takes action only after an asset fails
- ✔ **Preventive**, which anticipates and conducts maintenance based on OMPs
- ✔ **Condition-based**, which monitors assets to determine need for maintenance

Predictive maintenance leverages analytics to model foreseeable changes to the characteristics of individual systems or assets.

Predictive maintenance, as a tool to improve MRO operations, is being rapidly adopted. Predictive maintenance and the use of analytics represent a major opportunity for MRO organizations seeking a competitive advantage. A solution that delivers a mature, flexible platform that can respond to the unique needs of aircraft maintenance by using open systems standards and that enables easy interconnections with existing technology will simplify the implementation of predictive maintenance best practices.



In the aviation industry, those who choose to take on adoption of modern technology as a platform to support effective maintenance will be well positioned for innovation. Moving away from highly customized, expensive, and archaic technology frees maintenance engineering to explore new opportunities available even within the confines of strict regulation.



Safe operations is the single most important factor for aviation service providers. Adhering to flight worthiness directives, managing complex asset configurations and scheduling for complex maintenance cycles benefit from new innovations derived by combining higher levels of analysis to terabytes of data. All this translates into safe, reliable transportation for customers and growth for the enterprise servicing them.

Chapter 5

Meeting Security, Compliance, and Other Considerations

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In This Chapter

- ▶ Making your strategy work
 - ▶ Understanding customer needs
 - ▶ Getting value from the Internet of Things
-

Every segment of the transportation industry has security, compliance, customer satisfaction, and a host of other important issues that need to be addressed. Ignoring these things simply isn't possible, but dealing with them can be complex.

This chapter looks at these important topics and discusses ways you can successfully address and resolve key issues before they become serious problems.

Making Sure Your Strategy Is Working

Operating and managing a transportation system involves complex tasks that require considerable planning as well as proper implementation. Not only do you need to create a system that operates efficiently, but also you need to have plans for dealing with any problems that might arise during those operations.

Efficient operation

The first part of your strategy has to address the operational efficiency. Hallmarks of such a strategy include the following:

- ✔ **Keeping operating costs in check:** Your system needs to function within budget, with reasonable operating costs.
- ✔ **Employing proactive maintenance:** A maintenance strategy must minimize downtime without wasting a large portion of your maintenance budget on unnecessary items or actions.
- ✔ **Maximizing usage:** The closer you get to operating at full infrastructure capacity, the greater return you'll derive from your total asset investments. For example, your fuel costs per passenger or piece of freight are significantly lower when your fleet operates at full capacity.

Security

A second element of your strategy has to deal with security. Any organization, and especially those in the transportation industry, as to be constantly aware of a multitude of external threats that face them in today's world. A few of these threats include

- ✔ **Cyberattacks:** Threats to computer systems are no longer limited to a few amateur hackers. These days, you also need to be vigilant for attacks launched by various state-sponsored groups in foreign countries. Some of the modern attacks go well beyond simply stealing data into the realm of possibly producing actual physical damage to equipment.
- ✔ **Physical security:** Hijackings, bombings, and hostage-taking incidents certainly make the evening news, but you need to be aware of the threat of other types of physical attack, too. Undetected, intentional physical damage to vehicles can easily cause accidents and impact the physical security of your fleet, crew, passengers, and cargo.

Compliance

Your strategy must also meet all necessary compliance requirements. These might include

- ✓ **Certification of technical documents:** Work tasks on complex assets are highly regulated. Many organizations contribute to their content and certified release.
- ✓ **Reporting:** You need to address any requirements regarding reporting of incidents, anomalies, threats, or other items that apply to your segment.
- ✓ **Skilled worker certification:** You need to certify that all of your equipment and operators are properly licensed and that all necessary certifications are fully up-to-date.



Be aware of compliance requirements in every jurisdiction where your fleet operates. These requirements can vary widely with noncompliance being very costly to your operations.

Understanding that On-time Delivery Means Customer Satisfaction

One important measure of success in the transportation industry is customer satisfaction. That's true because satisfied customers mean repeat business, greater loyalty, and enhanced brand value. No organization can stay in operation for very long without highly regarded, industry recognized services.

In today's competitive marketplace, people expect things to happen at the time they're promised. If a package is due on Tuesday, it must arrive on Tuesday. If a flight is scheduled to arrive at 8:15 a.m., you can bet passengers will be angry — and broadcast it across social media — if it's an hour late, and they miss their connecting flights.



The need to stick to published schedules is one reason why breakdowns or delays can be so costly. Not only do such problems mean that you need to quickly deal with whatever caused the problem, but also you have to try to satisfy angry customers. Substitutions, emergency crews, and interruption of service impact the bottom line . . . and not in a positive way.



An asset management solution that helps you anticipate problems before they impact schedules is an important tool in maintaining customer satisfaction.

Seeing How the Internet of Things Can Help

Billions of devices and objects (“things”) are being embedded with sensors and chips to form the Internet of Things (IoT). As these things gain the capability to communicate using the Internet, information networks deliver valuable insight about how systems are functioning. You can exploit this insight to create new operating and business models, improve business processes and reduce costs, strengthen security and manage risk, and manage this new dynamic environment.

Some of the ways IoT can help you achieve your goals as a reliable transportation service provider include the following:

- ✔ **Optimization:** With more and better real-time information available, implementing better traffic management procedures can result in reduced operating costs or adding more vehicles on demand.
- ✔ **Service extension:** Connecting service information to customers through mobile devices improves the customer experience resulting in greater satisfaction.
- ✔ **Control:** With real-time information, proactive maintenance strategy gains lead time to plan for repairs, improving timetable management, and asset management procedures can be far more effective.



Seek out ways to use published APIs to connect sensors from trackable assets to lower the cost of implementation. By using these standards, an unlimited number of devices and objects can be linked to location services. Location services for assets are proving to be a valuable aspect of customer service.



Weather impacts transportation services. Linking weather data to operational schedules, asset performance criteria, and passenger loads helps you predict and plan for appropriate levels of maintenance to ensure uninterrupted, reliable operations.

You can also take advantage of the IoT to institute an energy consumption monitoring and management solution. Remote monitoring of energy consumption — and quick communication about that consumption — provides insight on asset health, as long as it's understood in the context of the current operational state. For example, more fuel is consumed when traveling up a hill; less is consumed when traveling downhill. Understanding the relationship between fuel consumption and state of operation enables an organization to identify assets not performing at optimal levels.



The proliferation of IoT devices is attracting attackers and malware, with the always on, always connected characteristics of these devices making them perfect targets. The potential for disaster looms even greater, threatening widespread catastrophe and loss of life, as cyber criminals attempt to exploit connected devices. Security must span the entire infrastructure to assure the safety of physical systems, both individual devices that comprise an IoT network as well as through intelligent monitoring and management of the entire network.

Chapter 6

Ten Facts about Reliability and Transportation

In This Chapter

- ▶ Designing maintainability into your assets
 - ▶ Attaining executive support
 - ▶ Getting your budget cleared
 - ▶ Using PR to your advantage
 - ▶ Looking for leaders
 - ▶ Using all your resources
-

This chapter gathers together ten facts that are important for you to take away from this book.

Designing in Maintainability

Maintainability is something that needs to be designed into your assets. You need to involve maintenance teams when developing requirements for new assets so that your vehicles, aircraft, trucks, and all other assets can be properly designed to be maintainable.



Industry standards organizations often have design guidelines available that you can use as references.

Remembering Training

Training isn't an option! Don't let procurement officers negotiate away training on new systems using the false premise that users can simply pick up the knowledge they need during normal operations. Proper training is vital to having the reliable systems you need.



Training reduces the time needed to get new systems functioning properly, so proper training actually saves more than it costs.

Garnering Executive Support

The top reason for failure to implement best practices is a lack of executive buy-in. Accountability needs to start at the top, so make sure executives support the mandate for change. Without this support, it can be impossible to get the entire organization on board, which hampers a successful outcome.



Often the most enthusiastic executive support happens when executives, across key lines of business, can see quantifiable and qualified benefits from any imperative or initiative.

Justifying Your Budget

These days, no one has unlimited budget. You need to create a risk-based matrix for developing asset criticality as an essential part of any maintenance strategy. This matrix can help you determine and justify the proper budget levels to support your operations.



Predictive maintenance can help extend asset life cycles while also reducing overall maintenance costs.

Remembering the Small Stuff

Do sweat the small stuff! More time spent upfront in designing master data, correct data domains, workflows, and reports translates into better user acceptance and adoption. Attention

to detail helps you reduce the chances that something important is overlooked.



Documentation is vital and it's critical that your documentation is reviewed by all strategically invested parties. Often, omissions or errors are obvious to a fresh set of eyes.

Knowing What's Good Enough

Don't let unattainable perfection get in the way of good enough. Focus on a single area for process improvement by choosing one with a progressive team, a big problem to solve, or a new fleet. Apply the concepts of remembering the small stuff and creating proper documentation holistically in this target area first to work out the kinks, then to bring on new areas one at a time based on prioritization.



There will always be failures in mechanical systems. Absolute perfection probably isn't a reasonable or attainable goal. Predicting and avoiding failures by using best practices and modern asset management approaches can however drive the occurrence and severity of failures to an ever smaller number.

Using PR

Pay attention to public opinion especially within your organization. Conduct regular updates to ensure continued support for your project. Small successes build support for larger efforts and continued support.



Sometimes a hands-on demo provides the best exposure and bang for the buck. A strategically timed open house can build an awful lot of support.

Finding Leaders

Look for leaders and influencers at every level of your organization. The best leaders often don't carry the title of manager.



One way to find out your hidden leaders or influencers is to simply ask members of your team to help you build a broad coalition of key stakeholders.

Considering Other Industries

Don't be afraid to look to other industries for best practices. Maintenance and reliability in your industry looks surprisingly similar in other industries. Seek out best practices in maintenance and you will find jewels to use in your own environment.



Thinking outside the box can help you find parallels in seemingly unrelated organizations. After all, enterprise relies on a fleet of assets to achieve its mission. It may be fixed or mobile but each share similar needs and are limited by budget. Learning from these leaders will enhance your knowledge and give you new business models to consider.

Using Available Resources

Take advantage of free resources. Your suppliers and systems vendors have experience with many enterprises who also may be asset intensive or have maintenance systems in place. Make sure they are asked to participate in strategy discussions. Ask them to share their insight and ideas on how to improve practices.



Don't forget that vendors may be able to put you in touch with other customers who may have had to face problems similar to yours.

Notes



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Notes



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Notes

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Notes

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Transportation is the backbone of modern society

Many people, materials, and products depend on reliable transportation to move them from where they are to where they need to be and when they need to be there. But reliability doesn't just happen — it takes planning, processes, and follow-through to make sure that these vital transportation systems are dependable, on-time, and economical. That's where this book comes in. *Reliable Transportation For Dummies*, IBM Limited Edition, shows you what it takes to keep a fleet operating efficiently while keeping maintenance expenses in check. You get information and ideas about maintaining a reliable fleet operation that doesn't break the bank.

- **Protect your investment** — maintain your fleets and avoid costly breakdowns, accidents, or other failures
- **Understand customer expectations** — meet the daily demands for service
- **Address challenges** — both in rail services and aviation
- **Let the Internet of Things (IoT) help** — get valuable insight about how your systems function with cognitive computing and analytics



Open the book and find:

- An introduction to reliable transportation
- How reliability and inner city transportation relate
- Reliability within rail services and aviation
- Ways to meet security and compliance guidelines
- Ten facts about reliability and transportation

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