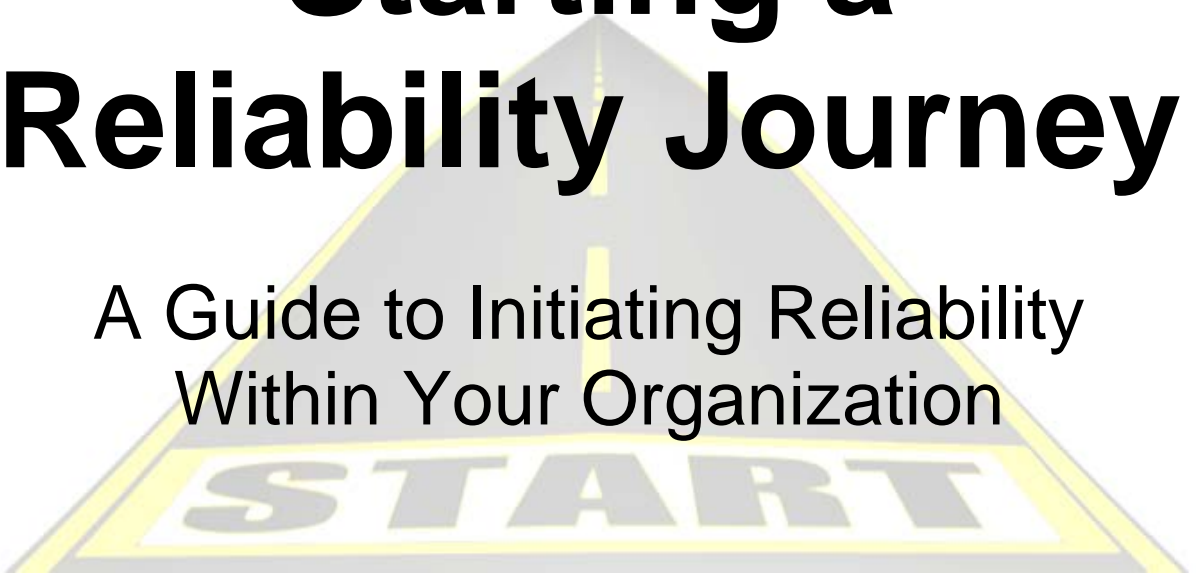


Starting a Reliability Journey

A Guide to Initiating Reliability
Within Your Organization



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INTRODUCTION



Ralph Waldo Emerson is credited for saying that “Life is a journey, not a destination.” Emerson’s quote is an apt description of the lifelong journey we undertake in the application of reliability within an organization. Implementing a reliability program is not simply a software purchase; it’s not just a checklist of items that must be completed that will ensure you have reliable products and processes. A reliability program is a complex learning, knowledge-based system unique to your products and processes. It is supported by leadership, built on the skills that you develop within your team, integrated into your business processes and executed by following proven standard work practices.

Characteristics

The characteristics of learning and knowledge become the foundational elements that make implementing reliability a journey versus a quickly achieved trip to a destination. A journey will take time, is often difficult and implies a process of personal change and development. The reliability journey will last the lifetime of your products, your processes and your company. There will be difficulties to overcome involving those people, products and processes that you are trying to improve. Done well, your reliability program will change how the organization works and it will have a positive impact on your organizational culture and the profitability of the business.

People and Skills

Improving reliability is done through the application of statistics, physics and engineering to your products and processes. Therefore, all reliability programs begin with people and the development of the skills and knowledge they need to learn. You then need to provide your team with the right systems and tools matched to support the work they need to perform. And finally, you must leverage the knowledge that your team gains to drive the improvements needed by your business to remain competitive and profitable in today’s global marketplace.



ABOUT RELIASOFT



ReliaSoft has been helping individuals and companies navigate their reliability journeys since 1992. ReliaSoft’s own journey has caused us to evolve into a global reliability solutions company that offers a comprehensive range of services dedicated to meeting the reliability engineering and quality needs of product manufacturers and maintenance organizations worldwide. ReliaSoft’s capabilities encompass all aspects of reliability engineering through all stages of product development, deployment and operation.

Our Mission



ReliaSoft's mission is to promote proper reliability engineering methodologies and empower our customers to apply these methodologies in ways that will maximize their profitability while assuring the safety, reliability and quality of their products, processes and services.

We accomplish this mission through our global leadership in all aspects of reliability engineering, and by providing tools, education, services, resources and certification programs that serve the needs of product manufacturers and maintenance organizations worldwide. We maintain this leadership by heavily investing in R&D, from both a theoretical and an IT standpoint. We continuously incorporate new and proven technologies into our solutions, enabling our customers to efficiently leverage our research in their day-to-day activities. We publish and share our findings in the form of textbooks and papers for the betterment of the engineering community.

Our Global Family



To provide the highest possible level of customer service, ReliaSoft has established an international network of wholly owned subsidiaries (regional centers) complemented by independent sales and support partners. We are headquartered in Tucson, Arizona USA with offices in São Paulo Brazil, Warsaw Poland, Chennai India and Singapore.

Visit us at www.Reliasoft.com

GETTING STARTED



An old Chinese proverb states, “A journey of a thousand miles begins with a single step.” This is a great way to look at starting your reliability journey; just take that first step. Even the longest and most difficult ventures have a starting point and the good news is that they don’t all have to begin in the same way or from the same point. You want to leverage your particular needs and strengths such that you set up your initial launch into reliability to be as successful as possible.

Launch Points

There are several launch points that a company might use to initiate a reliability journey within their organization. You might have a business need to reduce warranty costs and improve customer satisfaction (see page 5). Or maybe you have a talented team in your test area that could easily be developed to improve your tests' capability to predict field reliability (see page 7). Another launch point might come from product development/R&D where leadership has determined a need to improve how to design products to be more reliable (see page 9). Or there might be opportunities for improving manufacturing equipment reliability and operational availability on the production side of the business (see pages 11 and 14).

Return On Investment (ROI)

For each launch point, there are tools and training that best fit that focus area. With minimal investment, your organization can quickly unlock improvements in knowledge gained by applying reliability to your product and process data. These data-driven decisions culminate in tangible business results.

For each area, examples of ROI from the *2015 Best Practices in Reliability* study conducted by ReliaSoft will be provided.

Respondents to the survey from across a broad spectrum of businesses (including aerospace, automotive, defense, energy, healthcare and heavy equipment) shared the gains that their organizations have realized from reliability programs.

Your return will be determined by the investment in leadership, people, support systems and tools, as well as the commitment you apply to your reliability journey.



STARTING WITH WARRANTY IMPROVEMENT



A need to reduce warranty costs and customer complaints is common throughout industry, and is often a driver for launching the reliability journey.

Leader / Champion

Most typically, the warranty program is administered out of the Quality department. Therefore the natural leader is the Director of Quality.

Team

Most quality organizations include a team of specialists assigned to manage quality data and guide the organization in resolving product and process issues. It is recommended that the entire team be trained in the reliability methods and tools to support a warranty reduction initiative. Additionally, you may want to add representatives from R&D and Production to act as liaisons to the Quality group and help with communication of improvement activities.

It is recommended to develop at least three warranty improvement team members, a product engineer and a manufacturing engineer for a total of five initial users.

Skills and Recommended Training

The common skills for warranty improvement include: Data management to set up the incident reporting system; life data analysis to analyze the field failure rate and provide estimates of warranty cost based on production volumes; and critical problem solving skills to root cause the failure mechanisms and drive irreversible corrective actions.

[G475 FRACAS Principles and Applications](#): Introduces the fundamentals of Failure Reporting, Analysis and Corrective Action Systems (FRACAS), with an emphasis on the configuration and use of ReliaSoft's XFRACAS software for incident reporting, failure analysis, problem resolution and other related analyses.

[G400A Weibull and Life Data Analysis](#): Introduces and familiarizes the attendee to the core concepts in reliability engineering mathematics and focuses on the fundamentals of Weibull and life data analysis.

Tools to Start



[XFRACAS](#): ReliaSoft's XFRACAS is a highly configurable, web-based, closed-loop, enterprise-wide Incident/Failure/Data Reporting, Analysis and Corrective Action System. XFRACAS facilitates incident reporting, failure analysis, part tracking, root cause analysis, team-based problem solving, actions management and other related activities. The system simultaneously supports the acquisition, management and analysis of product reliability, quality, safety and risk management data from multiple locations and/or user groups.



[Weibull++](#): ReliaSoft's Weibull++ software tool is the industry standard in life data analysis (Weibull analysis) for thousands of companies worldwide. It includes data entry formats for using sales/returns data to perform life data analysis to make warranty projections.

ROI

Responses from the *Best Practices in Reliability* survey report that, on average, companies achieve the following levels of improvement when the focus is on warranty reduction:

- 14.4% reduction in failure modes observed in warranty
- Corresponding 14% reduction in customer complaints
- Warranty reduction plays a significant role in achieving the average 10% revenue growth reported due to overall product reliability improvement resulting from having a reliability program

TEST DEPARTMENT LAUNCH



Since many product development organizations follow a strategy of “Test and Fix” in order to develop robust and reliable products, the test area may be ideal for beginning a formal reliability journey.

Leader / Champion

Identifying the leader for reliability within the test area may take a little work. Often, test areas are divided into two functional groups: Test operations, where daily management of equipment and test operators is performed, and a test development team, where new test development and data analysis of test results are done. The manager of the test development group or the overall director for the test lab will be the best champion for a reliability program. If the test development is led out of the engineering department, then look there for a reliability leader.

Team

Test engineering groups are often well suited to take on the role of reliability engineer. They already interface with the product engineers and lab technicians. Typically, they are familiar with the product specifications, at least the areas of the spec that drive reliability and testing. They have been collecting test data and often performing the initial analysis on the results, writing test reports and, in some cases, even helping with root cause analysis of failures on test.

It is recommended to develop the entire test engineering team. This is done to ensure that all products receive the same level of support, all employees follow the same standard of work and a consistent message is provided from the test area to all its internal and external customers. Depending on the size of the organization, this is often a group of five to ten and may include both hourly and salaried employees.

Caution: Ensure employees have the appropriate computer and math skills prior to entering reliability training.

Skills and Recommended Training

The concept of “stress-strength interference” is the basis for life data analysis and accelerated test analysis and is foundational for test engineering. The goal is for this team to be proficient in test planning, data analysis and test development.

[G400 Foundations of Reliability Engineering Data Analysis and Modeling](#): Introduces and familiarizes the attendee to the fundamental concepts in reliability engineering mathematics, from basic data analysis and modeling to advanced methods and concepts.

[D521 Advanced Quantitative Accelerated Life Testing Analysis](#): Explores advanced concepts and applications for quantitative accelerated life testing data analysis, including tests with multiple stresses or time-dependent stresses.

Tools to Start



[Weibull++](#): ReliaSoft's Weibull++ software tool is the industry standard in life data analysis (Weibull analysis) for thousands of companies worldwide. One of the unique features of Weibull++ is the Reliability Test Design tool, which enables the user to determine the appropriate sample size, test duration or other variables for designing effective reliability and demonstration tests.



[ALTA](#): ReliaSoft’s Accelerated Life Testing Data Analysis software provides a comprehensive toolset for accelerated test planning and quantitative accelerated life testing data analysis, plots and reporting. The software provides the life-stress relationships required to analyze accelerated life test data with up to 8 simultaneous stress types, where stress is constant or varies with time.

ROI

Responses from the *Best Practices in Reliability* survey report that, on average, companies achieve the following levels of improvement when focused on testing:

- Contributes to the 14% reduction in failure modes
- Part of the 8.8% improvement in product development efficiency
- Plays a significant role in achieving the 10% revenue growth reported due to overall product reliability improvement
- Is a significant part of the reported 9.5% reduction in development time

PRODUCT DEVELOPMENT / R&D



Product Development can be the most challenging and also the most rewarding area in which to launch your reliability program. The challenges lie in the complexity of product development, which touches almost every aspect of the business, beginning with both your customers and suppliers, handing off to manufacturing, while still involved with warranty and customer satisfaction. But a successful implementation may provide a very high return on investment due to significant improvements in your product development process, reductions in warranty, increased sales, fewer problems in manufacturing, and more.

Caution: Reliability initiatives in product development will usually take three to five years to become fully integrated into your product development process.

Leader / Champion

The launch of a reliability program at this level will require an executive champion and a reliability initiative leader. The executive champion will be your VP or Director of Engineering. The reliability leader should be a senior manager with a passion to lead an organization change centered on reliability.

Team

Assembling the reliability team within a product engineering organization typically begins with the creation of a new department or group with the appropriate budget allocated to similar engineering functions. You begin by hiring from outside or selecting from within your reliability manager. The manager then will build the team from internal or external candidates as needed.

The size of the reliability team will be a function of the size of the product engineering organization and the complexity of the products developed. The *Best Practices in Reliability* survey indicates that each reliability practitioner will manage 2 - 4 projects at one time.

All members of the reliability group, including the manager, will go through extensive reliability training. At any one engineering site or business unit, this may be a small team of three to five or a large department of 20+ employees.

Skills and Recommended Training

A Reliability Engineer is a professional who understands how to apply the principles of performance evaluation and prediction to improve product/system safety, reliability and maintainability. The initial core skills that new reliability professionals must develop begin with foundations in Design for Reliability (DFR), supported by Failure Modes Effects Analysis (FMEA), life data analysis, reliability testing and system modeling.



ReliaSoft recommends initiating the skill development for the reliability team through the use of the [Certified Reliability Professional \(CRP\) program](#). To achieve certification, candidates must complete a series of training courses focused on important reliability engineering topics, successfully apply the learned body of knowledge in the workplace and publicly present this expertise in an industry conference or journal.

[D560 Design for Reliability \(DFR\) Program Planning and Implementation](#): Provides an overview of Design for Reliability and includes a complete DFR plan that can be customized to meet specific needs.

[G400 Foundations of Reliability Engineering Data Analysis and Modeling](#): Sets the foundation for all subsequent seminars by introducing the attendee to the fundamentals in reliability engineering, from basic data analysis and modeling to advanced methods and concepts. It begins with an in-depth discussion of Weibull and life data analysis and continues by expanding to advanced subjects.

[D470A Foundations of Effective FMEAs](#): Provides an overview of FMEA, FMECA and related analyses, with an emphasis on the use of ReliaSoft's Xfmea software for analysis, data management and reporting.

[G522A System Reliability and Maintainability Analysis and Optimization](#): Explores advanced concepts and applications for system reliability/maintainability analysis and optimization utilizing a reliability block diagram (RBD) or fault tree analysis (FTA) approach.

[D521 Advanced Quantitative Accelerated Life Testing Analysis](#): Explores advanced concepts and applications for quantitative accelerated life testing data analysis, including tests with multiple stresses or time-dependent stresses.

Tools to Start

For this launch point, it is recommended to start with the **ReliaSoft DFR Essentials Suite**.



[Xfmea](#): ReliaSoft’s Xfmea facilitates data management and reporting for all types of Failure Modes and Effects Analysis. The software provides predefined settings to fit the major industry standards (such as AIAG, SAE J1739 and MIL-STD-1629A) and also provides extensive customization options to fit your particular analysis and reporting needs.



[Weibull++](#): ReliaSoft's Weibull++ is the industry standard in life data analysis (Weibull analysis) for thousands of companies worldwide. The software is packed with tools for related reliability analyses, such as warranty data analysis, degradation data analysis, non-parametric data analysis, recurrent event data analysis and reliability test design.



[ALTA](#): ReliaSoft’s accelerated life testing data analysis software provides a comprehensive toolset for accelerated test planning and quantitative accelerated life testing data analysis, plots and reporting. The software provides the life-stress relationships required to analyze accelerated life test data with up to 8 simultaneous stress types, where stress is constant or varies with time.



[BlockSim](#): ReliaSoft’s BlockSim provides a comprehensive platform for system reliability, availability, maintainability and related analyses. The software offers a sophisticated graphical interface that allows you to model the simplest or most complex systems and processes using reliability block diagrams (RBDs) or fault tree analysis (FTA) — or a combination of both approaches!

ROI

Responses from the *Best Practices in Reliability* survey report that, on average, companies achieve the following levels of improvement related to product development reliability:

- 10% revenue growth due to overall product reliability improvement
- 8.8% improvement in product development efficiency
- 9.5% reduction in development time
- 9.6% reduction in project resource needs
- Contributes to the 14% reduction in failure modes and associated customer complaints

MANUFACTURING

Reliability in manufacturing uses many of the same methods and tools that are applied to reliability in product development. The difference is in the focus; for manufacturing, the key objective is production. Reliability for manufacturing can then be described as $Reliability_{(Production)} = Reliability_{(Maintenance)} + Reliability_{(Operations)}$.

Maintenance



Starting a reliability journey in maintenance is a very common-sense approach to building on the strengths of your maintenance team. Implementing reliability moves the maintenance team away from “firefighting” problems and toward problem prevention. Reliability Centered Maintenance (RCM) is a global standard process, recognized as the most efficient maintenance strategy, and it is the approach recommended by ReliaSoft.

Leader / Champion

The logical reliability leader is the Maintenance Manager, with the Plant Manager acting as the executive champion for the reliability program.

Team

The team for maintenance reliability can be a little tricky to assemble. You begin with the management team made up of the Maintenance Manager and his or her supervisors. Often, these folks started as hourly workers and may require additional coaching and development to lead and manage the RCM deployment.

Because reliability has an element of statistical application, the team will need to create a reliability engineering role. Organizations typically take one of two approaches to filling this role: a) hire asset management reliability engineers into the maintenance group or b) leverage the skills in the continuous improvement (CI) group found in the plant and have them assigned to provide analytical support for maintenance as a priority of their standard work.

The final part of the team is composed of craftspeople with skills unique to the equipment and systems that exist in a given facility. It is this group of specialists that perform the preventive, predictive and corrective work of the maintenance organization.

Skills and Recommended Training

The reliability skills needed within maintenance begin with understanding the functions of the production processes. They also include the ability to perform root cause analysis to determine failure mechanisms. This includes the application of life data analysis to failure and wear-out data. In addition, there is a significant need for skills related to scheduling, planning and optimizing the prevention and prediction work as well as the parts and resources needed to maintain the facilities.



ReliaSoft recommends initiating the skill development for the leaders of RCM and those in the reliability engineering role by following the [Certified Reliability Professional \(CRP\) program](#).

[M440 Reliability and Maintainability Analysis for Repairable Systems:](#)

Provides an overview of the ways in which reliability engineering concepts and methods can be applied for repairable systems analysis and maintenance planning.

[M480A RCM Principles and Applications:](#) Provides an overview of the fundamental Reliability Centered Maintenance techniques and procedures, with an emphasis on the use of ReliaSoft's RCM++ software for data capture, analysis and reporting.

[G522A System Reliability and Maintainability Analysis and Optimization:](#) Explores advanced concepts and applications for system reliability/maintainability analysis and optimization utilizing a reliability block diagram (RBD) or fault tree analysis (FTA) approach.

Tools to Start

For this launch point, it is recommended to start with **ReliaSoft RAM Essentials Suite**.



[RCM++:](#) ReliaSoft's RCM++ facilitates the Reliability Centered Maintenance (RCM) analysis approach for creating scheduled maintenance plans, which is an important aspect of an effective asset management program. The software provides support for the major industry RCM standards and also offers extensive configuration options to fit your organization's particular RCM analysis approach. Full-featured FMEA / FMECA functionality is also included.



[Weibull++](#): ReliaSoft's Weibull++ is the industry standard in life data analysis (Weibull analysis) for thousands of companies worldwide. It supports repairable system analysis to analyze current event data. It also has specialized tools to convert system failure and repair data into times-to-failure and times-to-repair.



[BlockSim](#): ReliaSoft's BlockSim provides a comprehensive platform for system reliability, availability, maintainability and related analyses. The software offers a sophisticated graphical interface that allows you to model the simplest or most complex systems and processes using reliability block diagrams (RBDs) or fault tree analysis (FTA) — or a combination of both approaches!

ROI

Responses from the *Best Practices in Reliability* survey report that, on average, companies achieve the following levels of improvement from a focus on enhancing maintenance reliability:

- 8% revenue growth due to improved manufacturing equipment reliability
- 8.5% productivity improvement resulting from better equipment reliability, reduced labor and lower spare parts carry costs
- 10.7% reduction in spare parts
- 9% reduction in the number of required preventive maintenance (PMs) tasks
- 10% reduction in unplanned downtime

OPERATIONS



A newer launch point of reliability is the application of reliability methods and tools within manufacturing operations. This approach is especially beneficial for high volume packaging lines. The focus is on eliminating stops that cause disruptions in production.

Leader / Champion

The leader may come from one of two areas: It may naturally fall to the manager of the Continuous Improvement group, or it may go to the Operations Manager. Because both of these leaders report to the Plant Manager, he or she will assume the role of executive champion.

Team

Leveraging the skills of the plant's Continuous Improvement (CI) group provides a strong foundation for launching reliability from this point. The CI team traditionally has been charged with helping the plant achieve its productivity goals. Therefore, this group, even in a small plant, consists of three to five skilled problem solvers.

It is recommended that the entire CI team, including the CI supervisor or manager, be trained in the application of reliability methods and tools to operations. You should also consider adding a representative from the plant Quality organization and the Maintenance group since improvements will touch both of these functions. Plan on developing at least five employees to start.

Skills and Recommended Training

The common skills for operation improvement include data management, because CI team members often must pull data from enterprise resource planning (ERP) systems such as SAP. Life data analysis will be used to analyze stops and determine mean time to stop (MTTS) and mean time to repair (MTTR) metrics. Good problem solving skills are also necessary in order to root cause the failure mechanisms and drive irreversible corrective actions. Finally, team members will need to be able to perform system analyses to prioritize productivity initiatives.

[G400 Foundations of Reliability Engineering Data Analysis and Modeling](#): Sets the foundation for all subsequent seminars by introducing the attendee to the fundamentals in reliability engineering, from basic data analysis and modeling to advanced methods and concepts. It begins with an in-depth discussion of Weibull and life data analysis and continues by expanding to advanced subjects.

[G522A System Reliability and Maintainability Analysis and Optimization](#): Explores advanced concepts and applications for system reliability/maintainability analysis and optimization utilizing a reliability block diagram (RBD) or fault tree analysis (FTA) approach.

Tools to Start



[Weibull++](#): ReliaSoft's Weibull++ is the industry standard in life data analysis (Weibull analysis) for thousands of companies worldwide. It also supports repairable system analysis to analyze current event data and has specialized tools to convert system failure and repair data into times-to-failure and times-to-repair.



[BlockSim](#): ReliaSoft's BlockSim provides a comprehensive platform for system reliability, availability, maintainability and related analyses. The software offers a sophisticated graphical interface that allows you to model the simplest or most complex systems and processes using reliability block diagrams or fault tree analysis — or a combination of both approaches!

ROI

Responses from the *Best Practices in Reliability* survey report that, on average, companies achieve the following levels of improvement from an application of reliability to plant operations:

- 9% revenue growth reported due to reduced stops and improved capacity
- 8.5% productivity improvement resulting from less scrap and rework and reduced overtime
- 10% reduction in scrap and rework
- 8% improvement in availability due to reduced stops

THE DESTINATION



You would not begin a journey without a destination in mind. For a reliability journey, our destination would be to develop the skills needed, supported with the right business processes, systems and tools, to enable the development and management of products and processes to perform their required functions without failure under required conditions for their defined useful life.

Although we may never quite attain the ideal state, we can certainly work toward that achievement. A famous American football coach, Vince Lombardi, once told his team: “Gentlemen, we will chase perfection, and we will chase it relentlessly, knowing all the while we can never attain it. But along the way, we shall catch excellence.” This is a great example of how to establish the vision for your reliability journey. Once you’ve taken those first steps, relentlessly pursue perfection in your reliability program so that you will achieve excellence.

Building on Your Start

Regardless of where you launched your reliability journey from, the improvements you make and the excellence you achieve will soon cause other parts of the company to want or need to launch their own journeys. This is because reliability touches every aspect of the business and our customers are demanding ever greater levels of reliability at competitive costs.



The training and tools that you have started with will become the building blocks that you will use to create a company-wide reliability program. With ReliaSoft, you will take the initial tools and knowledge gained at the start of your journey and combine them with new tools and knowledge to form an enterprise-level solution. We call that reliability solution the [Synthesis Platform](#).

Synthesis is an integrated reliability platform that can unite any or all of ReliaSoft's best-in-class reliability engineering applications into a powerful, easy-to-deploy, enterprise-capable, integrated reliability solution. It provides intelligent integration between reliability activities and tools, while simultaneously facilitating effective information sharing and cooperation across the organization.

HELPFUL REFERENCES AND RESOURCES



Help begins with our sales team. They will direct you to explore the best options that will meet your reliability needs. ReliaSoft also offers free trials of all tools in the Synthesis Platform so that you can see for yourself the quality and value of our products.

[How to Contact ReliaSoft Corporation](#)

Additional Helpful Resources

[ReliaSoft.com](#)

[SynthesisPlatform.net](#)

[Weibull.com](#): With over 6,000 pages, Weibull.com is devoted entirely to the topic of reliability engineering, reliability theory and reliability data analysis and modeling.

[ReliaWiki](#): ReliaWiki[®] provides a platform for sharing reliability engineering knowledge.

[RCM: Comparing Maintenance Strategies Based on Cost and Availability](#)