

[Excerpt from the Introduction to the book “Effective FMEAs,” written by Carl S. Carlson, published by John Wiley & Sons, ©2012, all rights reserved]

## Introduction

“Anything that can possibly go wrong, does.” Ancient mountaineering adage

Some call it the fourth law of thermodynamics. Some call it an ancient mountaineering adage. The most common ascription is Murphy’s Law: “If anything can go wrong, it will.” Whatever the source, it pays to anticipate problems and solve them before they entangle customers, or worse, become catastrophic.

Across the globe, development times are becoming shorter, cost concerns more acute, and customers are demanding and expecting absolute safety and high reliability. Companies need to rethink how they achieve these objectives. While it may have been sufficient in the past to focus on testing and analysis as the primary methods of ensuring high reliability, this is no longer sufficient because test-and-fix can take too long and is too costly. It is essential to ensure high design quality and reliability during the early development stages in order to shorten development times and stay within budgets. To do this, it is necessary to focus first on problem prevention, rather than merely problem solving, anticipating the factors that can lead to failure and ensuring designs are robust. Failure Mode and Effects Analysis (FMEA) can anticipate and prevent problems and help companies achieve high reliability in products and processes within considerably shorter development times, and within budget.

During my 30-year career in reliability engineering and management, I have had the pleasure to work with thousands of engineers and managers, and hundreds of companies. I have never met a single person who does not want to contribute to a successful team effort to develop trouble-free products or processes. Whether part of a design team, manufacturing, management, or a support activity, we all want to see our efforts make a difference in the quality and reliability of the products or services we support. There is a natural passion and energy of employees to achieve trouble-free products. Failure Mode and Effects Analysis is a key tool for accomplishing this objective.

The plain truth is FMEA has the potential to be a very powerful tool to achieve high reliability in products and processes; and when done well, it is remarkably effective. Yet in practice, FMEA does not always achieve the expected results, and can lose effectiveness.

While working in the fields of aerospace, vehicle engineering and reliability consulting, I have supervised or performed over two thousand FMEAs. During this time, I have seen just about every possible way to do FMEAs incorrectly, and discovered simple strategies to learn from these mistakes and turn them quality objectives. The purpose of this book is to share these best practices for doing FMEAs effectively.

One of the objectives of the book is to teach by example. Many case studies are discussed and examined, including industry-specific applications, two well known catastrophes (the Space Shuttle Challenger and the DC-10 cargo door blowout), and an FMEA case study on an all-terrain bicycle. Other case studies and stories about FMEA application are interspersed throughout the book. At the end of each chapter is a set of problems that can be useful in learning the fundamentals of FMEA and how FMEA can be applied to many different activities and industries.

To get good results from FMEAs, it is necessary to learn and apply the correct procedures. To get uniformly outstanding results with each and every FMEA, it is essential to learn and apply a set of simple strategies. This book teaches these strategies.

FMEA has been around for many decades and has a long history as a method to support product designs, manufacturing processes, service, and maintenance. There is a wide range of applications and types of FMEAs. This book is for anyone who wants to learn about FMEAs and how to do them effectively and efficiently regardless of job discipline or prior FMEA experience.

Whether you are involved in product designs, manufacturing, service, maintenance, management, quality, or any other discipline that supports product development and operations, FMEA can be a valuable tool to dramatically increase reliability; and ensure safety of equipment, personnel, processes or services. What is important is to learn from mistakes, follow the simple strategies covered in this book, and do the procedure correctly.

### **My personal philosophy regarding FMEAs**

Through the synergy engendered by the right team of experts, and by implementing correct and proven methods and procedures, problems can be anticipated and prevented resulting in safe and trouble-free products and processes, with the inherent risk in any system or process reduced to a very low level.

### **My Pledge to readers**

"Humility, that low, sweet root, from which all heavenly virtues shoot", Thomas More

FMEA is a broad subject, with a wide variety of standards, procedures and applications. There is no shortage of opinions and ideas from practitioners, both new and experienced. It is impossible to fully satisfy everyone, from every level of experience and every industry and application. However, I encourage feedback, and I will carefully listen to all comments, concerns, criticisms and suggestions. I will stay engaged and find ways to share comments, suggestions, and knowledge about the subject of FMEA with students, readers and industry practitioners. In the words of a great teacher, "learning is not a spectator sport." No one person has all of the answers, and by sharing our experience and knowledge, we can learn from each other.

I sincerely wish you the best in your quest to support safe and trouble-free products and processes.

Carl S. Carlson