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Airborne Electronic Hardware Design Assurance: A Practitioner's Guide To RTCA/DO-254



Synopsis

Written by a Federal Aviation Administration (FAA) consultant designated engineering representative (DER) and an electronics hardware design engineer who together taught the DO-254 class at the Radio Technical Commission for Aeronautics, Inc. (RTCA) in Washington, District of Columbia, USA, *Airborne Electronic Hardware Design Assurance: A Practitioner's Guide to RTCA/DO-254* is a testimony to the lessons learned and wisdom gained from many years of first-hand experience in the design, verification, and approval of airborne electronic hardware. This practical guide to the use of RTCA/DO-254 in the development of airborne electronic hardware for safety critical airborne applications: Describes how to optimize engineering processes and practices to harmonize with DO-254 Addresses the single most problematic aspect of engineering and compliance to DO-254 – poorly written requirements Includes a tutorial on how to write requirements that will minimize the cost and effort of electronic design and verification Discusses the common pitfalls encountered by practitioners of DO-254, along with how those pitfalls occur and what can be done about them Settles the ongoing debate and misconceptions about the true definition of a derived requirement Promotes embracing DO-254 as the best means to achieve compliance to it, as well as the best path to high-quality electronic hardware *Airborne Electronic Hardware Design Assurance: A Practitioner's Guide to RTCA/DO-254* offers real-world insight into RTCA/DO-254 and how its objectives can be satisfied. It provides engineers with valuable information that can be applied to any project to make compliance to DO-254 as easy and problem-free as possible.

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Customer Reviews

"This book, depicting the art of RTCA/DO-254 design assurance using the novel practitioner's approach, is based on the authors' and industry feedback, experiences, and lessons learned. Precise explanations ... provide efficient and clear guidelines directly applicable to appropriate engineering methodologies in defining, creating, and testing complex digital circuits for use in safety critical aircraft systems. ... The book's structure, mixing adequate regulatory needs accompanied with explanations and real examples, can be read with ease. The clear chaptering covers chronologically the aircraft electronic hardware lifecycle execution from planning to deployment, including configuration management and process assurance. Thus the reader can swiftly access material of interest, as chapters can easily be related to the well-known V-model development process. ... [Readers of this book will] learn how to comply with Federal Aviation Regulations and RTCA/DO-254, and gain insight into engineering best practices for airborne electronic hardware design assurance. Requirement capture techniques are applied and demonstrated through examples – a first in this type of technical literature. ... A very high-level writing style is found across all sections of the book. This book shall be considered as the reference when designing safety critical aircraft systems. ... A tremendous book, setting founding grounds to be used by engineers, managers, and students involved or interested in airworthiness hardware certification and aiming to reduce cost, effort, re-work, and deployment schedules." – Dr. Patrick Mejasson, Thales Avionics, Paris, France

"With a combined total of over 70 years of experience, Randall Fulton and Roy Vandermolen are veterans in aviation certification and airborne electronic hardware (AEH) development. Based on their vast and varied experience, they provide crucial information necessary to successfully manage, develop, and verify AEH. Reading this book is like sitting in a classroom with expert and battle-tested instructors. The concepts of AEH development, design, validation, and verification are clearly explained and illustrated. This book explains both the why and the how of critical concepts related to DO-254 compliance. Additionally, the material is written at a level that is practical for systems engineers, managers, and hardware engineers." – Leanna Rierson, Digital Safety Consulting, Wichita, Kansas, USA

"The succinct manner in which the requirements development methodology is captured is worth the price of the book. It provides a great reference for evaluating requirements development processes and standards." – Jeff Knickerbocker, Sunrise Certification and Consulting, Inc.,

Winfield, Kansas, USA

Randall Fulton has more than 36 years of electrical engineering experience in software and electronic hardware development and verification. He holds a BS from the Pennsylvania State University and earned his FAA DER credentials in software and programmable logic devices while working at Boeing Commercial Aircraft. As a DER, he has had approval authority for programmable logic devices since 1997 and has worked numerous Part 23 and Part 25 certification programs with field programmable gate arrays, ASIC, and software. Randall, along with Roy Vandermolen, taught the DO-254 practitioners course for RTCA in Washington, DC from 2006 to 2009. Randall has also taught the Airborne Electronic Hardware Job Functions class for the FAA Academy in Oklahoma City. He currently works as an FAA consultant DER through his company SoftwAir Assurance, Inc. Roy Vandermolen is an electronics design engineer with more than 35 years of experience ranging from vacuum tubes to programmable logic devices, but has spent the majority of that time designing and verifying programmable logic devices and the circuit cards that employ them. Roy holds a BS from the Massachusetts Institute of Technology, and is currently a staff engineer and certification manager for electronic flight control systems at Moog Aircraft and an airborne electronics hardware OBAR for Boeing Commercial Aircraft. Roy has worked in a variety of research laboratories, educational institutions, military R&D facilities, and commercial aircraft flight controls manufacturers. At Moog Aircraft, Roy has been involved in the design, verification, and certification of numerous Level A flight control systems. Roy, along with Randall Fulton, taught the DO-254 practitioners course for RTCA in Washington, DC from 2006 to 2009.

Just finished a detailed read of this new textbook on DO-254. This is the first comprehensive look at this standard provided by practitioners responsible for assessing Do-254 compliance. The book helps fill a void created by differing regulatory interpretations and widely disparate opinions on how and when DO-254 should be applied. The book offers a fairly straight-forward treatment of the complete contents of DO-254. The strongest chapters are those devoted to hardware requirements analysis/capture and something the authors have dubbed "Design Assurance Through Design Practice." These chapters drive home the point that design assurance is much more than simply completing certain process-driven documentation. Rather, the proper application of design assurance requires a strong foundation of solid requirements implemented and verified via a mindset of bulletproofing your design and going the extra mile to anticipate possible faults in your logic. Detailed examples focused on ways shift registers can misbehave due to clock skew or

synthesis tools can modify your logic design thus creating problems in unexpected places are especially beneficial to the reader. There are opportunities for improvement in the second edition including more discussion of where it may be possible to reduce effort for lower design assurance levels, more background on safety concerns associated with specific technologies (e.g., SRAM, COTS IP), creation and use of appropriate HDL standards, and how to ensure successful SOI audits of your DO-254 processes. A second edition could also easily add additional material of other potential error sources and how they should be addressed/mitigated within the DO-254 context. Finally, a treatment of additional verification techniques including Assertion-Based Verification (ABV) and Constrained Random Testing (CRT) and their use in satisfying DO-254 objectives would be helpful. Even without this material, this book is a significant contribution toward helping practitioners use and comply with DO-254.

This is, by far, the best book ever written on DO-254 specifically in regards to the philosophy of requirements and what it means to have a correct requirement. The future of verification is in this book - the industry as a whole will go over to DO-254 type requirements based verification as designs become more and more complex. I believe people will look back on this book in 10-15 years as similar to the 'Gang of Four' Design Patterns book that has designed software for the past twenty years. This book is very much a cognizant, detailed and thoughtful effort - while the main topics of the book can be used as a casual reader for managers, as a DO-254 verification low level contractor I cannot express enough gratitude regarding the detail - it has answered many questions that cannot be answered by an RTCA specification or DO-254.com planning charts.

I have been hoping someone would write a practical guide to RTCA/DO-254. It is here in this book. Written by two professionals that have lived it for many years. There is sufficient background on the RTCA guidance document for the novice to understand the intent and for the long suffering to explore the aha! moments of understanding. I thoroughly enjoyed these moments of insight myself as I read and reread the text. There is an excellent chapter on requirements which gives insight into a method of approach that makes the requirements-based verification of the end item almost a no-brainer! This chapter alone is worth the investment for those involved in requirements-based design and verification. It is about time. Thanks a million!!!

This is the first significant treatment of this important standard for airborne electronic hardware. All of the major deliverables are summarized and, importantly, differences between DO-254 and

DO-178 (the software standard) are highlighted. This is a great addition to the literature on the expanding sphere of avionics. I recommend reading this volume along with Developing Safety-Critical Software: A Practical Guide for Aviation Software and DO-178C Compliance 1st Edition by Leanna Rierson and the Digital Avionics Handbook, Third Edition 3rd Edition by Cary Spitzer, Uma Ferrell, and Thomas Ferrell.

This book has provided me many insights to the practical side of working with DO-254, but one of my biggest frustrations, especially given the high cost of the book, is the fact that the table of contents in the Kindle edition does not link to the associated page. Please fix this so I can give this book the review & rating it really deserves.

When it comes to requirements writing concepts, this is a book that can apply not just to DO-254 but to DO-178B/C and ARP-4754A also.

This book is a terrific resource and a clear, stepwise treatment of how to design DO-254 hardware correctly the first time. So very many of the clients I've come across are convinced that the planning (what's called "SOI-1" in DO-254), design (SOI-2), and verification (SOI-3) tasks for DO-254 are merely Annoying Documents and not useful for anything other than to check-off a box for the FAA. The author has produced a blueprint for doing all of this correctly, and backed it up with reasoning -- that planning has to come before design, that writing requirements before ANY VHDL or Verilog allows you to prove that you did it right, that the reqs have to be well-thought-out (not vague) and testable, and that writing the requirements with verification (not design or implementation) first in mind saves MASSIVE amounts of time later when the designer has to prove conclusively that "what you designed is also what you verified, and they are both what you wanted in the first place." Highly recommended. Daniel Conaway -- X-Tek Corporation

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