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Software Considerations in Airborne Systems and Equipment Certification

RTCA DO-178C
December 13, 2011

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FOREWORD

This report was prepared by RTCA Special Committee 205 (SC-205) and EUROCAE Working Group 71 (WG-71) and approved by the RTCA Program Management Committee (PMC) on December 13, 2011.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal Advisory Committee and develops consensus-based recommendations on contemporary aviation issues. RTCA's objectives include but are not limited to:

- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;

- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity, and efficiency;

- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and

- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders.

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1.0 INTRODUCTION

The rapid increase in the use of software in airborne systems and equipment used on aircraft and engines in the early 1980s resulted in a need for industry-accepted guidance for satisfying airworthiness requirements. DO-178, "Software Considerations in Airborne Systems and Equipment Certification", was written to satisfy this need.

This document, now revised in the light of experience, provides the aviation community with guidance for determining, in a consistent manner and with an acceptable level of confidence, that the software aspects of airborne systems and equipment comply with airworthiness requirements. As software use increases, technology evolves, and experience is gained in the application of this document, this document will be reviewed and revised. Appendix A provides the background of this document.

1.1 Purpose

The purpose of this document is to provide guidance for the production of software for airborne systems and equipment that performs its intended function with a level of confidence in safety that complies with airworthiness requirements. This guidance includes:

- Objectives for software life cycle processes.
- Activities that provide a means for satisfying those objectives.
- Descriptions of the evidence in the form of software life cycle data that indicate that the objectives have been satisfied.
- Variations in the objectives, independence, software life cycle data, and control categories by software level.
- Additional considerations (for example, previously developed software) that are applicable to certain applications.
- Definition of terms provided in the glossary.

In addition to guidance, supporting information is provided to assist the reader’s understanding.

1.2 Scope

This document discusses those aspects of certification that pertain to the production of software for airborne systems and equipment used on aircraft, engines, propellers and, by region, auxiliary power units. In discussing those aspects, the system life cycle and its relationship with the software life cycle is described to aid in the understanding of the certification process. A complete description of the system life cycle processes, including the system safety assessment and validation processes, or the certification process is not intended.

The guidance contained in this document does not define or imply the level of involvement of a certification authority in a certification process. To understand certification authority involvement, the applicant should refer to applicable regulations and guidance material issued by the relevant certification authority.

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Since certification issues are discussed only in relation to the software life cycle, the operational aspects of the resulting software are not discussed. For example, the certification aspects of user-modifiable data are beyond the scope of this document.

This document does not attempt to define firmware. Firmware should be classified as hardware or software and addressed by the applicable processes. This document assumes that during the system definition, functions have been allocated to either software or hardware. Other documents exist that provide guidance for development assurance for functions that are allocated to implementation in hardware. This document provides guidance for functions that are allocated to software.

Note: This allows an efficient method of implementation and development assurance to be determined at the time the system is specified and functions allocated. All parties should agree with this system decision at the time the allocation is made.

Matters concerning the structure of the applicant's organization, the commercial relationships between the applicant and its suppliers, and personnel qualification criteria are beyond the scope of this document.

1.3 Relationship to Other Documents

In addition to the airworthiness requirements, various national and international standards for software are available. In some communities, compliance with these standards may be required. However, it is outside the scope of this document to invoke specific national or international standards, or to propose a means by which these standards might be used as an alternative or in addition to this document.

It is recognized that projects may be obliged, through contract or other means, to comply with additional standards as applied by, for example, the engine or aircraft manufacturer. Such standards may be derived from general standards produced or adopted by the manufacturer for its activities. Such standards should be considered by the planning process and considered, as appropriate, when applying supplier oversight.

1.4 How to Use This Document

The following points should be noted when using this document:

a. This document is intended to be used by the international aviation community. To aid such use, references to specific national regulations and procedures are minimized. Instead, generic terms are used. For example, the term "certification authority" is used to denote the organization or person granting approval on behalf of the country responsible for certification of the product (for example, an aircraft, engine). Where a second country or group of countries validates or participates in this certification, this document may be used with due recognition given to bilateral agreements or memoranda of understanding between the countries involved.

b. This document recognizes that the guidance herein is not mandated by law, but represents a consensus of the aviation community. It also recognizes that alternative methods to the methods described herein may be available to the applicant. For these reasons, the use of words such as "shall" and "must" is avoided.

c. If an applicant adopts this document as a means of compliance, the applicant should satisfy all applicable objectives. This document should apply to the applicant and any of its suppliers, who are involved with any of the software life cycle processes or the

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