

RESOLUTION OF ADA*-RELATED CONCERNS IN DOD-STD-2167, REVISION A

by

Donald G. Firesmith 1LT Colin B. Gilyeat
Chairman, SIGAda SDSAWG JLC/CSM Subgroup

INTRODUCTION

The purpose of this article is to report to the Ada Community important actions concerning the revision of DOD-STD-2167, Defense System Software Development. DOD-STD-2167 standardizes the development of Mission-Critical Computer Resources software by establishing a uniform software development process which is applicable throughout the system life-cycle. Its purpose is to improve the government's management and oversight of this process and to result in the delivery of high quality software that will accomplish its intended mission. DOD-STD-2167 was released on June 4, 1985 as a tri-service coordinated standard. Revision A of this standard will be released for formal government and industry review on September 1, 1986. Revision A is scheduled for approval and release during the fall of 1987.

The Joint Logistics Commanders / Computer Software Management (JLC/CSM) Subgroup is currently responsible for the development of DOD-STD-2167 and DOD-STD-2168, Software Quality Program. The JLC/CSM Subgroup is made up of representatives of the Air Force (Air Force Systems Command, Air Force Logistics Command), Army, Navy, and the Marine Corps.

The SIGAda Software Development Standards and Ada Working Group (SDSAWG) was formed to promote the proper and cost-effective use of the Ada programming language and modern Ada-oriented software development methods by determining, analyzing, and reporting to the government, SIGAda, the software development industry, and academia any inconsistencies, whether explicit or implicit, between:

- 1) DOD-STD-2167 and related documents and
- 2) The proper use of the Ada programming language and modern Ada-oriented software development methods.

The SDSAWG has solicited comments from the Ada Community concerning DOD-STD-2167. These comments have been organized into concerns and provided to the JLC/CSM Subgroup. They represent the professional opinions of individual members of the Ada Community and do not represent the formal position of the ACM, SIGAda, the SDSAWG, or the government. Revision A will address concerns regarding the following:

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(Ada Joint Program Office)

- 1) The DEFAULT Ada coding standards.
- 2) The emphasis on top-down as a DEFAULT approach.
- 3) The emphasis on unit testing.
- 4) Ada as a default language for DOD-STD-2167.
- 5) DOD-STD-2167 as a "process" vs a "product" standard.

The remaining Ada-related concerns not addressed in Revision A will be the subject of a companion article to be published in the next edition of Ada Letters.

CONCERNS RESOLVED IN DOD-STD-2167, REVISION A

- 1) The DEFAULT Ada coding standards.

CONCERN:

Numerous comments were received concerning the Ada Coding Standards that were published as an appendix to the draft DOD-HDBK-287, Defense Systems Software Development Handbook. The raw comments were submitted to the JLC/CSM Subgroup and Logicon, the contractor responsible for DOD-STD-2167, Revision A (the location of the new DEFAULT Ada Coding Standard). These comments fell into the following two categories:

- 1) Comments to the effect that the primary coding standards in DOD-STD-2167 should be consistent with and based upon Ada.
- 2) Comments regarding specific aspects of the default Ada coding standard that appeared as an appendix of DOD-HDBK-287.

RESOLUTION:

The JLC/CSM Subgroup's resolution of this concern is that a set of DEFAULT Ada coding standards has been written and will be included as an appendix of DOD-STD-2167, Revision A. The comments from the Ada Community were used as input during the development of these coding standards. However, since it is the intent of the JLC/CSM Subgroup that DOD-STD-2167 be language independent, the primary coding standards will not be based on Ada. Comments regarding specific aspects of the DEFAULT Ada Coding Standards will be implemented as appropriate.

- 2) The emphasis on top-down as a DEFAULT approach.

CONCERN:

DOD-STD-2167 currently states (paragraph 4.8) that "The contractor shall use a top-down approach to design, code, integrate, and test all CSCI's unless specific alternate methodologies have been proposed . . . and received contracting agency approval." This requirement is defined in paragraph 3.22 and further reinforced in paragraphs 5.3.1.3, 5.3.1.4, 5.4.1.2,

5.4.1.3, 5.5.1.2, and 5.5.1.3. It was felt that this is an improper "how to" restriction on the contractor and that the appropriateness of "top-down", "bottom-up", "outside-in", "inside-out", and "holistic" approaches is method and life-cycle activity dependent. In addition, extensive reuse often implies a bottom-up approach. Choosing a single, default approach therefore seems counterproductive since no single approach appears optimal for all life-cycle activities. It is recommended that all mention of "top-down" be removed from DOD-STD-2167 and that no one approach be singled out as default. Since the contractor is already required to propose his software development method in the the Software Development Plan (para 10.2.7.1.1), the criteria for evaluating the contractor's proposed approach (e.g., well-defined, pre-planned, systematic, etc) should be included in DOD-HDBK-287, and the approach should be subject to contracting agency disapproval.

RESOLUTION:

The JLC/CSM Subgroup recognizes that there are other methods for software development in addition to those that are "top-down". For those instances in which the contractor does not propose a development methodology in the Software Development Plan (SDP), a DEFAULT methodology is required. In these instances, the government must define the development methodology used in order to maintain control over the software development. The government directed DEFAULT methodology is a "top-down" methodology, and is directed by DOD-STD-2167 ONLY when the contractor has not specified an alternative development methodology. A contractor always has the option of proposing an alternative methodology in the SDP. The JLC/CSM Subgroup's resolution of this concern is that the direction in the DOD-STD-2167 to use a "top-down" development methodology will be modified to make it clear that a contractor may propose an alternative development methodology. The JLC/CSM Subgroup will consider the recommendation to add criteria for evaluating a contractor proposed development methodology to a future revision of DOD-HDBK-287.

3) The emphasis on unit testing.

CONCERN:

The current emphasis on complete unit-level testing (paragraphs 5.4.1.2, 5.4.1.6-10) seems to be an inappropriate "how-to" restriction in light of the high modularity and low unit-level complexity of well-designed Ada software. For example, a single FORTRAN unit may be relatively-monolithic and correspond to several almost trivial Ada programming units. It may not be cost-effective to unit-test all (or even most) Ada programming units if they contain only data or consist of little more than a short sequence of calls and associated exception handling. The appropriate level at which to commence testing is language, method, and design dependent. It is recommended that the implied

requirement to individually unit test each unit be removed (paragraphs 5.4.1.2-3, 5.1.4.6, 5.1.4.10). Since the contractor is already required to propose his approach to unit-level testing in the Software Development Plan (paragraph 10.2.7.1.1d), the criteria for evaluating the contractor's proposed approach should be included in DOD-HDBK-287, and the approach should be subject to contracting agency disapproval.

RESOLUTION:

The JLC/CSM Subgroup's resolution of this concern is to incorporate these recommendations in DOD-STD-2167, Revision A. The JLC/CSM Subgroup will consider the recommendation to add criteria for evaluating a contractor proposed development methodology to a future revision of DOD-HDBK-287.

4) Ada as a default language for DOD-STD-2167.

CONCERN:

Because both Ada and DOD-STD-2167 have been developed and mandated to apply to the same class of software applications (i.e., all Mission-Critical Computer Resources software), it is felt that DOD-STD-2167 should take Ada as the default programming language. Thus, all requirements should not only be consistent with, but also support the proper use of, Ada. The primary coding standard (see paragraph 5.4.1.4 and Appendix C) should be for Ada, with other languages covered in a secondary language-independent coding standard (Appendix D). The Data Item Descriptions (DIDs) should encourage the presentation of information in the form of either Ada PDL or full Ada, and the examples should be drawn from Ada to the extent practical.

RESOLUTION:

Because DOD-STD-2167 is applied to a variety of software development projects that use languages other than Ada, the JLC/CSM Subgroup's resolution to this concern is that DOD-STD-2167 will remain language independent. However, the JLC/CSM Subgroup does recognize the need for DOD-STD-2167 and Ada to be mutually supportive. Moreover, it is recognized that the DIDs may require some modification to meet this goal.

5) DOD-STD-2167 as a "process" vs a "product" standard.

CONCERN:

DOD-STD-2167 is a process standard that "establishes a uniform software development process" (Foreword). By their very nature, process standards contain "how to" restrictions and inhibit innovation. It is not proper for the government to mandate "how" the contractor is to develop software. Software development methods that significantly deviate from the general process may

not be even proposed, regardless of technical merit, because of the political and economic risk to the contractor who proposes anything different than expected. In a rapidly evolving industry in which major improvement is necessary in order to solve the software crisis, innovation should be promoted, and many Requests for Proposals state that an innovative methodology is favorably considered in the contractor selection criteria. It is recommended that the contractor be required to propose a well defined, pre-planned, systematic software development process (i.e., methodology) that provides the government with adequate visibility and control in the SDP. The criteria for evaluating the proposed process should be included in DOD-HDBK-287, and it should be subject to contracting agency disapproval.

RESOLUTION:

The JLC/CSM Subgroup's position is that DOD-STD-2167 should be a process, as well as a product, standard. As currently defined, the software development process is driven by the DOD Acquisition process and must be an integral part of that process. In order for the government to maintain a common, single development process throughout a variety of software development projects, it is necessary for DOD-STD-2167 to define and direct the methodology for developing software. While the JLC/CSM Subgroup recognizes that a process standard inhibits innovation to some degree, it must be emphasized that DOD-STD-2167 does not prohibit the use of different development methodologies than that defined in the standard. If a different methodology is used, it must be documented in the SDP and will be subject to government disapproval. The intent of DOD-STD-2167 is to allow a contractor to propose what he believes to be the best development methodology for a particular software project. The JLC/CSM Subgroup will consider the recommendation to add criteria for evaluating a contractor proposed development methodology to a future revision of DOD-HDBK-287.

CONCLUSION

As mentioned earlier in this article, DOD-STD-2167 will be released for formal review on September 1, 1986. Please address all constructive comments on the above concerns by October 15, 1986 to:

Donald G. Firesmith
Chairman, SIGAda SDSAWG
Magnavox Electronic Systems Company
TC-C-3, Dept. 519
1313 Production Road
Fort Wayne, IN 46808
(219) 429-4327

These comments will be reviewed, consolidated, and provided to the JLC/CSM subgroup by November 15, 1986.