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Managing the Development of Artificial Intelligence Software		

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FOREWORD

This report is the result of a panel at the 1986 Annual EIA Computer Resources Data and Configuration Management Workshop conducted in Bellevue, WA. The Workshop serves to explore ideas, to assess the state-of-the-art, to identify difficult areas and to offer recommendations toward solutions; all in the field of Computer Resources. The Workshop attendees provide their inputs and ideas as individuals. The reports of the panels of the Workshop normally represent the consensus of discussion among these individuals. Therefore, this report cannot be viewed as reflecting the corporate policies of the EIA or of any Company or Government Agency. Likewise, the Association, the Companies and Government Agencies involved take no responsibility in the application of contents of this document.

Appreciation is extended to the Workshop Panel Members, the Panel Co-Chairs David Preston (ITTRI), Gary Wigle (Boeing Aerospace) and Perry DeWeese (Lockheed), along with the entire G-34 Computer Resources Committee and all others who contributed to the development of this bulletin.

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Managing the Development of Artificial Intelligence Software

1.0 Introduction

Expert systems are a wave of the information processing future. As time goes on they will become more and more part of the mainstream. However, a necessary pre-requisite to moving them into widespread use is to reduce the methodologies for expert system development closer to the more generally accepted software engineering techniques. This report offers a step towards that goal. It describes an alternative software life cycle model for expert system development. Since the field of Artificial Intelligence is so broad, this report limits the software to be considered. Systems that would be of the greatest interest to DoD over the next 5 to 7 years would be expert systems that have the following attributes:

- o may reason with uncertainty
- o are not necessarily rule-based
- o are non-learning systems.

For these systems, a developmental cycle is articulated, and each phase of the cycle described. Next, the activities, products, and audits and reviews for each development phase are stated in the manner of DoD-STD-2167A. This is followed by the management controls necessary to track system development, recommendations, and areas requiring future study.

In addition to limiting the scope of the software to expert systems, the system development cycle applicability is limited to full-scale engineering development. The earlier system development cycle phases of concept exploration and demonstration/validation are critical to the development of system specifications. However, if the development methodology described in this report were to be applied to these phases, significant problems would arise. The focus of the earlier life-cycle phases should be on refining system requirements, not on development. The models being developed for this purpose would be unnecessarily constrained if placed under the controls described here.

There is another issue that arises at these early phases, particularly through the use of rapid prototyping. A prototype is quickly developed to demonstrate potential capabilities and is typically neither designed nor documented for long-term use. However, if a capability is modeled, the temptation exists to use the software that models the capability. To discourage this, the concept exploration and demonstration/validation phases should be moderately unconstrained with system requirements of specifications the only output.

The intent of this report is to serve as a baseline for the tailoring of DoD-STD-2167A for the development of expert system software.

2.0 Expert System Development Cycle Overview

Figure 1 illustrates the panel recommendation for an expert system development cycle. The terminology of DoD-STD-2167A is used in this life cycle in order to make it understandable to the broadest possible audience. One new phase is added: knowledge acquisition, a new critical element of the expert system design process. The activity of prototyping although not a phase per se, is included at the requirements level due to the integral role it must play in the life cycle. The figure illustrates a complete replacement for the software track of the DoD-STD-2167A life cycle. Many of the activities are very similar, however, sequences and control points are effected.

- 2.1. **System Concept.** No difference is seen in this phase of the life cycle. This is largely a user activity and the user must definitize the need regardless of whether an expert system is to be used.
- 2.2. **System/Software Requirements Analysis.** Similarly this phase is largely unchanged. However, as design issues begin to crystalize, some knowledge of system benefits and limitations may be necessary. The functional baseline is established at the very end of this phase.