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Ada

Compiler Validation

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EXECUTIVE SUMMARY

The purpose of this executive summary is to provide only an overview of the Ada compiler validation process. Anyone who obtains services from the Ada certification body must understand the definition of terms and follow the more specific rules provided in the body of this document.

- Organization and Responsibilities

The Ada certification body consists of the Ada Joint Program Office, (AJPO), the Ada Validation Organization (AVO), the ACVC Maintenance Organization (AMO), and the Ada Validation Facilities (AVFs). The AJPO, a component of the Department of Defense, establishes the policies of the Ada certification system, issues validation certificates for AVF-tested Ada implementations and registers Ada implementations that are un-tested by an AVF. The AVO, the Institute for Defense Analyses, provides the technical and administrative support required to operate the Ada certification system. The AMO, Wright-Patterson Air Force Base, provides the technical and administrative support required to supply the Ada Compiler Validation Capability (ACVC) for use in the operation of the Ada certification system. There are five AVFs chartered by the AJPO to conduct validation (see Section 3 and Appendix E). The Ada certification body operates in conjunction with the U.S. Department of Commerce which has the responsibility for establishing and maintaining a certification system for the Federal Information Processing Standards (FIPS).

- The Ada Compiler Validation Capability

The ACVC is designed to demonstrate the compliance of an Ada implementation with the Ada Programming Language. Each new version of the ACVC test suite is released for a period of six months before it is used for validation. At the end of six months, the new version of the ACVC is released for validation use for a period of 18 months. Some test programs may contain test objectives which are irrelevant for a particular Ada implementation and may be declared inapplicable, in whole or in parts, for that implementation. The ACVC User's Guide, distributed with the ACVC, contains detailed rules about implied inapplicability of test programs. Some test programs are designed to make use of implementation dependent characteristics and must be adjusted according to rules given in the ACVC User's Guide or must be modified by the AVF after consultation with the AVO. Tests may be withdrawn from the ACVC by the AVO when it is found that they are based on assumptions that need not hold true for all Ada implementations or that the test program does not meet its test objective. Any interested party may dispute a test program through an AVF (see Section 4.4 and Appendix B). The AVF customizes an ACVC for each Ada implementation which is validated by testing. An Ada implementation passes a given ACVC version if it processes each test of the customized ACVC in accordance with the Ada programming language, whether the test is applicable or inapplicable; otherwise, the Ada implementation fails the ACVC. The ACVC is available to the public from the National Technical Information Service (NTIS) according to Department of Commerce policies and rules for the payment of fees and for export

control. The ACVC is also available to AVF customers.

- **Validation by Testing**

There are six steps which must be completed by a customer and the Ada certification body so that the customer obtains a validation certificate and a Validation Summary Report (VSR). These steps are:

1. A formal validation agreement between the customer and an AVF is required to obtain validation services (see Section 5.1).
2. Prevalidation which consists of customer testing, submission of results to the AVF, and the resolution of test issues (see Section 5.2).
3. Validation testing performed by an AVF at the customer's site (see Section 5.3).
4. A Declaration of Conformance is completed and signed by the customer not later than at validation testing. A validation certificate will not be issued until a Declaration of Conformance has been completed (see Section 5.4 and Appendix A).
5. A VSR is prepared by the AVF to document the validation by testing (see Section 5.5).
6. A Validation Certificate is issued by authority of the AJPO for a successfully tested Ada implementation (see Section 5.6).

The ACVC version used for validation by testing must be the current one: there is no exception to this rule. A validation certificate will expire one year after the expiration date of the ACVC version used for the validation (see Section 5).

- **Validation by Registration**

An Ada implementation may be derived from one which has been validated by testing (a base implementation) when four conditions are true (see Section 6.2). These conditions provide an easy test for determining whether to proceed with a request to register an Ada implementation which was derived from a base implementation. A registration request must be submitted to the AVF that validated the base implementation and the request must provide the information required to substantiate a signed Declaration of Conformance for the derived Ada implementation (see Section 6.3). Upon request, the AVF may provide a template for a registration request which can then be completed by any party interested in initiating a registration. The AVF will review registration requests for completeness and plausibility of information. A registration request which is accepted by the AVF and the AVO will be forwarded to the AJPO to be added to the public list of Ada implementations validated by registration. A derived implementation loses its status of being validated if it is challenged successfully (see Section 6.7), upon expiration of the validation certificate of its base implementation, or when registration is revoked by the customer. A procedure is provided for adjudication of a claim that the derived implementation fails the customized ACVC used to validate the base implementation (See Section 6.7-6.9).

1. INTRODUCTION

The United States Department of Defense (DoD) sponsored the development of the **Ada programming language** and established the **Ada Joint Program Office (AJPO)** as part of an effort to support recognized principles of software engineering for a wide range of applications. In view of the well known benefits of standardization, the **AJPO** has established a **certification system** to prevent the proliferation of dialects of the **Ada programming language** and to encourage **Ada implementations** which conform to the [ANSI 83]. The **Ada certification system** rules of procedure and management address the **validation** of **Ada implementations** by testing and by registration. This document provides an operational definition of a **validated Ada compiler** which is required by [DoD 87] and by the [FIRMR 87] and revises the rules and definitions issued in [AJPO 87].

The **certification body** of the **Ada certification system** consists of the **AJPO** for overall direction, the **Ada Validation Organization (AVO)** and **ACVC Maintenance Organization (AMO)** for technical support, and the **Ada Validation Facilities (AVFs)** for performing validations. The **Ada certification body** operates in conjunction with the U.S. Department of Commerce which has the responsibility for establishing and maintaining a **certification system** for the Federal Information Programming Standards (FIPS).

It is important to note the scope and intent of **Ada validation**. Users of an **Ada implementation** are cautioned that the purpose of **validation** is to encourage **conformity** of **Ada implementations** with the standard and that characteristics other than those specified by the standard, such as performance or suitability for a particular application, are outside the scope of **Ada validation**. Moreover, users are cautioned that the yardstick of **conformity testing** is the collection of test programs contained in the **ACVC**. Thus, **compliance** is measured only within the limitation of these tests.

A glossary of terms used in this document is provided in Section 2. Terms defined in the glossary are signified in the text of the document by bold print. Appendices to this document provide examples of documents used in **validation**, current points of contact and references.

2. GLOSSARY OF TERMS

Ada PROGRAMMING LANGUAGE: The language defined by reference [ANSI 83] or its successors.

ACVC MAINTENANCE ORGANIZATION (AMO): The part of the certification body that maintains the ACVC.

ACVC USER'S GUIDE: A document that explains the technical details of processing the test programs and evaluating their results.

Ada COMPILER: The software and any needed hardware that have to be added to a given host and target computer system to allow transformation of Ada programs into executable form and execution thereof.

Ada COMPILER VALIDATION CAPABILITY (ACVC): The means for testing compliance of Ada implementations, consisting of the test suite, the support programs, the ACVC user's guide and the template for the validation summary report.

Ada IMPLEMENTATION: An Ada compiler with its host computer system and its target computer system.

Ada JOINT PROGRAM OFFICE (AJPO): The part of the certification body which provides policy and guidance for the Ada certification system.

Ada VALIDATION FACILITY (AVF): The part of the certification body which carries out the procedures required to establish the compliance of an Ada implementation.

Ada VALIDATION ORGANIZATION (AVO): The part of the certification body that provides technical guidance for operations of the Ada certification system.

APPLICABLE ACVC TEST: A test which is neither inapplicable nor withdrawn. Compare with inapplicable test program and withdrawn test program.

BASE IMPLEMENTATION: An Ada implementation that was validated by testing (see Section 5).

CERTIFICATION BODY: [ISO/IEC 86] An impartial body, governmental or non-governmental, possessing the necessary competence and reliability to operate a certification system, and in which the interests of all parties concerned with the functioning of the system are represented.

CERTIFICATION MARK: A mark which may be used only on products directly associated with the Ada compiler for which the certification mark was awarded.

CERTIFICATION SYSTEM: [ISO/IEC 86] A system having its own rules of procedure and management for carrying out conformity certifications.

COMPLIANCE of an Ada IMPLEMENTATION: The ability of the implementation to pass an ACVC version. [Note: For the purposes of this document, compliance is a practical measure of conformity.]

COMPUTER SYSTEM: [ISO 74 ANSI/IEEE 83] A functional unit, consisting of one or more computers and associated software, that uses common storage for all or part of a program and also for all or part of the data necessary for the execution of the program; executes user-written or user-designated programs; performs user-designated data manipulation, including arithmetic operations and logic operations; and that can execute programs that modify themselves during execution. A computer system may be a stand-alone unit or may consist of several inter-connected units.

CONFORMITY: [ISO/IEC 86] Fulfillment by a product, process or service of all requirements specified. [Note: Also see Section 1.1.2 in the ANSI/MIL-STD-1815A]

CONFORMITY TESTING: The process described in Section 5 of this document.

CUSTOMER: An individual or corporate entity who enters into an agreement with an AVF which specifies the terms and conditions for AVF services (of any kind) to be performed.

CUSTOMIZED TEST SUITE: The ACVC tests, adjusted as necessary, that must be used for a given Ada implementation (see Section 4.5).

DECLARATION of CONFORMANCE: A formal statement from a customer assuring that conformity is realized or attainable on the Ada implementation for which validation status is requested. [see Appendix A for a sample format of a declaration of conformance.]

DERIVED IMPLEMENTATION: An Ada implementation that was obtained from a base implementation which has a current validation certificate (see Section 6).

FAIL AN ACVC VERSION: The Ada implementation fails one or more test of the customized test suite according to the relevant evaluation criteria.

FUNCTIONAL UNIT: [ISO 74 ANSI/IEEE 83] An entity of hardware, software or both, capable of accomplishing a specified purpose.

HOST COMPUTER SYSTEM: A computer system where Ada source programs are transformed into executable form.

INAPPLICABLE TEST: A test that contains one or more test objectives found to be irrelevant for the given Ada implementation.

INSTRUCTION SET: [ANSI/IEEE 83] The set of instructions of a computer, of a programming language, or of the programming languages in a programming system.

OPERATING SYSTEM: [ISO 74] Software that controls the execution of programs and that provides services such as resource allocation, scheduling, input/output control, and

data management. Usually, operating systems are predominantly software, but partial or complete hardware implementations are possible.

PASS AN ACVC VERSION: Each test of the customized test suite is processed according to the Ada programming language.

PREVALIDATION TESTING: Processing of an appropriately customized test suite by the customer.

RESULT PROFILE: The result of processing the customized test suite according to given evaluation criteria (see Section 6).

SOFTWARE MAINTENANCE: [ANSI/IEEE 83] Modification of a software product after delivery to correct faults, to improve performance, or to adapt the product to a changed environment (see below).

- **CORRECTIVE MAINTENANCE:** Maintenance performed specifically to overcome existing faults.
- **PERFECTIVE MAINTENANCE:** Maintenance performed to improve performance or maintainability.
- **ADAPTIVE MAINTENANCE:** Maintenance performed to make a software product usable in a changed environment.

TARGET COMPUTER SYSTEM: A computer system where the executable form of Ada programs are executed.

TEST ISSUE: Any problem arising during validation (see Section 5.2.3).

VALIDATION: The process of checking the conformity of an Ada compiler to the Ada programming language and of issuing a certificate for this implementation.

VALIDATED ADA IMPLEMENTATION: An Ada implementation that has been validated successfully either by AVF testing (see Section 5) or by registration (see Section 6).

VALIDATED Ada COMPILER: The compiler of a validated Ada implementation.

VALIDATION CERTIFICATE (VC): Issued by authority of the AJPO for tested Ada implementations which pass an ACVC version.

VALIDATION SUMMARY REPORT: A report produced by an AVF containing results that are observed from testing a specific Ada implementation or grouping of Ada implementations.

WITHDRAWN TEST : A test found to be incorrect and not used in conformity testing. A test may be incorrect because it has an invalid test objective, fails to meet its test objective, or contains erroneous or illegal use of the Ada programming language.

3. ORGANIZATION AND RESPONSIBILITIES

This section specifies the role of organizations which form the **certification body** and of customers who receive service from them.

3.1 Ada Joint Program Office (AJPO)

The **AJPO** establishes the policies of the **certification system** by:

- a. establishing the conditions for issuance, the life, and the scope of a **validation certificate**;
- b. establishing the schedule for issuing versions of the **ACVC**;
- c. approving each release of an **ACVC** version;
- d. designating members of the **certification body**;
- e. resolving issues that may arise during **validation** when these issues can not be resolved through the best efforts of the **AVO** and **AVF**;
- f. maintaining the official lists of validated **Ada implementations**; and
- g. issuing documents pertaining to **validation**.

3.2 The Ada Validation Organization (AVO)

The **AVO** provides the technical and administrative support required to operate the **certification system** by:

- a. advising the **AJPO** and **AVFs** concerning requirements for modification to the **validation procedures**;
- b. resolving issues that may arise during the **validation process**;
- c. reviewing all **VSRs** prepared by **AVFs**;
- d. recommending to the **AJPO** issuance of a **validation certificate** for **Ada implementations** validated by testing (see Section 5) and the registration of **derived implementations** (see Section 6);
- e. participating in the **ACVC** quality control and configuration management process;
- f. deciding on the withdrawal of test programs from the **ACVC** version that is being used for **validation**; and
- g. convening meetings of the members of the **certification body** at appropriate intervals to discuss the **validation process** and to evaluate practices.

3.3 The ACVC Maintenance Organization (AMO)

The **AMO** provides the technical and administrative support required to supply the **ACVC** for use in the operation of the **certification system** by:

- a. producing **ACVC** versions according to a schedule established by the **AJPO**;
- b. performing quality control and configuration management according to procedures approved by the **AJPO**;
- c. distributing the **ACVC** version releases to **AVFs** and the **AVO**;
- d. distributing the final release of **ACVC** versions to the U.S. National Technical Information Service (NTIS), a service of the U.S. Department of Commerce, for further distribution to the public; and
- e. providing information to the public concerning the list of test programs withdrawn from the current test suite, the number of test programs in each version and release of the test suite, and other information that promotes a public awareness of the test suite and evaluation criteria.

3.4 Ada Validation Facilities (AVFs)

An **AVF** is chartered by the **AJPO** to conduct validation by:

- a. adhering to validation procedures approved by the **AJPO**;
- b. producing the **VSR**;
- c. forwarding unresolved test issues to the **AVO** for review and analysis, with final resolution to be provided by the **AJPO**, if necessary;
- d. forwarding a customer's registration request for a derived Ada implementation to the **AVO**, with recommendations based upon knowledge of the base implementation and the completeness of documentation supporting the request; and
- e. striving to satisfy national accreditation criteria.

The **AJPO** may issue an **AVF** charter to an organization that has been recognized as an accredited testing laboratory by the U.S. Department of Commerce, National Institute of Standards and Technology (NIST). The **AJPO** may issue a charter to an organization located in a country which has a Memorandum of Understanding (MoU) with the U.S. government covering the chartering of **AVFs**, according to the rules specified in the MoU. An **AVF** charter may remain in effect indefinitely; however, a charter can be revoked by the **AJPO**, at any time, for due cause. The **AJPO** may direct an impartial body to conduct an audit at any time or prior to issuing an **AVF** charter. Audits are conducted in accordance with procedures established by the **AJPO** at the time of the audit and are tailored to reflect the purpose of the audit.

3.5 Customers

Customers are serviced by the Ada certification body in matters concerning Ada validation. In requesting services of the Ada certification body, customers are to provide accurate and complete information to perform validation, to register derived Ada implementations, or to obtain other services.

4. THE ADA COMPILER VALIDATION CAPABILITY

The ACVC is designed to demonstrate compliance of an Ada implementation with the Ada Programming Language. The ACVC is distributed as a collection of test programs, support programs which facilitate processing the tests, and an ACVC User's Guide that explains the criteria for evaluating the results.

4.1 Versions

Each new version of the ACVC test suite is released for a period of six months before it is used for validation. During this period, a compiler implementor or any interested party may submit comments to the AMO. At the end of six months, the new version of the ACVC is released for validation use for a period of 18 months. A version's tests may be slightly changed between releases as a result of AMO modifications, but the two releases of any version are essentially the same. Comment on the ACVC tests should be submitted in the test-dispute format (see Appendix B); the AMO will evaluate comments and will take appropriate action after consultation with the AVO.

4.2 Inapplicable Tests

Each test program in the test suite has one or more test objectives described in a comment in the test program. Some test objectives may be irrelevant for a given Ada implementation. For example, the test objective "check write operations for permanent files" is irrelevant for an implementation on an embedded computer system which does not allow the creation of permanent files. Test programs containing test objectives which are irrelevant for a particular Ada implementation may be declared inapplicable, as a whole or in parts, for that implementation. As a general rule, the inapplicability of a test is established by analysis of the result of processing the test program. However, results obtained from one test program may imply the inapplicability of others which need not be processed. The ACVC User's Guide contains detailed rules about implied inapplicability and the omission of inapplicable test programs.

4.3 Test Modifications

Some of the test and support programs are designed to make use of implementation dependent characteristics (e.g., line lengths and integer ranges). These programs must be adjusted to a given Ada implementation according to the rules contained in the ACVC User's Guide. In addition to these anticipated test modifications, additional changes may be required to remove unforeseen conflicts between the test program and implementation dependent characteristics of the Ada implementation (e.g., the algorithm for recovering from syntax errors). The allowable changes for each Ada implementation are determined by an AVF after consultation with the AVO.

4.4 Test Withdrawal

In any ACVC version that is used for validation, it is possible that a test program is based on assumptions which need not hold true for all Ada implementations or that the test program does not meet its test objectives. In these cases, the AVO may issue a correction

to the evaluation criteria in the ACVC User's Guide or the test program may be withdrawn from that version of the test suite. Any interested party may dispute a test program through an AVF by asking for a review of its evaluation criteria or for its withdrawal. The form for submitting a test dispute is provided in Appendix B.

4.5 Customization

A customized test suite is produced by the AVF for each Ada implementation that is a candidate for validation. This customization always consists of removing withdrawn tests and in making required modifications to test and support programs, and may include removal of some inapplicable tests when detailed rules for them are provided in the ACVC User's Guide.

4.6 Passing the ACVC

An Ada implementation passes a given ACVC version if it processes each test of the customized test suite in accordance with the Ada programming language, whether the test is applicable or inapplicable: otherwise, the Ada implementation fails the ACVC.

4.7 Availability

The ACVC is available to the general public from the NTIS according to U.S. Department of Commerce policies and rules for payment of fees and for export control. The ACVC is also available to a customer of an AVF from that AVF. It should be noted that the distribution of the ACVC is subject to export restrictions as detailed by laws of the U.S. and other countries.

5. VALIDATION BY TESTING

There are six steps which must be completed by a **customer** and the **certification body** so that the **customer** obtains a **validation certificate** and a **VSR**. The same **ACVC** version must be used to complete the steps described in this section. The **ACVC** version used for **validation** testing must be the current one: there is no exception to this rule. The **AVF** must be able to begin testing the **Ada implementation** at the **customers** site before the current **ACVC** version expires or else **validation** with that **ACVC** version will not be allowed. Anyone who intends to obtain a **validation certificate** should contact an **AVF**, as soon as the intention is known, to obtain advice on the handling of the **ACVC**, on interpretation of the test evaluation criteria, and on the operational details of that **AVF**'s management practices.

5.1 Step One: Validation Agreement

In order to obtain services from the **certification body**, an interested party must become a **customer** of an **AVF** by reaching a formal agreement. This agreement should address the following topics:

- a. identification of the **Ada implementation** to be tested and the **ACVC** version to be used;
- b. a statement of work, including analysis of **prevalidation testing**, **validation**, and preparation of the **VSR**;
- c. the format of data to be exchanged;
- d. a schedule of events and the site of **validation**;
- e. financial arrangements;
- f. retention of records;
- g. **AVF** liability; and
- h. confidentiality of **validation** information.

The schedule for events, deliverables, and payments should take into account the fact that certain steps in **validation** require interaction with other members of the **certification body** (i.e., **AVO** or **AJPO**). The **AVF** will put forth its best effort to keep confidential a **customer's** intent to obtain a **validation certificate** and the projected schedule for **validation**. This confidentiality will not be allowed to interfere with the normal review procedures of **validation**. If the **customer** requests confidentiality for reasons of national security, the **customer** will provide to the **AVF** an official statement of the security level that applies to the **validation**, and the **AVF** will obtain further guidance from the **AJPO**.

5.2 Step Two: Prevalidation

The requirements of this step are discussed separately so that the **customer** understands the interaction that is required with an **AVF**.

5.2.1 Customer Testing

After entering into a formal agreement, the customer provides the necessary information for the AVF to prepare a customized test suite or, the customer may prepare a customized test suite according to instructions in the ACVC user's guide. The customer then processes all the tests in this customized test suite using the candidate Ada implementation or another Ada implementation which produces the same result. If the implementation provides for options in the way programs are processed, then the same set of options must be chosen for all test programs, with the possible exception of an option controlling the production of information output. Any other exception constitutes a test issue which must be resolved with the AVF (see Section 5.2.3). Test issues should be sent to the AVF for analysis as soon as they are known.

5.2.2 Submission of Results

Upon completion of testing, the customer delivers the complete set of results in the agreed format to the AVF. These results are accompanied by the following information:

- a. a list of test programs which the customer claims are inapplicable, together with an explanation for these claims;
- b. a list of test programs which are disputed but not withdrawn (see Section 4.4) together with explanations (see Appendix B for format);
- c. an annotated sample command script;
- d. the complete set of option settings used for processing the customized test suite, including the default settings; and
- e. complete and current documentation for implementation dependent characteristics as required in the VSR.

5.2.3 Test Issues

A test issue may be any of the following:

- a. a missing or incomplete result to a test;
- b. a result presented in an inadequate form;
- c. a disagreement between the customer and the AVF as to the interpretation of a result;
- d. a change in the choice of options to be used during testing;
- e. a result which makes the Ada implementation fail the ACVC according to the current evaluation criteria; or
- f. an implementation dependent characteristic that may effect the conformity of the Ada implementation.

The material submitted by the customer is analyzed by the AVF and any test issues are resolved. If the AVF and the customer cannot agree on a way to resolve a test issue, the issue will be referred to the AVO for a resolution. It may be justified to leave a test issue unresolved at prevalidation. For example, it may be impossible to check the processing

of control characters by inspecting printed results. The AVF will note these unresolved issues and describe the results which will be expected during validation testing. It is also possible that the customer information provided for production of the customized test suite (see Section 5.2.1) was insufficient so that corrections to the customized test suite must be made and additional processing will be required.

5.2.4 Incomplete Prevalidations

The AVF and the customer may agree that, at the customer's risk, parts of the customized test suite need not be processed. The customer must certify that the results from a previous prevalidation submitted to the AVF or validation results obtained by the AVF are identical to those that would have been obtained by the customer. The normal practice is to submit complete prevalidation results.

5.2.5 Successful Prevalidation

Prevalidation testing is successful if the analysis of results and the resolution of test issues show that the candidate Ada implementation passes the customized test suite. Prevalidation is successful with caveats if the results are satisfactory except that they were incomplete (see Section 5.2.4) or if resolution of some test issues are deferred until validation testing by agreement between the AVF and the customer.

5.3 Step Three: Validation Testing

Upon successful completion of prevalidation, with or without caveats, the AVF tests the Ada implementation at the site and time mutually agreed by the AVF and customer. The AVF prepares a customized test suite based upon customer information and any information collected during the resolution of test issues. The customized test suite is installed and processed under AVF supervision. If the AVF determines that the results agree with those obtained from prevalidation and are satisfactory with respect to the caveats, the testing has been successful: otherwise, re-testing will be required.

5.4 Step Four: Declaration of Conformance

At some time during the validation but not later than at validation testing, the customer will complete and sign a declaration of conformance. The declaration states that the organization which is responsible for the production, maintenance or distribution of the Ada compiler is offering a product that is in compliance with the Ada programming language. The declaration becomes part of the AVF records and is copied into the VSR. A Validation Certificate will not be issued unless a signed declaration of conformance has been provided to the AVF.

5.5 Step Five: Validation Summary Report

A VSR is produced for each validation testing effort. A single VSR may cover validation testing of several Ada implementations, provided that they all have the same result profile. The VSR provides the following documentation pertaining to the validation effort:

- a. identification of the customer responsible for validation of the Ada implementation;

- b. identification of the organization responsible for the production, maintenance, or distribution of the **Ada compiler** or **Ada implementation**;
- c. identification of the **Ada implementation** tested;
- d. options provided by the **Ada compiler** and identity of the options used for testing;
- e. description of the **AVF** testing procedure with sample command scripts that were used to process the test suite;
- f. the **inapplicable test programs** and **implementation dependent characteristics** exhibited by the test programs that established inapplicability;
- g. the **implementation dependent characteristics** pertinent to the **customized test suite**;
- h. description of **implementation dependent characteristics** as detailed by "Appendix F" of [Ada 83];
- i. **withdrawn test programs**; and
- j. **modifications to test programs** with an explanation for such modifications.

5.5.1 VSR Production

The **VSR** is prepared by the **AVF** but includes material which is produced by the **customer**, such as the "Appendix F" required by [ANSI 83]. A draft of the **VSR** is sent to the **AVO** for approval before or after validation testing. The final version of the **VSR** is signed by the **AVF**, the **AVO**, and the **AJPO**.

5.5.2 VSR Availability

The final version of the **VSR** is available to the general public from NTIS and from the **AVF** that produced it. The **AVF** may require payment of a fee for **VSR** reproduction and mailing costs.

5.6 Step Six: Validation Certificate

For each successfully tested **Ada implementation**, one certificate is issued by authority of the **AJPO**. An example of a certificate is provided in Appendix C. The information on the **validation certificate** describes the tested **Ada implementation**: the source of this information is the signed **declaration of conformance** which the **AVF** provides to the **AVO** after completion of testing. The **customer** will ensure that the information contained on the certificate does not infringe on the rights of third parties and may be required to provide a written statement of consent from any third party involved. Currently, **validation certificates** will expire one year after the expiration date of the **ACVC** version used for the validation. An entry in the list of **Ada implementations** validated by testing will be made for each certificate issued. This entry will be removed when the certificate expires.

5.7 Advertising Validated Status

The **customer** will not advertise or make public claims that the **Ada implementation** is validated until after receiving a **validation certificate** or after receiving formal notification

from the AVF that the AJPO has issued a validation certificate. A waiver of confidentiality must be signed by a customer who intends to advertise the completion of events that indicate progress toward completion of validation. If a waiver of confidentiality has been signed with the AVF, the AVF will respond to inquiries about the customer's advertisements or public claims by acknowledging receipt of validation materials (i.e., a formal agreement, pre-validation results, or validation testing results) without judgement concerning the success of the validation.

5.8 Certification Mark

The certification mark (see Appendix D for reproduction) may only be used on products directly associated with validated Ada compilers, such as disks, tapes, packaging, advertising, reference manuals and any other associated documentation where a significant portion relates to a validated Ada compiler. This unique mark distinguishes compilers validated in accordance with the rules in this document. The certification mark can be reproduced in any size, color, or combination of colors.

6. VALIDATION BY REGISTRATION

6.1 Result Profile

Two **Ada** implementations which pass a given **ACVC** version have the same **result profile** when:

- a. they use the same **customized test suite**;
- b. **inapplicable test programs** in the **customized test suite** are the same for both implementations;
- c. **inapplicable test programs** are inapplicable for the same reasons; and
- d. any implementation dependent characteristics tested for by the **customized test suite** are the same for both implementations.

6.2 Derived Implementations

An **Ada** implementation may be derived from a **base implementation** when all the following conditions are true:

- a. the **validation certificate** for the **base implementation** has an expiration date at least three months beyond the time of derivation;
- b. the **host and target computer systems** of the **base** and **derived Ada implementations** have compatible instruction sets and operating systems;
- c. the **Ada implementation** proposed for registration contains an **Ada compiler** that was obtained from the **Ada compiler** of the **base implementation** by changes that are within the scope of accepted **software maintenance practices**; and
- d. The **result profile** for the **Ada implementation** is either the same as the **base implementation** or, if there are minor differences, these differences are justified as being within the scope of accepted **software maintenance practices** (see Section 6.3).

Common examples of compatible instruction sets and operating systems are two different **computer system** models in a manufacturer's product line or the **computer systems** produced by different manufacturers that use the same **functional units** and **operating systems**.

The changes that may be made to an **Ada compiler** for the purpose of derivation will be within the scope of **software maintenance** as applied to the domain of compiler construction. Changes must be classified as **corrective**, **adaptive**, or **perfective**. Examples of these changes are the correction of a compiler error, the adaptation to an **operating system** upgrade, the addition of a floating point processor to a small **target computer system**, or the perfection of a garbage collection algorithm.

6.3 Registration Request

Registration of an **Ada implementation** can be achieved only through the **AVF** which validated the **base implementation**. Any interested party may initiate a registration by sending a request to the appropriate **AVF** and paying a fee established by the **AVF**. The registration request must contain the following information:

- a. reference to the **base implementation** and its **validation certificate**;
- b. identifying description of the **Ada implementation(s)** that is being derived from the **base implementation**;

[Note that this description must include the nomenclature of the **computer system(s)**, including **operating system** for both **host** and **target computer system(s)**, or **run-time system** for the **target computer**, if applicable, the **Ada compiler name** and **version identifier**, and identifier for any components of the **host** and **target computer systems** listed in the **VSR** for the **base implementation**.]

- c. a signed **declaration of conformance** for the **derived implementation(s)**;
- d. a consent agreement from any other party having a legal interest in the **Ada compiler**;
- e. a statement as to whether the **Ada implementation(s)** have been tested with the **customized test suite** used in the **validation** of the **base implementation**; and
- f. a statement supported by appropriate evidence that the **Ada implementation(s)** may, in fact, be derived from the referenced **base implementation**.

The statement, required by f. above, will include the classification of **software maintenance changes** (see Section 6.2) and the effect these changes have on the **result profile**; will list the differences between the **computer systems** of the **base implementation** and the **derived implementation**; and will describe the effect these differences have on the **Ada compiler**. The information required by e. and f. above substantiate the claim made in the **declaration of conformance**.

6.4 AVF Evaluation

The **AVF** will not perform testing on **derived implementations**. The **AVF** will review the registration request for completeness and the plausibility of information. The **certification body** may require the **customer** to provide written statements concerning a **result profile** from any third party involved. If the **AVF** and **customer** cannot reach an agreement on the registration request, the issue is referred to the **AVO** for a decision.

6.5 Registration

Registration requests which are acceptable to the **AVF** are forwarded to the **AVO** for registration with the **AJPO** as **validated Ada implementations** untested by an **AVF**. The **customer** will be notified by the **AVF** when the **AVO** approves registration. A **validation certificate** will not be issued for these **derived implementations** but the **customer** may use the **certification mark** awarded to the **base implementation**. The list of **derived implementations** and information provided in the registration request will be available to the public from the **AJPO**.

6.6 Expiration of Validated Status

A **derived implementation** loses its status of being validated if it is challenged successfully (see Section 6.7), upon expiration of the **validation certificate** of its **base implementation**, or when registration is revoked by the **customer**.

6.7 Challenges

Any **derived implementation** may be challenged by any interested party through the **AVF** which initiated its registration. The challenger will pay a challenge fee to the appropriate **AVF** and will submit a challenge request which:

- a. identifies the **derived implementation** being challenged;
- b. names one **ACVC** test from the **customized test suite** together with its implementation dependent parameters, if any; and
- c. describes in which way the implementation will fail this test.

The **AVF** will send this challenge to its registration **customer** asking for comment. The challenge will be considered settled if the registration is revoked by the registration **customer**; otherwise, the challenge will be settled as outlined in Section 6.9.

6.8 Challenge Mark

The **AVF** will inform the **AVO** that a challenge for a given **derived implementation** has been received. The **derived implementation** will then be marked as "challenged" on the list of **derived implementations** maintained by the **AJPO**. Information pertaining to the challenge may be requested by any interested party and received from the **AVF**. It should be noted that a challenge mark applies only to the **derived implementation** which was named and does not indicate any judgement about the **conformity** of the challenged implementation.

6.9 Challenge Test

The **AVF** will conclude a formal agreement with the challenger which covers the **AVF's** cost for performing a challenge test. For challenge testing, the challenged **derived implementation** will be tested against the named **ACVC** test. The challenger will provide access to the challenged **derived implementation** and appropriate expertise to facilitate the **AVF** test. The **AVO** will be informed of the test result. Depending on its result, the **AVO** will settle the challenge by either removing the challenge mark or the **derived implementation** from the list of **validated Ada compilers**.

APPENDIX A

Declaration of Conformance

Customer: _____

Ada Validation Facility: _____

ACVC Version: _____

Ada Implementation

Ada Compiler Name: _____

Version: _____

Host Computer System: _____

Target Computer System: _____

Customer's Declaration

I, the undersigned, representing <customer> declare that <customer> has no knowledge of deliberate deviations from the Ada Language Standard ANSI/MIL-STD-1815A in the implementation(s) listed in this declaration.

Signature

Date

APPENDIX B

Implementer Dispute Format

[part A]

Implementer: <implementer's name>
Configuration: <host & target hardware & operating systems>
ACVC Version: <ACVC version#>
Pre-Validation Submittal Date: <due date for in-house results>

[Part A will be completed once by each implementer; part B will be completed for each dispute. It is not necessary for a pre-validation date to have been established. Part A information is treated as confidential.]

[part B]

Reference: <test name {,test name}>
Summary: <brief description of the dispute>
Discussion: <detailed description of the dispute>

[In this Discussion, arguments should be specified using test line #s and references to pertinent sections of the Ada standard, Commentaries (AI-xxxx), or the ACVC Implementer's Guide (AIG)*. The implementer must describe the behavior of the implementation for the test or tests that are disputed, stating the particular test messages that are produced. It is sufficient for the detailed description to be limited to the particular segment of test code that is disputed. Relevant source code with compiler messages should be included. (For a group of tests that cause much the same behavior, it is sufficient for a detailed description to be given for one of them, with the relevant line numbers given for the like problems in the related tests.)

If the argument depends upon implementation constraints of hardware or software (e.g., characteristics of the operating system), then these should be specified; the particular computer and operating system should be identified. It is especially important that implementations that fail to pass some test due to *capacity limitations* be described in enough detail for the AVO to assess the reasonableness of these limitations.

Failure to fully specify the points pertinent to a dispute might result in an adverse decision being made, with the disputer having to further argue the case with a second submittal to the AVO. Yet it is possible that the Summary will suffice to adequately present a dispute.

*(The AIG is not an official interpretation of the Ada standard but it might provide useful information in support of a dispute in explaining implementation choices.)]

APPENDIX C
Validation Certificate

Ada Joint Program Office

Ada Validation Certificate <number>

The
<compiler name>
was validated by testing using ACVC version <number>
in the configuration consisting of the
Host Computer System
<description>
and the
Target Computer System
<description>

Ada Validation Facility: _____

Date of Issue: _____

Expiration Date: _____

Validation Customer: _____

APPENDIX D
Certification Mark

APPENDIX E

Points of Contact

Ada Validation Facility Managers

Mr. Bobby Evans
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Engineering Applications Directorate
DCS/Communications-Computer Systems
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ACVC Maintenance Organization

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Ada Joint Program Office

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Ada Information Center

Ms. Anne Eustice
Ada Information Clearinghouse
IIT Research Institute
4600 Forbes Blvd.
Lanham, Md. 20706-4312
Telephone: + 703-685-1477

ACVC and VSR Distribution

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, Va. 22161
Telephone: + 703-487-4650

DoD Directives and Ada Policy Statements

Ms. Jan Bodanyi
OASDPA
Pentagon Room 2E757
Washington, D.C. 20301-1400
Telephone: + 202-695-0192

Validated Compiler Lists

AJPO - Official Ada lists, updated monthly.

Michele Kee
Ada Information Clearinghouse
IIT Research Institute
4600 Forbes Boulevard
Lanham, MD 20706-4312
Telephone: + 703-685-1477

NIST - All FIPS validated compilers, updated quarterly.

National Institute of Standards and Technology
National Computer and Telecommunications Laboratory
Gaithersburg, MD 20899

APPENDIX F

References

[AJPO 87] Ada Joint Program Office: Ada Compiler Validation Procedures and Guidelines, Version 1.1, 1 January 1987

[ANSI 83] American National Standards Institute and United States Department of Defense: ANSI/MIL-STD-1815A Reference Manual for The Ada Programming Language, 1983 Note: This standard is identical with ISO/8652-1987 and FIPS 119, 1985. The ANSI 83 is available from various publishers and from the U. S. Government at the following addresses:

Commanding Officer
Naval Publications and Forms Center
Attn: NPODS
5801 Tabor Avenue
Philadelphia, Pennsylvania 19120

Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

The ISO/8652-1987 (French and English versions) is available from:

AFNOR
Tour Europe, cedex 7
F-92080 Paris la Defence
France

[ANSI/IEEE 83] American National Standards Institute and Institute of Electrical and Electronics Engineers, Inc., Standard 729-1983; "ANSI/IEEE Standard Glossary of Software Engineering Terminology".

[DoD 87] Department of Defense Directives: Number 3405.1, 2 April 1987 Subject: Computer Programming Language Policy and Number 3405.2, 30 March 1987 Subject: Use of Ada in Weapon Systems.

[FIRMR 87] General Services Administration, Federal Information Resources Management Regulations (FIRMR) 201.8-109, 10 July 1981, Subject: Validation of Compilers.

[ISO 74] International Standards Organization: ISO 2382/I-1974 Data Processing - Vocabulary - Section 01: Fundamental Terms.

[ISO/IEC 86] International Standards Organization: ISO/IEC, Guide 2, 5th edition 1986 - General Terms and Their Definitions Concerning Standardization and Related Activities.