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Ada programming language

EXECUTIVE SUMMARY

This Validation Summary Report (VSR) summarizes the results and conclusions of validation testing performed on the IBM S/370 - VM/SP to RT PC - AIX Ada Cross Compiler, using Version 1.8 of the Ada Compiler Validation Capability (ACVC). The IBM AIX Ada Cross Compiler is hosted on an IBM 3081 operating under VM/SP (using CMS), Version 3.1. Programs processed by this compiler may be executed on an IBM RT PC operating under AIX, Version 1.1. *Keywords:*

On-site testing was performed 24 April 1987 through 28 April 1987 at IBM Corporation in Gaithersburg MD, under the direction of the Ada Validation Facility (AVF), according to Ada Validation Organization (AVO) policies and procedures. The AVF identified 2102 of the 2399 tests in ACVC Version 1.8 to be processed during on-site testing of the compiler. The 19 tests withdrawn at the time of validation testing, as well as the 278 executable tests that make use of floating-point precision exceeding that supported by the implementation, were not processed. After the 2102 tests were processed, results for Class A, C, D, and E tests were examined for correct execution. Compilation listings for Class B tests were analyzed for correct diagnosis of syntax and semantic errors. Compilation and link results of Class L tests were analyzed for correct detection of errors. There were 41 of the processed tests determined to be inapplicable. The remaining 2061 tests were passed.

The results of validation are summarized in the following table:

RESULT	CHAPTER													TOTAL
	2	3	4	5	6	7	8	9	10	11	12	14		
Passed	93	205	280	243	161	97	136	262	107	32	217	228	2061	
Failed	0	0	0	0	0	0	0	0	0	0	0	0	0	
Inapplicable	23	120	140	4	0	0	3	0	23	0	1	5	319	
Withdrawn	0	5	5	0	0	1	1	2	4	0	1	0	19	
TOTAL	116	330	425	247	161	98	140	264	134	32	219	233	2399	

The AVF concludes that these results demonstrate acceptable conformity to ANSI/MIL-STD-1815A Ada.

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AVF Control Number: AVF-VSR-67.0787
87-01-21-IBM

Ada[®] COMPILER
VALIDATION SUMMARY REPORT:
IBM Corporation

IBM S/370 - VM/SP to RT PC -
AIX Ada Cross Compiler, Version 2.2

IBM 3081 Host and IBM RT PC Target

Completion of On-Site Testing:
28 April 1987

Prepared By:
Ada Validation Facility
ASD/SCOL
Wright-Patterson AFB OH 45433-6503

Prepared For:
Ada Joint Program Office
United States Department of Defense
Washington, D.C.

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Ada® Compiler Validation Summary Report:

Compiler Name: IBM S/370 - VM/SP to RT PC - AIX Ada Cross Compiler,
Version 2.2

Host: IBM 3081 under VM/SP
(using CMS), Version 3.1

Target: IBM RT PC under AIX,
Version 1.1

Testing Completed 28 April 1987 Using ACVC 1.8

This report has been reviewed and is approved.

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EXECUTIVE SUMMARY

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On-site testing was performed 24 April 1987 through 28 April 1987 at IBM Corporation in Gaithersburg MD, under the direction of the Ada Validation Facility (AVF), according to Ada Validation Organization (AVO) policies and procedures. The AVF identified 2102 of the 2399 tests in ACVC Version 1.8 to be processed during on-site testing of the compiler. The 19 tests withdrawn at the time of validation testing, as well as the 278 executable tests that make use of floating-point precision exceeding that supported by the implementation, were not processed. After the 2102 tests were processed, results for Class A, C, D, and E tests were examined for correct execution. Compilation listings for Class B tests were analyzed for correct diagnosis of syntax and semantic errors. Compilation and link results of Class L tests were analyzed for correct detection of errors. There were 41 of the processed tests determined to be inapplicable. The remaining 2061 tests were passed.

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Failed	0	0	0	0	0	0	0	0	0	0	0	0	0
Inapplicable	23	120	140	4	0	0	3	0	23	0	1	5	319
Withdrawn	0	5	5	0	0	1	1	2	4	0	1	0	19
TOTAL	116	330	425	247	161	98	140	264	134	32	219	233	2399

The AVF concludes that these results demonstrate acceptable conformity to ANSI/MIL-STD-1815A Ada.

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CHAPTER 1

INTRODUCTION

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard.

Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from characteristics of particular operating systems, hardware, or implementation strategies. All of the dependencies observed during the process of testing this compiler are given in this report.

The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. The purpose of validating is to ensure conformity of the compiler to the Ada Standard by testing that the compiler properly implements legal language constructs and that it identifies and rejects illegal language constructs. The testing also identifies behavior that is implementation dependent but permitted by the Ada Standard. Six classes of tests are used. These tests are designed to perform checks at compile time, at link time, and during execution.

INTRODUCTION

1.1 PURPOSE OF THIS VALIDATION SUMMARY REPORT

This VSR documents the results of the validation testing performed on an Ada compiler. Testing was carried out for the following purposes:

- . To attempt to identify any language constructs supported by the compiler that do not conform to the Ada Standard
- . To attempt to identify any unsupported language constructs required by the Ada Standard
- . To determine that the implementation-dependent behavior is allowed by the Ada Standard

Testing of this compiler was conducted by SofTech, Inc., under the direction of the AVF according to policies and procedures established by the Ada Validation Organization (AVO). On-site testing was conducted from 24 April 1987 through 28 April 1987 at IBM Corporation in Gaithersburg MD.

1.2 USE OF THIS VALIDATION SUMMARY REPORT

Consistent with the national laws of the originating country, the AVO may make full and free public disclosure of this report. In the United States, this is provided in accordance with the "Freedom of Information Act" (5 U.S.C. #552). The results of this validation apply only to the computers, operating systems, and compiler versions identified in this report.

The organizations represented on the signature page of this report do not represent or warrant that all statements set forth in this report are accurate and complete, or that the subject compiler has no nonconformities to the Ada Standard other than those presented. Copies of this report are available to the public from:

Ada Information Clearinghouse
Ada Joint Program Office
OUSDRE
The Pentagon, Rm 3D-139 (Fern Street)
Washington DC 20301-3081

or from:

Ada Validation Facility
ASD/SCOL
Wright-Patterson AFB OH 45433-6503

Questions regarding this report or the validation test results should be directed to the AVF listed above or to:

Ada Validation Organization
Institute for Defense Analyses
1801 North Beauregard Street
Alexandria VA 22311

1.3 REFERENCES

1. Reference Manual for the Ada Programming Language, ANSI/MIL-STD-1815A, February 1983.
2. Ada Validation Organization: Procedures and Guidelines, Ada Joint Program Office, 1 January 1987.
3. Ada Compiler Validation Capability Implementers' Guide, SofTech, Inc., December 1984.

1.4 DEFINITION OF TERMS

ACVC The Ada Compiler Validation Capability. A set of programs that evaluates the conformity of a compiler to the Ada language specification, ANSI/MIL-STD-1815A.

Ada Standard ANSI/MIL-STD-1815A, February 1983.

Applicant The agency requesting validation.

AVF The Ada Validation Facility. In the context of this report, the AVF is responsible for conducting compiler validations according to established policies and procedures.

AVO The Ada Validation Organization. In the context of this report, the AVO is responsible for setting procedures for compiler validations.

Compiler A processor for the Ada language. In the context of this report, a compiler is any language processor, including cross-compilers, translators, and interpreters.

Failed test A test for which the compiler generates a result that demonstrates nonconformity to the Ada Standard.

Host The computer on which the compiler resides.

INTRODUCTION

Inapplicable test	A test that uses features of the language that a compiler is not required to support or may legitimately support in a way other than the one expected by the test.
Passed test	A test for which a compiler generates the expected result.
Target	The computer for which a compiler generates code.
Test	A program that checks a compiler's conformity regarding a particular feature or features to the Ada Standard. In the context of this report, the term is used to designate a single test, which may comprise one or more files.
Withdrawn test	A test found to be incorrect and not used to check conformity to the Ada language specification. A test may be incorrect because it has an invalid test objective, fails to meet its test objective, or contains illegal or erroneous use of the language.

1.5 ACVC TEST CLASSES

Conformity to the Ada Standard is measured using the ACVC. The ACVC contains both legal and illegal Ada programs structured into six test classes: A, B, C, D, E, and L. The first letter of a test name identifies the class to which it belongs. Class A, C, D, and E tests are executable, and special program units are used to report their results during execution. Class B tests are expected to produce compilation errors. Class L tests are expected to produce link errors.

Class A tests check that legal Ada programs can be successfully compiled and executed. However, no checks are performed during execution to see if the test objective has been met. For example, a Class A test checks that reserved words of another language (other than those already reserved in the Ada language) are not treated as reserved words by an Ada compiler. A Class A test is passed if no errors are detected at compile time and the program executes to produce a PASSED message.

Class B tests check that a compiler detects illegal language usage. Class B tests are not executable. Each test in this class is compiled and the resulting compilation listing is examined to verify that every syntax or semantic error in the test is detected. A Class B test is passed if every illegal construct that it contains is detected by the compiler.

Class C tests check that legal Ada programs can be correctly compiled and executed. Each Class C test is self-checking and produces a PASSED, FAILED, or NOT APPLICABLE message indicating the result when it is executed.

Class D tests check the compilation and execution capacities of a compiler. Since there are no capacity requirements placed on a compiler by the Ada Standard for some parameters--for example, the number of identifiers

permitted in a compilation or the number of units in a library--a compiler may refuse to compile a Class D test and still be a conforming compiler. Therefore, if a Class D test fails to compile because the capacity of the compiler is exceeded, the test is classified as inapplicable. If a Class D test compiles successfully, it is self-checking and produces a PASSED or FAILED message during execution.

Each Class E test is self-checking and produces a NOT APPLICABLE, PASSED, or FAILED message when it is compiled and executed. However, the Ada Standard permits an implementation to reject programs containing some features addressed by Class E tests during compilation. Therefore, a Class E test is passed by a compiler if it is compiled successfully and executes to produce a PASSED message, or if it is rejected by the compiler for an allowable reason.

Class L tests check that incomplete or illegal Ada programs involving multiple, separately compiled units are detected and not allowed to execute. Class L tests are compiled separately and execution is attempted. A Class L test passes if it is rejected at link time--that is, an attempt to execute the main program must generate an error message before any declarations in the main program or any units referenced by the main program are elaborated.

Two library units, the package REPORT and the procedure CHECK_FILE, support the self-checking features of the executable tests. The package REPORT provides the mechanism by which executable tests report PASSED, FAILED, or NOT APPLICABLE results. It also provides a set of identity functions used to defeat some compiler optimizations allowed by the Ada Standard that would circumvent a test objective. The procedure CHECK_FILE is used to check the contents of text files written by some of the Class C tests for chapter 14 of the Ada Standard. The operation of these units is checked by a set of executable tests. These tests produce messages that are examined to verify that the units are operating correctly. If these units are not operating correctly, then the validation is not attempted.

The text of the tests in the ACVC follow conventions that are intended to ensure that the tests are reasonably portable without modification. For example, the tests make use of only the basic set of 55 characters, contain lines with a maximum length of 72 characters, use small numeric values, and place features that may not be supported by all implementations in separate tests. However, some tests contain values that require the test to be customized according to implementation-specific values--for example, an illegal file name. A list of the values used for this validation is provided in Appendix C.

A compiler must correctly process each of the tests in the suite and demonstrate conformity to the Ada Standard by either meeting the pass criteria given for the test or by showing that the test is inapplicable to the implementation. The applicability of a test to an implementation is considered each time the implementation is validated. A test that is inapplicable for one validation is not necessarily inapplicable for a subsequent validation.

CHAPTER 2
CONFIGURATION INFORMATION

2.1 CONFIGURATION TESTED

The candidate compilation system for this validation was tested under the following configuration:

Compiler: IBM S/370 - VM/SP to RT PC - AIX Ada Cross Compiler,
Version 2.2

ACVC Version: 1.8

Certificate Number: 870427W1.08046

Host Computer:

Machine:	IBM 3081
Operating System:	VM/SP (using CMS), Version 3.1
Memory Size:	64 megabytes

Target Computer:

Machine:	IBM RT PC
Operating System:	AIX, Version 1.1
Memory Size:	4 megabytes

Communications Network:	IBM RT PC 3278 Emulation (Coaxial cable)
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CONFIGURATION INFORMATION

2.2 IMPLEMENTATION CHARACTERISTICS

One of the purposes of validating compilers is to determine the behavior of a compiler in those areas of the Ada Standard that permit implementations to differ. Class D and E tests specifically check for such implementation differences. However, tests in other classes also characterize an implementation. This compiler is characterized by the following interpretations of the Ada Standard:

- . Capacities.

The compiler correctly processes tests containing loop statements nested to 65 levels, block statements nested to 65 levels, and recursive procedures separately compiled as subunits nested to 17 levels. It correctly processes a compilation containing 723 variables in the same declarative part. (See tests D55A03A..H (8 tests), D56001B, D64005E..G (3 tests), and D29002K.)

- . Universal integer calculations.

An implementation is allowed to reject universal integer calculations having values that exceed `SYSTEM.MAX_INT`. This implementation does not reject such calculations and processes them correctly. (See tests D4A002A, D4A002B, D4A004A, and D4A004B.)

- . Predefined types.

This implementation supports the additional predefined type `LONG_INTEGER` in the package `STANDARD`. (See tests B86001C and B86001D.)

- . Based literals.

An implementation is allowed to reject a based literal with a value exceeding `SYSTEM.MAX_INT` during compilation, or it may raise `NUMERIC_ERROR` or `CONSTRAINT_ERROR` during execution. This implementation raises `NUMERIC_ERROR` during execution. (See test E24101A.)

- . Array types.

An implementation is allowed to raise `NUMERIC_ERROR` or `CONSTRAINT_ERROR` for an array having a `'LENGTH` that exceeds `STANDARD.INTEGER'LAST` and/or `SYSTEM.MAX_INT`.

CONFIGURATION INFORMATION

No exception is raised by this implementation for a packed BOOLEAN array having a 'LENGTH exceeding INTEGER'LAST. (See test C52103X.)

A packed two-dimensional BOOLEAN array with more than INTEGER'LAST components raises CONSTRAINT_ERROR when the length of a dimension is calculated and exceeds INTEGER'LAST. (See test C52104Y.)

A null array with one dimension of length greater than INTEGER'LAST may raise NUMERIC_ERROR or CONSTRAINT_ERROR either when declared or assigned. Alternatively, an implementation may accept the declaration. However, lengths must match in array slice assignments. No exception is raised by this implementation. (See test E52103Y.)

In assigning one-dimensional array types, the expression appears to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. In assigning two-dimensional array types, the expression does not appear to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. (See test C52013A.)

. Discriminated types.

During compilation, an implementation is allowed to either accept or reject an incomplete type with discriminants that is used in an access type definition with a compatible discriminant constraint. This implementation accepts such subtype indications. (See test E38104A.)

In assigning record types with discriminants, the expression appears to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. (See test C52013A.)

. Aggregates.

In the evaluation of a multi-dimensional aggregate, the order in which choices are evaluated and index subtype checks are made appears to depend upon the aggregate itself. (See tests C43207A and C43207B.)

In the evaluation of an aggregate containing subaggregates, all choices are not evaluated before being checked for identical bounds. (See test E43212B.)

All choices are evaluated before CONSTRAINT_ERROR is raised if a bound in a nonnull range of a nonnull aggregate does not belong to an index subtype. (See test E43211B.)

CONFIGURATION INFORMATION

- . Functions.

An implementation may allow the declaration of a parameterless function and an enumeration literal having the same profile in the same immediate scope, or it may reject the function declaration. If it accepts the function declaration, the use of the enumeration literal's identifier denotes the function. This implementation rejects the declaration. (See test E66001D.)

- . Representation clauses.

The Ada Standard does not require an implementation to support representation clauses. If a representation clause is not supported, then the implementation must reject it. While the operation of representation clauses is not checked by Version 1.8 of the ACVC, they are used in testing other language features. This implementation accepts 'SIZE and 'STORAGE_SIZE for tasks, and 'SMALL clauses; it rejects 'STORAGE_SIZE for collections. Enumeration representation clauses, including those that specify noncontiguous values, appear not to be supported. (See tests C55B16A, C87B62A, C87B62B, C87B62C, and BC1002A.)

- . Pragmas.

The pragma `INLINE` is not supported for procedures or functions. (See tests CA3004E and CA3004F.)

- . Input/output.

The package `SEQUENTIAL_IO` cannot be instantiated with unconstrained array types and record types with discriminants. The package `DIRECT_IO` cannot be instantiated with unconstrained array types and record types with discriminants without defaults. (See tests AE2101C, AE2101H, CE2201D, CE2201E, and CE2401D.)

An existing text file can be opened in `OUT_FILE` mode, can be created in `OUT_FILE` mode, and can be created in `IN_FILE` mode. (See test EE3102C.)

More than one internal file can be associated with each external file for text I/O for both reading and writing. (See tests CE3111A..E (5 tests).)

More than one internal file can be associated with each external file for sequential I/O for both reading and writing. (See tests CE2107A..F (6 tests).)

More than one internal file can be associated with each external file for direct I/O for both reading and writing. (See tests CE2107A..F (6 tests).)

CONFIGURATION INFORMATION

An external file associated with more than one internal file can be deleted. (See test CE2110B.)

Temporary sequential and direct files are given a name. Temporary files given names are deleted when they are closed. (See tests CE2108A and CE2108C.)

. Generics.

Generic subprogram declarations and bodies cannot be compiled in separate compilations. (See test CA2009F.)

Generic package declarations and bodies cannot be compiled in separate compilations. (See tests CA2009C and BC3205D.)

CHAPTER 3

TEST INFORMATION

3.1 TEST RESULTS

Version 1.8 of the ACVC contains 2399 tests. When validation testing of the IBM S/370 - VM/SP to RT PC - AIX Ada Cross Compiler was performed, 19 tests had been withdrawn. The remaining 2380 tests were potentially applicable to this validation. The AVF determined that 319 tests were inapplicable to this implementation, and that the 2061 applicable tests were passed by the implementation.

The AVF concludes that the testing results demonstrate acceptable conformity to the Ada Standard.

3.2 SUMMARY OF TEST RESULTS BY CLASS

RESULT	TEST CLASS						TOTAL
	A	B	C	D	E	L	
Passed	67	862	1073	17	11	31	2061
Failed	0	0	0	0	0	0	0
Inapplicable	2	5	295	0	2	15	319
Withdrawn	0	7	12	0	0	0	19
TOTAL	69	874	1380	17	13	46	2399

TEST INFORMATION

3.3 SUMMARY OF TEST RESULTS BY CHAPTER

RESULT	CHAPTER												TOTAL
	2	3	4	5	6	7	8	9	10	11	12	14	
Passed	93	205	280	243	161	97	136	262	107	32	217	228	2061
Failed	0	0	0	0	0	0	0	0	0	0	0	0	0
Inapplicable	23	120	140	4	0	0	3	0	23	0	1	5	319
Withdrawn	0	5	5	0	0	1	1	2	4	0	1	0	19
TOTAL	116	330	425	247	161	98	140	264	134	32	219	233	2399

3.4 WITHDRAWN TESTS

The following 19 tests were withdrawn from ACVC Version 1.8 at the time of this validation:

C32114A	C41404A	B74101B	BC3204C
B33203C	B45116A	C87B50A	
C34018A	C48008A	C92005A	
C35904A	B49006A	C940ACA	
B37401A	B4A010C	CA3005A..D (4 tests)	

See Appendix D for the reason that each of these tests was withdrawn.

3.5 INAPPLICABLE TESTS

Some tests do not apply to all compilers because they make use of features that a compiler is not required by the Ada Standard to support. Others may depend on the result of another test that is either inapplicable or withdrawn. The applicability of a test to an implementation is considered each time a validation is attempted. A test that is inapplicable for one validation attempt is not necessarily inapplicable for a subsequent attempt. For this validation attempt, 319 tests were inapplicable for the reasons indicated:

- C34001D, B52004E, B55B09D, and C55B07B use SHORT_INTEGER which is not supported by this compiler.
- C34001F and C35702A use SHORT_FLOAT which is not supported by this compiler.
- C34001G and C35702B use LONG_FLOAT which is not supported by this compiler.

TEST INFORMATION

- . C55B16A makes use of an enumeration representation clause containing noncontiguous values which is not supported by this compiler.
- . B86001D requires a predefined numeric type other than those defined by the Ada language in package STANDARD. There is no such type for this implementation.
- . C86001F redefines package SYSTEM, but TEXT_IO is made obsolete by this new definition in this implementation and the test cannot be executed since the package REPORT is dependent on the package TEXT_IO.
- . C87B62B uses the length clause 'STORAGE_SIZE for access types which is not supported by this compiler. The length clause is rejected during compilation.
- . BA111C, CA1012A, CA2009C, CA2009F, LA5008A..H (8 tests), LA5008J, LA5008M, LA5008N, and BC3205D compile generic specifications and bodies in separate compilations which is not supported by this compiler.
- . CA3004E, EA3004C, and LA3004A use INLINE pragma for procedures which is not supported by this compiler.
- . CA3004F, EA3004D, and LA3004B use INLINE pragma for functions which is not supported by this compiler.
- . LA5008I and LA5008K are inapplicable because, in this implementation, a generic unit is made obsolete by the recompilation of a unit on which the generic body (but not the specification) depends. Since this implementation does not support separate compilation of generic unit specifications and bodies, a generic specification must be considered obsolete whenever the body is found to be obsolete. These tests should report at link time that the body of a generic unit is obsolete. However, a compile-time error message reports that the generic unit is obsolete.
- . AE2101C, CE2201D, and CE2201E use an instantiation of package SEQUENTIAL_IO with unconstrained array types which is not supported by this compiler.
- . AE2101H and CE2401D use an instantiation of package DIRECT_IO with unconstrained array types which is not supported by this compiler.
- . The following 278 tests require a floating-point accuracy that exceeds the maximum of 6 supported by the implementation:

C24113C..Y (23 tests)	C35708C..Y (23 tests)	C45421C..Y (23 tests)
C35705C..Y (23 tests)	C35802C..Y (23 tests)	C45424C..Y (23 tests)
C35706C..Y (23 tests)	C45241C..Y (23 tests)	C45521C..Z (24 tests)
C35707C..Y (23 tests)	C45321C..Y (23 tests)	C45621C..Z (24 tests)

TEST INFORMATION

3.6 SPLIT TESTS

If one or more errors do not appear to have been detected in a Class B test because of compiler error recovery, then the test is split into a set of smaller tests that contain the undetected errors. These splits are then compiled and examined. The splitting process continues until all errors are detected by the compiler or until there is exactly one error per split. Any Class A, Class C, or Class E test that cannot be compiled and executed because of its size is split into a set of smaller subtests that can be processed.

Splits were required for six Class B tests:

BA3006A	BA3007B	BA3008B
BA3006B	BA3008A	BA3013A

3.7 ADDITIONAL TESTING INFORMATION

3.7.1 Prevalidation

Prior to validation, a set of test results for ACVC Version 1.8 produced by the IBM S/370 - VM/SP to RT PC - AIX Ada Cross Compiler was submitted to the AVF by the applicant for review. Analysis of these results demonstrated that the compiler successfully passed all applicable tests, and that the compiler exhibited the expected behavior on all inapplicable tests.

3.7.2 Test Method

Testing of the IBM AIX Ada Cross Compiler using ACVC Version 1.8 was conducted on-site by a validation team from the AVF. The configuration consisted of an IBM 3081 host operating under VM/SP (using CMS), Version 3.1, and an IBM RT PC target operating under AIX, Version 1.1. The host and target computers were linked via an IBM RT PC 3278 emulation.

A magnetic tape containing all tests except for withdrawn tests and tests requiring unsupported floating-point precisions was taken on-site by the validation team for processing. Tests that make use of implementation-specific values were customized before being written to the magnetic tape. Tests requiring splits during the prevalidation testing were included in their split form on the magnetic tape.

The contents of the magnetic tape were loaded directly onto the host computer. After the test files were loaded to disk, the full set of tests was compiled on the IBM 3081, and all executable tests were run on the IBM RT PC. Assembler files were transferred to the target computer over a coaxial cable via a 3278 emulation capability provided on the RT PC. Each assembler source file from the CMS download was assembled, and each

executable test was linked and executed. The output from each test was directed to a results file in addition to the console.

The results of execution and the results of linking the Class L tests were uploaded to the host using a 3278 emulation capability on the RT PC. Compiler listings, console spools, and execution results were transferred to another 3081 via a Remote Spooling Communication System (RSCS) for printing on an IBM 3800 printer.

The compiler was tested using command scripts provided by IBM Corporation and reviewed by the validation team. The compiler was invoked through the use of a CMS execute statement named ART. ART supports the following options:

- BCF Causes the code generator to generate output filenames according to the working library tag number range. If either MAIN or BIND are specified in addition to BCF, a file called MAIN BCF A is created. MAIN BCF A contains the filenames of all files that must be bound together to create the executable image. If BCF is not specified, the compiler uses the input filename for the output filename.
- BIND This option binds a main program which has been previously compiled as a library unit. When using this option, the parameter to ART must be the compilation unit name. This option can be used when a main program has subunits.
- INIT Initializes the working sublibrary for the compiler.
- LIB Informs the RT compiler generator that this compilation unit is a library unit, rather than a main unit; in other words, the program will not be executed directly, but instead is "withed" by another unit.
- LIST Invokes the Ada listing tool to produce a source listing after the compilation. If errors occur during compilation, appropriate error messages are interspersed in the listing.
- MAIN Directs the Ada RT Compiler to produce code for this unit as a main program. This program can "with" other programs and expect to have the "withed" units included and elaborated at run time.

TEST INFORMATION

The following options were in effect for testing:

Single File Tests:

```
ART acvc_file_name (MAIN/main_compilation_unit_name BCF INIT/TSTLIB LIST
```

Multiple File Tests - the first file is compiled as follows:

```
ART acvc_file_name (LIB BCF LIST INIT/TSTLIB
```

Each subsequent file is compiled as follows (same as first file except without initializing the compilation library):

```
ART acvc_file_name (LIB BCF LIST
```

After all files are compiled, the main is binded as follows:

```
ART main_compilation_unit_name (BIND BCF
```

Test output, compilation listings, and job logs were captured on magnetic tape and archived at the AVF. The listings examined on-site by the validation team were also archived.

3.7.3 Test Site

The validation team arrived at IBM Corporation in Gaithersburg MD on 24 April 1987, and departed after testing was completed on 28 April 1987.

APPENDIX A

DECLARATION OF CONFORMANCE

IBM Corporation has submitted the following declaration of conformance concerning the IBM S/370 - VM/SP to RT PC - AIX Ada Cross Compiler.

APPENDIX B

APPENDIX F OF THE Ada STANDARD

The only allowed implementation dependencies correspond to implementation-dependent pragmas, to certain machine-dependent conventions as mentioned in chapter 13 of MIL-STD-1815A, and to certain allowed restrictions on representation clauses. The implementation-dependent characteristics of the IBM S/370 - VM/SP to RT PC - AIX Ada Cross Compiler, Version 2.2, are described in the following sections which discuss topics in Appendix F of the Ada Language Reference Manual (ANSI/MIL-STD-1815A). Implementation-specific portions of the package STANDARD are also included in this appendix.

```
package STANDARD is
```

```
...
```

```
type INTEGER is range -32768 .. 32767;
```

```
type LONG_INTEGER is range -2_147_483_648 .. 2_147_483_647;
```

```
type FLOAT is digits 6 range -1.70141E38 .. 1.70141E38;
```

```
type DURATION is delta 2.0**(-14) range -86_400.0 .. 86_400.0;
```

```
...
```

```
end STANDARD;
```

AIX Compiler Appendix F

Pragmas

Unrecognized and unsupported pragmas are ignored with an appropriate error message.

The pragmas `Controlled`, `Inline`, `List`, `Memory_Size`, `Optimize`, `Pack`, `Page`, `Shared`, `Storage_Unit`, and `System_Name` are not supported.

The pragmas `Elaborate`, `Priority`, and `Suppress` are supported.

The `Interface` pragma is supported for three languages: C, PL8, and assembly. The assembly and PL8 interface pragmas are part of the Ada implementation, and should not be used. The C interface pragma provides calling conventions compatible with the C language implementation for AIX.

Implementation Defined Attributes

There are no implementation defined attributes.

Representation Clauses

Length Clauses (LRM 13.2) are supported in the following instances:

- a. `'Storage_Size` for task types (not access types)
- b. `'Size`
- c. `'Small`

No other representation clauses are supported.

Restrictions On Unchecked Conversion

`Unchecked_Conversion` between two types (or subtypes) A and B is permitted provided that A and B are the same static size, and neither A nor B are private.

Interpretation Of Type Address

The type address is implemented as the 32-bit virtual address of the corresponding object.

Package System

PACKAGE System IS

TYPE Address is access integer;

TYPE Name IS (TeleSoft_Ada);
System_Name : CONSTANT name := TeleSoft_Ada;
Storage_Unit : CONSTANT := 8;
Memory_Size : CONSTANT := 1024*1024;

-- System-Dependent Named Numbers:

Min_Int : CONSTANT := -(2 ** 31);
Max_Int : CONSTANT := (2 ** 31) - 1;
Max_Digits : CONSTANT := 6;
Max_Mantissa : CONSTANT := 31;
Fine_Delta : CONSTANT := 1.0 / (2 ** (Max_Mantissa - 1));
Tick : CONSTANT := 1.0;

-- Other System-Dependent Declarations

SUBTYPE Priority IS Integer RANGE 0 .. 255;
Max_Object_Size : CONSTANT := (32*1024)-1;
Max_Record_Count : CONSTANT := (32*1024)-1;
Max_Text_Io_Count : CONSTANT := 16*1024;
Max_Text_Io_Field : CONSTANT := 1000;

-- Other Types

TYPE Subprogram_Value is
Record
Entry_Point : Address;
Static_Base : Address;
End Record;

END System;

Convention Used For Generating Names

Ada names are hashed to 8 character identifiers in the output object code. The first letter of each 8 character identifier defines the object designated by the identifier as follows:

- B - label used to delimit blocks of code for optimization
- D - Static Data (i.e., library package data)
- F - Stack frame size for a given subprogram
- H - End of subprogram code
- L - Literal pool for package
- P - Subprogram entry point
- R - Label Defining the return code for a subprogram
- T - miscellaneous label
- X - Exception label

The last seven characters of the identifiers implement the hashing function and have no particular meaning to the user.

Implementation Defined Characteristics For Input-Output Packages.

For AIX, Text_IO, Sequential_IO, and Direct_IO are supported. Direct_IO and Sequential_IO cannot be instantiated with unconstrained array types or unconstrained types with discriminants without defaults. Text_IO.standard_input and Text_IO.standard_output are mapped to AIX standard input and output respectively. Text_IO is byte oriented, so each byte will appear in the output (input) as it is written (read). Filenames are restricted by AIX to a maximum of 14 characters. Under RT Ada, filenames exceeding 14 characters, including pathname, raise Name_Error. AIX places no restrictions on characters in filenames; RT Ada restricts permissible characters to printable characters from the basic Ada character set, except blanks and asterisks.

APPENDIX C

TEST PARAMETERS

Certain tests in the ACVC make use of implementation-dependent values, such as the maximum length of an input line and invalid file names. A test that makes use of such values is identified by the extension .TST in its file name. Actual values to be substituted are represented by names that begin with a dollar sign. A value must be substituted for each of these names before the test is run. The values used for this validation are given below.

<u>Name and Meaning</u>	<u>Value</u>
\$BIG ID1 Identifier the size of the maximum input line length with varying last character.	(1..199 => 'A', 200 => '1')
\$BIG ID2 Identifier the size of the maximum input line length with varying last character.	(1..199 => 'A', 200 => '2')
\$BIG ID3 Identifier the size of the maximum input line length with varying middle character.	(1..100 102..200 => 'A', 101 => '3')
\$BIG ID4 Identifier the size of the maximum input line length with varying middle character.	(1..100 102..200 => 'A', 101 => '4')
\$BIG INT_LIT An integer literal of value 298 with enough leading zeroes so that it is the size of the maximum line length.	(1..197 => '0', 198..200 => "298")

TEST PARAMETERS

<u>Name and Meaning</u>	<u>Value</u>
<p><u>\$BIG_REAL_LIT</u> A real literal that can be either of floating- or fixed-point type, has value 690.0, and has enough leading zeroes to be the size of the maximum line length.</p>	(1..194 => '0', 195..200 => "69.0E1")
<p><u>\$BLANKS</u> A sequence of blanks twenty characters fewer than the size of the maximum line length.</p>	(1..180 => ' ')
<p><u>\$COUNT_LAST</u> A universal integer literal whose value is TEXT_IO.COUNT'LAST.</p>	16383
<p><u>\$EXTENDED_ASCII_CHARS</u> A string literal containing all the ASCII characters with printable graphics that are not in the basic 55 Ada character set.</p>	"abcdefghijklmnopqrstuvwxyz" & "!\$%?@\`{}~"
<p><u>\$FIELD_LAST</u> A universal integer literal whose value is TEXT_IO.FIELD'LAST.</p>	1000
<p><u>\$FILE_NAME_WITH_BAD_CHARS</u> An illegal external file name that either contains invalid characters, or is too long if no invalid characters exist.</p>	"XX XX"
<p><u>\$FILE_NAME_WITH_WILD_CARD_CHAR</u> An external file name that either contains a wild card character, or is too long if no wild card character exists.</p>	"XYZ#"
<p><u>\$GREATER_THAN_DURATION</u> A universal real value that lies between DURATION'BASE'LAST and DURATION'LAST if any, otherwise any value in the range of DURATION.</p>	100_000.0
<p><u>\$GREATER_THAN_DURATION_BASE_LAST</u> The universal real value that is greater than DURATION'BASE'LAST, if such a value exists.</p>	131_072.0

TEST PARAMETERS

<u>Name and Meaning</u>	<u>Value</u>
\$ILLEGAL_EXTERNAL_FILE_NAME1 An illegal external file name.	"BAD/CHARACTER*%@"
\$ILLEGAL_EXTERNAL_FILE_NAME2 An illegal external file name that is different from \$ILLEGAL_EXTERNAL_FILE_NAME1.	(1..50 => 'A')
\$INTEGER_FIRST The universal integer literal expression whose value is INTEGER'FIRST.	-32768
\$INTEGER_LAST The universal integer literal expression whose value is INTEGER'LAST.	32767
\$LESS_THAN_DURATION A universal real value that lies between DURATION'BASE'FIRST and DURATION'FIRST if any, otherwise any value in the range of DURATION.	-100_000.0
\$LESS_THAN_DURATION_BASE_FIRST The universal real value that is less than DURATION'BASE'FIRST, if such a value exists.	-131_072.0
\$MAX_DIGITS The universal integer literal whose value is the maximum digits supported for floating-point types.	6
\$MAX_IN_LEN The universal integer literal whose value is the maximum input line length permitted by the implementation.	200
\$MAX_INT The universal integer literal whose value is SYSTEM.MAX_INT.	2_147_483_647

TEST PARAMETERS

<u>Name and Meaning</u>	<u>Value</u>
<p><u>\$NAME</u> A name of a predefined numeric type other than <u>FLOAT</u>, <u>INTEGER</u>, <u>SHORT_FLOAT</u>, <u>SHORT_INTEGER</u>, <u>LONG_FLOAT</u>, or <u>LONG_INTEGER</u> if one exists, otherwise any undefined name.</p>	<p><u>LONG_LONG_INTEGER</u></p>
<p><u>\$NEG_BASED_INT</u> A based integer literal whose highest order nonzero bit falls in the sign bit position of the representation for <u>SYSTEM.MAX_INT</u>.</p>	<p>16#FFFFFFFFE#</p>
<p><u>\$NON_ASCII_CHAR_TYPE</u> An enumerated type definition for a character type whose literals are the identifier <u>NON_NULL</u> and all non-ASCII characters with printable graphics.</p>	<p>(<u>NON_NULL</u>)</p>

APPENDIX D

WITHDRAWN TESTS

Some tests are withdrawn from the ACVC because they do not conform to the Ada Standard. The following 19 tests had been withdrawn at the time of validation testing for the reasons indicated. A reference of the form "AI-ddddd" is to an Ada Commentary.

- . C32114A: An unterminated string literal occurs at line 62.
- . B33203C: The reserved word "IS" is misspelled at line 45.
- . C34018A: The call of function G at line 114 is ambiguous in the presence of implicit conversions.
- . C35904A: The elaboration of subtype declarations SFX3 and SFX4 may raise NUMERIC_ERROR instead of CONSTRAINT_ERROR as expected in the test.
- . B37401A: The object declarations at lines 126 through 135 follow subprogram bodies declared in the same declarative part.
- . C41404A: The values of 'LAST and 'LENGTH are incorrect in the if statements from line 74 to the end of the test.
- . B45116A: ARRPRIBL1 and ARRPRIBL2 are initialized with a value of the wrong type--PRIBOOL_TYPE instead of ARRPRIBOOL_TYPE--at line 41.
- . C48008A: The assumption that evaluation of default initial values occurs when an exception is raised by an allocator is incorrect according to AI-00397.
- . B49006A: Object declarations at lines 41 and 50 are terminated incorrectly with colons, and end case; is missing from line 42.
- . B4A010C: The object declaration in line 18 follows a subprogram body of the same declarative part.

WITHDRAWN TESTS

- . B74101B: The begin at line 9 causes a declarative part to be treated as a sequence of statements.
- . C87B50A: The call of "/"= at line 31 requires a use clause for package A.
- . C92005A: The "/"= for type PACK.BIG_INT at line 40 is not visible without a use clause for the package PACK.
- . C940ACA: The assumption that allocated task TT1 will run prior to the main program, and thus assign SPYNUMB the value checked for by the main program, is erroneous.
- . CA3005A..D (4 tests): No valid elaboration order exists for these tests.
- . BC3204C: The body of BC3204C0 is missing.

END

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