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7. PERFORMING ORGANIZATION NAME (S) AND       8. PERFORMING         Ada Validating Facility, Language Control Facility ASB/SCEL, Building 676, Rm.       0RGANIZATION         135       Wright-Patterson AFB, Dayton, OH 45433			
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# Certificate Information

The following Ada implementation was tested and determined to pass ACVC 1.11. Testing was completed on 30 June 1994.

Compiler Name and Version:	VADSself for DEC Alpha AXP OSF/1, Product Number: 2100-01439, Version 6.2
Host Computer System:	DEC 3000 Model 500 AXP under OSF/1, V1.3
Target Computer System:	Same as host
Customer Agreement Number:	94-05-12-RAT

See section 3.1 for any additional information about the testing environment.

As a result of this validation effort, Validation Certificate 940630W1.11360 is awarded to Rational Software Corporation. This certificate expires two years after MIL-STD-1815B is approved by ANSI.

This report has been reviewed and is approved.

Ada Validation Facility Dale E. Lange Technical Director 645 CCSG/SCSL Wright-Patterson AFB OH 45433-5707

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Ada Validation Organization Director, computer and Software Engineering Division Institute for Defense Analyses Alexandria VA 22311

Add Joint Program Office Donald J. (Beifer Director, AJPO Defense Information Systems Agency, Center for Information Management

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Ada COMPILER VALIDATION SUMMARY REPORT: Certificate Number: 940630W1.11360 Rational Software Corporation VADSself for DEC Alpha AXP OSF/1, Product Number: 2100-01439, Version 6.2 DEC 3000 Model 500 AXP under OSF/1, V1.3

(Final)

Prepared By: Ada Validation Facility 645 CCSG/SCSL Wright-Patterson AFB OH 45433-5707



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This report has been reviewed and is approved.

Ada Validation Facility () Dale E. Lange Technical Director 645 CCSG/SCSL Wright-Patterson AFB OH 45433-5707

Ada Validation Organization Director, Computer and Software Engineering Division Institute for Defense Analyses Alexandria VA 22311

Ada Joint Program Office Donald J. Reifer Director, AJPO Defense Information Systems Agency, Center for Information Management

## DECLARATION OF CONFORMANCE

Customer: Rational Software Corporation

Ada Validation Facility: 645 CCSG/SCSL Wright-Patterson AFB OH 45433-5707

ACVC Version: 1.11

Ada Implementation:

Ada Compiler Name and Version: VADSself for DEC Alpha AXP OSF/1, Product Number: 2100-01439, Version 6.2

Host Computer System: DEC 3000 Model 500 AXP (OSF/1 V1.3)

Target Computer System: Same as host.

Declaration:

I, the undersigned, declare that I have no knowledge of deliberate deviations from the Ada Language Standard ANSI/MIL-STD-1815A, ISO 8652-1987, FIPS 119 as tested in this validation and documented in the Validation Summary Report.

Stephen Scalpone

Director of Core Technology

Date: 6

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# TABLE OF CONTENTS

CHAPTER	1	INTRODUCTION
	1.1 1.2 1.3 1.4	USE OF THIS VALIDATION SUMMARY REPORT
CHAPTER	2	IMPLEMENTATION DEPENDENCIES
	2.1 2.2 2.3	WITHDRAWN TESTS
CHAPTER	3	PROCESSING INFORMATION
	3.1 3.2 3.3	TESTING ENVIRONMENT       3-1         SUMMARY OF TEST RESULTS       3-1         TEST EXECUTION       3-2
APPENDIX	A	MACRO PARAMETERS
APPENDIX	В	COMPILATION SYSTEM OPTIONS

APPENDIX C APPENDIX F OF THE Ada STANDARD

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#### CHAPTER 1

## INTRODUCTION

The Ada implementation described above was tested according to the Ada Validation Procedures [Pro92] against the Ada Standard [Ada83] using the current Ada Compiler Validation Capability (ACVC). This Validation Summary Report (VSR) gives an account of the testing of this Ada implementation. For any technical terms used in this report, the reader is referred to [Pro92]. A detailed description of the ACVC may be found in the current ACVC User's Guide [UG89].

# 1.1 USE OF THIS VALIDATION SUMMARY REPORT

Consistent with the national laws of the originating country, the Ada Certification Body 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 implementation has no nonconformities to the Ada Standard other than those presented. Copies of this report are available to the public from the AVF which performed this validation or from:

> National Technical Information Service 4 5285 Port Royal Road Springfield VA 22161

Questions regarding this report or the validation test results should be directed to the AVF which performed this validation or to:

Ada Validation Organization Computer and Software Engineering Division Institute for Defense Analyses 1801 North Beauregard Street Alexandria VA 22311-1772

# 1.2 REFERENCES

- [Ada83] Reference Manual for the Ada Programming Language, ANSI/MIL-STD-1815A, February 1983 and ISO 8652-1987.
- [Pro92] Ada Compiler Validation Procedures, Version 3.1, Ada Joint Program Office, August 1992.
- [UG89] Ada Compiler Validation Capability User's Guide, 21 June 1989.

## 1.3 ACVC TEST CLASSES

Compliance of Ada implementations is tested by means of the ACVC. The ACVC contains a collection of test 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. Class B and class L tests are expected to produce errors at compile time and link time, respectively.

The executable tests are written in a self-checking manner and produce a PASSED, FAILED, or NOT APPLICABLE message indicating the result when they are executed. Three Ada library units, the packages REPORT and SPPRT13, and the procedure CHECK\_FILE are used for this purpose. The package REPORT 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 package SPPRT13 is used by many tests for Chapter 13 of the Ada Standard. 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 REPORT and CHECK\_FILE is checked by a set of executable tests. If these units are not operating correctly, validation testing is discontinued.

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 all violations of the Ada Standard are detected. Some of the class B tests contain legal Ada code which must not be flagged illegal by the compiler. This behavior is also verified.

Class L tests check that an Ada implementation correctly detects violation of the Ada Standard involving multiple, separately compiled units. Errors are expected at link time, and execution is attempted.

In some tests of the ACVC, certain macro strings have to be replaced by implementation-specific values — for example, the largest integer. A list of the values used for this implementation is provided in Appendix A. In addition to these anticipated test modifications, additional changes may be required to remove unforeseen conflicts between the tests and implementation-dependent characteristics. The modifications required for this implementation are described in section 2.3.

INTRODUCTION

For each Ada implementation, a customized test suite is produced by the AVF. This customization consists of making the modifications described in the preceding paragraph, removing withdrawn tests (see section 2.1), and possibly removing some inapplicable tests (see section 2.2 and [UG89]).

In order to pass an ACVC an Ada implementation must process each test of the customized test suite according to the Ada Standard.

#### 1.4 DEFINITION OF TERMS

Ada Compiler The software and any meeded 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 CompilerThe means for testing compliance of Ada implementations,Validationconsisting of the test suite, the support programs, the ACVCCapabilityuser's guide and the template for the validation summary(ACVC)report.

Ada An Ada compiler with its host computer system and its Implementation target computer system.

Ada Joint The part of the certification body which provides policy and guidance for the Ada certification system. Office (AJPO)

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

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

Compliance of The ability of the implementation to pass an ACVC version. an Ada Implementation

Computer A functional unit, consisting of one or more computers and System 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 and that can execute programs that modify operations; themselves during execution. A computer system may be a stand-alone unit or may consist of several inter-connected units.

## INTRODUCTION

Compiler

- Conformity Fulfillment by a product, process, or service of all requirements specified.
- 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.

Declaration of A formal statement from a customer assuring that conformity Conformance is realized or attainable on the Ada implementation for which validation status is realized.

Host Computer A computer system where Ada source programs are transformed System into executable form.

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

ISO International Organization for Standardization.

- LRM The Ada standard, or Language Reference Manual, published as ANSI/MIL-STD-1815A-1983 and ISO 8652-1987. Citations from the LRM take the form "<section>.<subsection>:<paragraph>."
- Operating Software that controls the execution of programs and that System 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.

TargetA computer system where the executable form of Ada programsComputerare executed.System

Validated Ada The compiler of a validated Ada implementation.

Validated Ada An Ada implementation that has been validated successfully Implementation either by AVF testing or by registration [Pro92].

- Validation The process of checking the conformity of an Ada compiler to the Ada programming language and of issuing a certificate for this implementation.
- Withdrawn<br/>testA test found to be incorrect and not used in conformity<br/>testing. A test may be incorrect because it has an invalid<br/>test objective, fails to meet its test objective, or contains<br/>erroneous or illegal use of the Ada programming language.

### CHAPTER 2

#### IMPLEMENTATION DEPENDENCIES

#### 2.1 WITHDRAWN TESTS

The following tests have been withdrawn by the AVO. The rationale for withdrawing each test is available from either the AVO or the AVF. The publication date for this list of withdrawn tests is 22 November 1993.

B27005A C35507L C35508M C43004A C45651A A74006A C83026A C97116A CC1223A AD1B08A CD2A41E CD4022D CD5111A AD7201A CD9005A CE2119B	E28005C C35507N C35508N C45114A C46022A C74308A B83026B C98003B BC1226A BD2A02A CD2A87A CD4024B CD7004C AD7201E CD9005B CE2205B	B28006C C355070 C35702A C45346A B49008A B83022B C83041A BA2011A CC1226B CD2A21E CD2B15C CD4024C ED7005D CD7204B CDA201E CE2405A	C32203A C35507P C35702B C45612A B49008B B83022H B85001L CB7001A BC3009B CD2A23E BD3006A CD4024D CD7005E AD7206A CE21071 CE3111C	C34006D C355081 C37310A C45612B A54B02A B83025B C86001F CB7001B BD1B02B CD2A32A BD4008A CD4031A AD7006A BD8002A CE2117A CE3116A	C35507K C35508J B41308B C45612C C55B06A B83025D C94021A CB7004A BD1B06A CD2A41A CD4022A CD4051D CD7006E BD8004C CE2117B CE3118A
CD9005A	CD9005B	CDA201E	CE2107I	CE2117A	CE2117B
CE3411B CE3814A	CE3203B CE3412B CE3902B	CE3607B	CE3607C	CE3607D	CE3812A
				4	

## 2.2 INAPPLICABLE TESTS

A test is inapplicable if it contains test objectives which are irrelevant for a given Ada implementation. Reasons for a test's inapplicability may be supported by documents issued by the ISO and the AJPO known as Ada Commentaries and commonly referenced in the format AI-ddddd. For this implementation, the following tests were determined to be inapplicable for the reasons indicated; references to Ada Commentaries are included as appropriate. The following 201 tests have floating-point type declarations requiring more digits than SYSTEM.MAX DIGITS:

C24113L.Y (14 tests)C35705L.Y (14 tests)C35706L.Y (14 tests)C35707L.Y (14 tests)C35708L.Y (14 tests)C35802L.Z (15 tests)C45241L.Y (14 tests)C45321L.Y (14 tests)C45421L.Y (14 tests)C45521L.Z (15 tests)C45524L.Z (15 tests)C45621L.Z (15 tests)C45641L.Y (14 tests)C46012L.Z (15 tests)

C35713C, B86001U, and C86006G check for the predefined type LONG\_FLOAT; for this implementation, there is no such type.

C35713D and B86001Z check for a predefined floating-point type with a name other than FLOAT, LONG\_FLOAT, or SHORT\_FLOAT; for this implementation, there is no such type.

A35801E checks that FLOAT'FIRST..FLOAT'LAST may be used as a range constraint in a floating-point type declaration; for this implementation, that range exceeds the range of safe numbers of the largest predefined floating-point type and must be rejected. (See section 2.3.)

C45624A..B (2 tests) check that the proper exception is raised if MACHINE OVERFLOWS is FALSE for floating point types and the results of various floating-point operations lie outside the range of the base type; for this implementation, MACHINE OVERFLOWS is TRUE.

B86001Y uses the name of a predefined fixed-point type other than type DURATION; for this implementation, there is no such type.

C96005B uses values of type DURATION's base type that are outside the range of type DURATION; for this implementation, the ranges are the same.

CD1009C checks whether a length clause can specify a non-default size for a floating-point type; this implementation does not support such sizes.

CD2A84A, CD2A84E, CD2A84I...J (2 tests), and CD2A84O use length clauses to specify non-default sizes for access types; this implementation does not support such sizes.

The tests listed in the following table check that USE ERROR is raised if the given file operations are not supported  $r_{-}$  the given combination of mode and access method; this implementation supports these operations.

Test	File Operati	on Mode	File Access	Method
CE2102D	CREATE	IN FILE	SEQUENTIAL	
CE2102E	CREATE	OUT_FILE	SEQUENTIAL	

#### IMPLEMENTATION DEPENDENCIES

1

CE2102F CE2102J CE2102N CE2102O CE2102O CE2102P CE2102Q CE2102R CE2102R CE2102T CE2102U CE2102U CE2102V CE2102V CE2102W CE3102E CE3102F CE3102G CE3102I CE3102J	CREATE CREATE OPEN RESET OPEN RESET OPEN RESET OPEN RESET CREATE RESET DELETE CREATE OPEN	INOUT FILE IN FILE OUT FILE IN FILE IN FILE OUT FILE OUT FILE INOUT FILE IN FILE IN FILE OUT FILE IN FILE IN FILE ANY Mode OUT FILE IN FILE	DIRECT IO DIRECT IO DIRECT IO SEQUENTIAL IO SEQUENTIAL IO SEQUENTIAL IO SEQUENTIAL IO DIRECT IO DIRECT IO DIRECT IO DIRECT IO DIRECT IO TEXT IO TEXT IO TEXT IO TEXT IO TEXT IO
CE31025 CE3102K	OPEN	OUT_FILE	TEXT_IO.

CE2203A checks that WRITE raises USE\_ERROR if the capacity of an external sequential file is exceeded; this implementation cannot restrict file capacity.

CE2403A checks that WRITE raises USE\_ERROR if the capacity of an external direct file is exceeded; this implementation cannot restrict file capacity.

CE3304A checks that SET LINE LENGTH and SET PAGE LENGTH raise USE ERROR if they specify an inappropriate value for the external file; there are no inappropriate values for this implementation.

CE3413B checks that PAGE raises LAYOUT ERROR when the value of the page number exceeds COUNT'LAST; for this implementation, the value of COUNT'LAST is greater than 150000, making the checking of this objective impractical.

## 2.3 TEST MODIFICATIONS

Modifications (see section 1.3) were required for 22 tests.

The following tests were split into two or more tests because this implementation did not report the violations of the Ada Standard in the way expected by the original tests.

B24009A	B33301B	B38003A	B38003B	B38009A	<b>B38</b> 009B
B85008G	B85008H	BC1303F	BC3005B	BD2B03A	BD2D03A
BD4003A					

A35801E was graded inapplicable by Evaluation Modification as directed by the AVO. The compiler rejects the use of the range FLOAT'FIRST..FLOAT'LAST as the range constraint of a floating-point type declaration because the bounds

# IMPLEMENTATION DEPENDENCIES

lie outside of the range of safe numbers (cf. LRM 3.5.7:12).

CD1009A, CD1009I, CD1C03A, CD2A22J, and CD2A31A..C were graded passed by Evaluation Modification as directed by the AVO. These tests use instantiations of the support procedure LENGTH\_CHECK, which uses Unchecked Conversion according to the interpretation given in AI-00590. The AVO ruled that this interpretation is not binding under ACVC 1.11; the tests are ruled to be passed if they produce Failed messages only from the instances of LENGTH\_CHECK--i.e, the allowed Report.Failed messages have the general form:

" \* CHECK ON REPRESENTATION FOR <TYPE ID> FAILED."

AD9001B was graded passed by Test Modification as directed by the AVO. This test checks that no bodies are required for interfaced subprograms; among the procedures that it uses is one with a parameter of mode OUT (line 36). This implemenation does not support pragma INTERFACE for procedures with parameters of mode OUT. The test was modified by commenting out line 36 and 40; the modified test was passed.

## CHAPTER 3

#### PROCESSING INFORMATION

# 3.1 TESTING ENVIRONMENT

The Ada implementation tested in this validation effort is described adequately by the information given in the initial pages of this report.

For technical and sales information about this Ada implementation, contact:

Sam Quiring Rational Software Corporation 1600 NW Compton Dr., Suite 357 Aloha, OR 97006-1992 (503) 690-1116

Testing of this Ada implementation was conducted at the customer's site by a validation team from the AVF.

3.2 SUMMARY OF TEST RESULTS

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 Standard, whether the test is applicable or inapplicable; otherwise, the Ada Implementation fails the ACVC [Pro92].

For all processed tests (inapplicable and applicable), a result was obtained that conforms to the Ada Programming Language Standard.

The list of items below gives the number of ACVC tests in various categories. All tests were processed, except those that were withdrawn because of test errors (item b; see section 2.1), those that require a floating-point precision that exceeds the implementation's maximum precision (item e; see section 2.2), and those that depend on the support of a file system -- if none is supported (item d). All tests passed, except those that are listed in sections 2.1 and 2.2 (counted in items b and f, below).

#### PROCESSING INFORMATION

<ul> <li>a) Total Number of Applicable Tests</li> <li>b) Total Number of Withdrawn Tests</li> <li>c) Processed Inapplicable Tests</li> <li>d) Non-Processed I/O Tests</li> <li>e) Non-Processed Floating-Point</li> </ul>	3824 104 41 0	
Precision Tests	201	
f) Total Number of Inapplicable Tests	242	(c+d+e)
g) Total Number of Tests for ACVC 1.11	4170	(a+b+f)

# 3.3 TEST EXECUTION

A magnetic tape containing the customized test suite (see section 1.3) was taken on-site by the validation team for processing. The contents of the magnetic tape were loaded onto a Sun SPARCcenter 2000 and copied to the host computer system.

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After the test files were loaded onto the host computer, the full set of tests was processed by the Ada implementation.

The tests were compiled, linked and executed on the host computer system. The results were captured on the host computer system.

Testing was performed using command scripts provided by the customer and reviewed by the validation team. See Appendix B for a complete listing of the processing options for this implementation. It also indicates the default options. The options invoked explicitly for validation testing during this test were:

Option/Switch Effect

-w Suppress warning diagnostics.

Test output, compiler and linker 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.

3-2

# APPENDIX A

#### MACRO PARAMETERS

This appendix contains the macro parameters used for customizing the ACVC. The meaning and purpose of these parameters are explained in [UG89]. The parameter values are presented in two tables. The first table lists the values that are defined in terms of the maximum input-line length, which is the value for \$MAX\_IN\_LEN--also listed here. These values are expressed here as Ada string aggregates, where "V" represents the maximum input-line length.

Macro Parameter	Macro Value
\$MAX_IN_LEN	499 Value of V
\$BIG_ID1	(1V-1 => 'A', V => '1')
\$BIG_ID2	$(1V-1 \implies 'A', V \implies '2')$
\$BIG_ID3	$(1V/2 \Rightarrow 'A') \& '3' \& (1V-1-V/2 \Rightarrow 'A')$
\$BIG_ID4	$(1V/2 \Rightarrow 'A') \& '4' \& (1V-1-V/2 \Rightarrow 'A')$
\$BIG_INT_LIT	(1V-3 => '0') & "298"
\$BIG_REAL_LIT	(1V-5 => '0') & "690.0"
\$BIG_STRING1	'"' & (1V/2 => 'A') & '"'
\$BIG_STRING2	'"' & (1V-1-V/2 => 'A') & '1' & '"'
\$ <b>BLANK</b> S	(1V-20 => ' ')
\$MAX_LEN_INT_BASED_L	ITERAL "2:" & (1V-5 => '0') & "11:"
\$MAX_LEN_REAL_BASED_	LITERAL ' "16:" & (1V-7 => '0') & "F.E:"

\$MAX\_STRING\_LITERAL '"' & (1..V-2 => 'A') & '"'

The following table lists all of the other macro parameters and their respective values.

Macro Parameter	Macro Value
\$ACC_SIZE	64
<b>ŞALIGNMENT</b>	4
\$COUNT_LAST	2147483647
\$DEFAULT_MEM_SIZE	16777216
\$DEFAULT_STOR_UNIT	8
\$DEFAULT_SYS_NAME	AXP_SELF
\$DELTA DOC 0.00000000000000000000000000000000000	0108420217248550443400745280086994171142578125
\$ENTRY_ADDRESS	SYSTEM."+"(16#2#)
\$ENTRY_ADDRESS1	SYSTEM."+"(16#31#)
\$ENTRY_ADDRESS2	SYSTEM."+"(16#32#)
\$FIELD_LAST	2147483647
\$FILE_TERMINATOR	, ,
\$FIXED_NAME	NO_SUCH_TYPE
\$FLOAT_NAME	NO_SUCH_TYPE
\$FORM_STRING	
\$FORM_STRING2	"CANNOT_RESTRICT_FILE_CAPACITY"
\$GREATER_THAN_DURATIO	N 100000.0
\$GREATER_THAN_DURATIO	N BASE LAST T000000000.0
\$GREATER_THAN_FLOAT_E	ASE LAST 1.8E+308
\$GREATER_THAN_FLOAT_S	SAFE LARGE 5.0E307

# MACRO PARAMETERS

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GREATER_THAN_SHORT_FLOAT_SAFE_LARGE 9.0E37		
\$HIGH_PRIORITY	99	
\$ILLEGAL_EXTERNAL_FIL	E_NAME1 /illegal/file_name/2}]%2102c.dat	
\$ILLEGAL_EXTERNAL_FIL	E_NAME2 /illegal/file_n <b>ame</b> /CE2102C*.dat	
\$INAPPROPRIATE_LINE_L	ength —1	
\$INAPPROPRIATE_PAGE_L	ENGTH —1	
\$INCLUDE_PRAGMA1	PRAGMA INCLUDE ("A28006D1.TST")	
\$INCLUDE_PRAGMA2	PRAGMA INCLUDE ("B28006D1.TST")	
\$INTEGER_FIRST	-2147483648	
\$INTEGER_LAST	2147483647	
\$INTEGER_LAST_PLUS_1	2147483648	
\$INTERFACE_LANGUAGE	с	
\$LESS_THAN_DURATION	-100000.0	
\$LESS_THAN_DURATION_BASE_FIRST -1000000000.0		
\$LINE_TERMINATOR	ASCII.LF & ASCII.FF	
\$LOW_PRIORITY	0 ,	
\$MACHINE_CODE_STATEMENT CODE_0'(OP => NOP);		
\$MACHINE_CODE_TYPE	CODE_0	
\$MANTISSA_DOC	63	
\$MAX_DIGITS	15	
\$MAX_INT	9223372036854775807	
\$MAX_INT_PLUS_1	9223372036854775808	
\$MIN_INT	-9223372036854775808	
\$NAME	TINY_INTEGER	

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A-3

MACRO PARAMETERS

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\$NAME_LIST	AXP_SELF
\$NAME_SPECIFICATION1	/usr/vc/tst/acvcl.11/c/e/X2120A
\$NAME_SPECIFICATION2	/usr/vc/tst/acvcl.11/c/e/X2120B
\$NAME_SPECIFICATION3	/usr/vc/tst/acvcl.11/c/e/X3119A
\$NEG_BASED_INT	16#F00000000000000E#
\$NEW_MEM_SIZE	16777216
\$NEW_STOR_UNIT	8
\$NEW_SYS_NAME	AXP_SELF
\$PAGE_TERMINATOR	ASCII.FF
\$RECORD_DEFINITION	RECORD SUBP: OPERAND; END RECORD;
\$RECORD_NAME	CODE_0
\$TASK_SIZE	64
\$TASK_STORAGE_SIZE	1024
<b>\$TICK</b>	0.01
\$VARIABLE_ADDRESS	VAR_1'ADDRESS
\$VARIABLE_ADDRESS1	VAR_2'ADDRESS
\$VARIABLE_ADDRESS2	VAR_3'ADDRESS
\$YOUR_PRAGMA	PRAGMA PASSIVE

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# APPENDIX B

# COMPILATION SYSTEM OPTIONS

The compiler options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to compiler documentation and not to this report.

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ada

#### Command Reference

ada

ada - invoke the Ada compiler

Syntax

ada [options] [source file]... [object file.o]...

Arguments

object\_file.o non-Ada object file names. These files will be passed on to the linker and will be linked with the specified Ada object files.

options options to the compiler. These are:

- -A (disassemble) Disassemble the units in the source file after compiling them. -A can be followed by arguments that further define the disassembly display (e.g., -Aa, -Ab, -Ad, -Af, -Al, -As).
  - a Add hexadecimal display of instruction bytes to disassembly listing.
  - b Disassemble the unit body [default].
  - d Print the data section (if present) as well.
  - f Use the alternative format for output.
  - 1 Put the disassembly output in file "file name.das"
  - s Disassemble the unit spec.

-a file name (archive) Treat file name as an object archive file created by ar. Since some archive files end with .a, -a is used to distinguish archive files from Ada source files.

- -Bstatic/dynamic (SPARCompiler Ada only) (static) If static is indicated, the Ada program is compiled and linked statically. The default is dynamic.
- -c suppress the control messages generated when pragma PAGE and/or pragma LIST are encountered.
- -D identifier type value (define) Define an identifier of a specified type and value.

-DA1.0

- -DA1.1
- -DA2.0

(architecture) Specify the architecture version the compiler should generate code for. These options override the ARCHITECTURE INFO directive [Default: -DA1.1] (HP PA-RISC only)

-d (dependencies) Analyze for dependencies only. Do not do

## COMPILATION SYSTEM OPTIONS

semantic analysis or code generation. Update the library, marking any defined units as uncompiled. The -d option is used by a.make to establish dependencies among new files. This option will attempt to do imports for any units referenced from outer libraries. This should reduce relocation and reduce user disk space usage.

-E

-E directory

(error output) Without a directory argument, ada processes error messages using a.error and directs a brief message to standard output; the raw error messages are left in source\_file.err. If a directory name is given, the raw error output is placed in directory/source file.err. The file of raw error messages can be used as input to a.error. Only one -e or -E option should be used.

- -e (error) Process compilation error messages using a error and send it to standard output. Only the source lines containing errors are listed. Only one -e or -E option should be used.
- -Eferror\_file source file (error) Process source file and place any error messages

in the file indicated by error file. Note that there is no space between the -Ef and error\_file.

- -El
- -El directory

(error listing) Same as the -E option, except that a source listing with errors is produced. Note that the source listing is directed to standard out while the raw errors are placed in source file.err.

- -el (error listing) Intersperse error messages among source lines and direct to standard output.
- -Elferror file source file

(error listing) Same as the -Ef option, except that a source listing with errors is produced and directed to standard output. The raw errors are written to error file.

-ev (error vi(1)) Process syntax error messages using a.error, embed them in the source file and call the environment editor ERROR EDITOR. If ERROR EDITOR is defined, the environment variable ERROR PATTERN should also be defined. ERROR PATTERN is an editor search command that locates the first occurrence of '###' in the error file. If no editor is specified, vi(1) is invoked.

The value of the environment variable ERROR TABS, if set, is used instead of the default tab settings (8).

-F (full DIANA) Do not trim the DIANA tree before output to net files. To save disk space, the DIANA tree will be trimmed so that all pointers to nodes that did not involve a subtree that define a symbol table will be nulled (unless those nodes are part of the body of an inline or generic or certain other values needing to be retained for the debugging or compilation information). The trimming generally removes initial values of variables and all statements.

- -G (GVAS) Display suggested values for the MIN\_GVAS\_ADDR and MAX GVAS ADDR INFO directives.
- -K (keep) Keep the intermediate language (IL) file produced by the compiler front end. The IL file will be placed in the .objects directory with the file name Ada source.
- -L library name

(library) Operate in VADS library library name. [Default: current working directory]

#### -lfile abbreviation (VADSself only)

(library search) This is an option passed to the ld(1) linker, telling it to search the specified library file. (No space between the -1 and the file abbreviation.)

#### -M unit name

(main) Produce an executable program by linking the named unit as the main program. unit name must already be compiled. It must be either a parameterless procedure or a parameterless function returning an integer. The executable program will be named a.out unless overridden with the -o option.

-M source file

(main) Produce an executable program by compiling and linking source file. The main unit of the program is assumed to be the root name of the file (for foo.a the unit is foo). Only one file may be preceded by -M. The executable program will be named a.out unless overridden with the -o option.

- -N (no code sharing) Compile all generic instantiations without sharing code for their bodies. This option overrides the SHARE BODY INFO directive and the SHARE\_CODE or SHARE\_BODY pragmas.
- -NX (NX) Link with NX startup code and with the NX archive libraries. This option is valid only if the -M option has also been invoked. (Sun SPARC => Paragon only)

#### -0[0-9]

(optimize) Invoke the code optimizer. An optional digit (there is no space before the digit) provides the level of optimization. The default is -04.

### COMPILATION SYSTEM OPTIONS

- -O full optimization
- -00 no optimization
- -O1 copy propagation, constant folding, removing dead variables, subsuming moves between scalar variables
- -O2 add common subexpression elimination within basic blocks
- -O3 add global common subexpression elimination
- -O4 add hoisting invariants from loops and address optimizations
- -05 add range optimizations, instruction scheduling and one pass of reducing induction expressions
- -O6 add unrolling of innermost loops
- -07 add one more pass of induction expression reduction
- -O8 add one more pass of induction expression reduction -O9 add one more pass of induction expression
  - 09 add one more pass of induction expression reduction and add hoisting expressions common to the then and the else parts of if statements

Hoisting from branches (and cases alternatives) can be slow and does not always provide significant performance gains so it can be suppressed.

Note that using the -O0 option can alleviate some problems when debugging. For example, using a higher level of optimization, you may receive a message that a variable is no longer active or is not yet active. If you experience these problems, set the optimization level to 0 using the -O0 option.

#### -o executable file

(output) This option is to be used in conjunction with the -M option. executable file is the name of the executable rather than the default, a.out (self) or a.vox (cross).

- -P Invoke the Ada Preprocessor.
- -R VADS library

(recompile instantiation) Force analysis of all generic instantiations, causing reinstantiation of any that are out of date. VADS library is the library in which the recompilation is to occur. If it is not specified, the recompilation occurs in the current working directory.

- -r (recreate) Recreate the library's GVAS TABLE file. This option reinitializes the file and exits. This allows recovery from "GVAS exhausted" without recompiling all the files in the library.
- -S (suppress) Apply pragma SUPPRESS to the entire compilation for all suppressible checks.
- -sh (show) Display the name of the tool executable but do not execute it.
- -T (timing) Print timing information for the compilation.

-trb

(trace block) Generate code to trace entry into basic blocks and calls and returns (for use with a.trace only)

-trc

(trace calls) Generate code to trace calls and returns (for use with a.trace only)

-v (verbose) Print compiler version number, date and time of compilation, name of file compiled, command input line, total compilation time and error summary line. Storage usage information about the object file is provided.

-w (warnings) Suppress warning diagnostics.

-xlicinfo

(license) Indicates if FLEX1m is running and its status if it is operational. If it is not operational, a message indicating this is displayed.

source file name of the source file to be compiled.

Description

The ada command executes the Ada compiler and compiles the named Ada source file. The file must reside in a VADS library directory. The ada.lib file in this directory is modified after each Ada unit is compiled.

By default, ada produces only object and net files. If the -M option is used, the compiler automatically invokes a.ld and builds a complete program with the named library unit as the main program.

For cross systems, the compiler generates object files compatible with the host linker in VOX format. The VOX format is discussed in Appendix A of the Programmer's Guide.

Non-Ada object files (.o files produced by a compiler for another language) may be given as arguments to ada. These files will be passed on to the linker and will be linked with the specified Ada object files.

Command line options may be specified in any order but the order of compilation and the order of the files to be passed to the linker can be significant.

Several VADS compilers may be simultaneously available on a single system. Because the ada command in any VADS location/bin on a system will execute the correct compiler components based upon visible library directives, the option -sh is provided to print the name of the components actually executed.

Program listings with a disassembly of machine code instructions are generated by a.db or a.das.

NOTE: If two files of the same name from different directories are compiled in the same ada library using the -L option (even if the contents and unit names are different), the second compilation will overwrite the first. For example, the compilation of /usr/directory2/foo.a -L /usr/vads/test will overwrite the compilation of /usr/directory1/foo.a -L /usr/vads/test in the VADS library /usr/vads/test.

NOTE: It is possible to specify the directory for temporary files by setting the environment variable TMPDIR to the desired path. If TEMPDIR is not set, /tmp is used. If the path specified by TMPDIR does not exist or is not writeable, the program exits with an error message to that effect.

#### Diagnostics

The diagnostics produced by the VADS compiler are intended to be self-explanatory. Most refer to the RM. Each RM reference includes a section number and optionally, a paragraph number enclosed in parentheses.

# See Also

a.app, a.das, a.db, a.error, a.info, a.ld, a.make, a.mklib, appendixf

## LINKER OPTIONS

The linker options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to linker documentation and not to this report.

a.ld

#### Command Reference

a.ld

a.ld - build an executable program from previously compiled units

Syntax

a.ld [options] unit name [linker options]

Arguments

linker options
 All arguments after unit name are passed to the linker.
 library abbreviations or object files.

options options to the a.ld command. These are:

-DA1.0

-DA1.1

-DA2.0

(architecture) Specify the architecture version the compiler should generate code for. These options override the ARCHITECTURE INFO directive [Default: -DA1.1] (HP PA-RISC only)

- -DO (objects) Use partially linked objects instead of archives as an intermediate file if the entire list of objects cannot be passed to the linker in one invocation. This option is useful because of limitations in the archiver on some hosts (including ULTRIX, HP-UX and System V). (VADSself only)
- -DT (time) Displays how long each phase of the prelinking process takes.
- -Du unit\_list (units) Traces the addition of indirect dependencies to the named units.
- -Dx (dependencies) Displays the elaboration dependencies used each time a unit is arbitrarily chosen for elaboration.
- -DX (debug) Debug memory overflow (use in cases where linking a large number of units causes the error message "local symbol overflow" to occur).
- -E unit name (elaborate) Elaborate unit name as early in the elaboration order as possible.
- -F (files) Print a list of dependent files in order and suppress linking.
- -K (keep) Do not delete the termorary file containing the list of object files to link. This file is only present when many object

files are being linked.

-L library name

(library) Collect information for linking in library name instead of the current directory. However, place the executable in the current directory.

- -NX (NX) Link with NX startup copde and with the NX archive libraries. (Sun SPARC => Paragon only)
- -o executable file

(output) Use the specified fielname as the name of the output rather than the default a.out (self) or a.vox (cross).

- -sh (show) Display the name of the tool executable but do not execute it.
- -T (table) List the symbols in the elaboration table to standard output.
- -U (units) Print a list of dependent units in order and suppress linking.
- -v (verbose) Print the linker command before executing it.
- -V (verify) Print the linker command but suppress execution.
- -w (warnings) Suppress warning messages.
- unit name

name of an Ada unit. It must name a non-generic subprogram. If unit name is a function, it must return a value of the type STANDARD.INTEGER. This integer result will be passed back to the shell as the status code of the execution.

# Description

a.ld collects the object files needed to make unit name a main program and calls the ld(1) linker to link together all Ada and other language objects required to produce an executable image in a.out (self) or a.vox (cross). The utility uses the net files produced by the Ada compiler to check dependency information. a.ld produces an exception mapping table and a unit elaboration table and passes this information to the linker. The elaboration list generated by a.ld will not include library level packages that do not need elaboration. Similarly, packages that contain no code that can raise an exception will no longer have exception tables.

a.ld reads instructions for generating executables from the ada.lib file in the VADS libraries on the search list. Besides information generated by the compiler, these directives also include WITHn directives that allow the automatic linking of object modules compiled from other languages or Ada object modules not named in context clauses in the Ada source. Any number of WITHn

## COMPILATION SYSTEM OPTIONS

directives may be placed into a library but they must be numbered contiguously beginning at WITH1. The directives are recorded in the library's ada.lib file and have the following form.

WITH1:LINK:object\_file: WITH2:LINK:archive\_file:

WITH directives may be placed in the local Ada libraries or in any VADS library on the search list.

A WITHN directive in a local VADS library or earlier on the library search list will hide the same numbered WITHN directive in a library later in the library search list.

Use the tool a.info to change or report library directives in the current library.

For VADSself on Silicon Graphics Computer Systems, the USE LAST LINK INFO directive speeds relinking by retaining a list of units, their types, seals and dependencies.

VADS\_location/bin/a.ld is a wrapper program that executes the correct executable based upon directives visible in the ada.lib file. This permits multiple VADS compilers to exist on the same host. The -sh option prints the name of the actual executable file.

NOTE: It is possible to specify the directory for temporary files by setting the environment variable TMPDIR to the desired path. If TMPDIR is not set, /tmp is used. If the path specified by TMPDIR does not exist or is not writeable, the program exits with an error message to that effect.

## Files

a.out (self), a.vox (cross)	default output file
.nets	Ada DIANA net files directory
.objects/*	Ada object files
VADS location/standard/*	startup and standard library routines

## Diagnostics

Self-explanatory diagnostics are produced for missing files, etc. Additional messages are produced by the ld linker.

#### APPENDIX C

#### 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 the Ada Standard, and to certain allowed restrictions on representation clauses. The implementation-dependent characteristics of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this Appendix are to compiler documentation and not to this report. Implementation-specific portions of the package STANDARD, which are not a part of Appendix F, are:

package STANDARD is

type INTEGER is range -2147483648 .. 2147483647; type TINY INTEGER is range -128 .. 127; type SHORT INTEGER is range -32768 .. 32767; type LONG\_INTEGER is range -9223372036854775808 .. 9223372036854775807;

type FLOAT is digits 15 range -1.79769313486232E+308 .. 1.79769313486232E+308; type SHORT FLOAT is digits 6 range -3.40282E+38 .. 3.40282E+38;

6

end STANDARD:

. . . . . . . . . .

#### APPENDIX F. Implementation-Dependent Characteristics

#### 1. Implementation-Dependent Pragmas

## 1.1. INLINE ONLY Pragma

The INLINE\_ONLY pragma, when used in the same way as pragma INLINE, indicates to the compiler that the subprogram must always be inlined. This pragma also suppresses the generation of a callable version of the routine which saves code space. If a user erroneously makes an INLINE ONLY subprogram recursive a warning message will be emitted and an PROGRAM ERROR will be raised at run time.

# 1.2. INITIALIZE Pragma

Takes one of the identifiers STATIC or DYNAMIC as the single pragma is only allowed with the single level package spec or body. It specifies that all objects in the package be initialized as requested by the pragma (i.e. statically or dynamically). Only library-level objects are subject to static initialization; all objects within procedures are always (by definition) dynamic. If pragma INITIALIZE(STATIC) is used, and an object cannot be initialized statically, code will be generated to initialize warning message will be generated. the object and a

## 1.3. BUILT IN Pragma

The BUILT IN pragma is used in the implementation of some predefined Ada packages, but provides no user access. It is used only to implement code bodies for which no 'actual Ada body can be provided, for example the MACHINE CODE package.

1.4. SHARE CODE Pragma

The SHARE CODE pragma takes the name of a generic instantiation or a generic unit as the first argument and one of the identifiers TRUE or FALSE as the second argument. This pragma is only allowed immediately at the place of a declarative item in a declarative part or package specification, or after a library unit in a compilation, but before any subsequent compilation unit.

When the first argument is a generic unit the pragma applies to all instantiations of that generic. When the first argument is the name of a generic instantiation the pragma applies only to the specified instantiation, or overloaded instantiations.

If the second argument is TRUE the compiler will try to share code generated for a generic instantiation with code generated for other instantiations of the same generic. When the second argument is FALSE each instantiation will get a unique copy of the generated code. The extent to which code is shared between instantiations depends on this pragma and the kind of generic formal parameters declared for the generic unit.

The name pragma SHARE BODY is also recognized by the implementation and has the same effect as SHARE CODE. It is included for compatability with earlier versions of VADS.

#### 1.5. NO IMAGE Pragma

The pragma suppresses the generation of the image array used for the IMAGE attribute of enumeration types. This eliminates the overhead required to store the array in the executable image. An attempt to use the IMAGE attribute on a type whose image array has been suppressed will result in a compilation warning and PROGRAM ERROR raised at run time.

#### 1.6. EXTERNAL NAME Pragma

The EXTERNAL NAME pragma takes the name of a subprogram or variable defined in Ada and allows the user to specify a different external name that may be used to reference the entity from other languages. The pragma is allowed at the place of a declarative item in a package specification and must apply to an object declared earlier in the same package specification.

#### 1.7. INTERFACE NAME Pragma

The INTERFACE NAME pragma takes the name of a a variable or subprogram defined in another language and allows it to be referenced directly in Ada. The pragma will replace all occurrences of the variable or subprogram name with an external reference to the second, link argument. The pragma . is allowed at the place of a declarative item in a package specification and must apply to an object or subprogram declared earlier in the same package specification. The object must be declared as a scalar or an access type. The object cannot be any of the following:

a loop variable, a constant, an initialized variable, an array, or a record.

#### 1.8. IMPLICIT CODE Pragma

Takes one of the identifiers ON or OFF as the single argument. This pragma is only allowed within a machine code procedure. It specifies that implicit code generated by the compiler be allowed or disallowed. A warning is issued if OFF is used and any implicit code needs to be generated. The default is ON.

### 1.9. OPTIMIZE CODE Pragma

Takes one of the identifiers ON or OFF as the single argument. This pragma is only allowed within a machine code procedure. It specifies whether the code should be optimized by the compiler. The default is ON. When OFF is specified, the compiler will generate the code as specified.

# 1.10. NON REENTRANT

This pragma takes one argument which can be the name of either a library subprogram or a subprogram declared immediately within a library package spec or body. It indicates to the compiler that the subprogram will not be called recursively allowing the compiler to perform specific optimizations. The pragma can be applied to a subprogram or a set of overloaded subprograsm within a package spec or package body.

## 1.11. NOT ELABORATED

This pragma can only appear in a library package specification. It indicates that the package will not be elaborated because it is either part of the RTS, a configuration package or an Ada package that is referenced from a language other than Ada. The presence of this pragma suppresses the generation of elaboration code and issues warnings if elaboration code is required.

# 1.12. BIT PACK pragma

Indicates to the compiler that packing down to the bit level is desired. pragma BIT PACK can be used interchangeably with pragma PACK and pragma BYTE PACK

1.13. BYTE PACK pragma

Indicates to the compiler that packing down to the byte level is desired. Components at least as large as, or larger than, a byte, are packed at byte boundaries. pragma BYTE\_PACK can be used interchangeably with pragma PACK and pragma BIT PACK.

1.14. LINK WITH pragma

Can be used to pass arguments to the target linker. It may appear in any declarative part and accepts one argument, a constant string expression. This argument is passed to the target linker whenever the unit containing the pragma is included in a link. Note that the linker uses selective linking; it will include only those objects required to complete the link.

For UNIX systems, if the constant string expression begins with "-", the string is left untouched. However, if the string begins with neither "-" nor "/", then the string is prefixed with "./".

1.15. PASSIVE Pragma

This pragma has five forms:

pragma PASSIVE
pragma PASSIVE(ABORT\_UNSAFE);
pragma PASSIVE(ABORT\_SAFE);
pragma PASSIVE(ABORT\_UNSAFE, mutex\_attr'address);
pragma PASSIVE(ABORT\_SAFE, mutex\_attr'address);

This pragma can be applied to a task or task type declared immediately within a library package specification or body. It directs the compiler to optimize certain tasking operations. It is possible that the statements in the task body will prevent the intended optimization, in these cases a warning will be generated at compile time and will raise TASKING ERROR at run time.

1.16. RTS INTERFACE pragma

Take the name of an RTS routine and the name of a userdefined routine. Allows for the replacement of the default calls made implicitly at run-time to the underlying RTS routines. You can cause the compiler to generate calls to any routine of your choosing as long as it's parameters and RETURN value match the original. Use this pragma with caution.

1.17. TASK ATTRIBUTES Pragma

This pragma has two forms:

pragma TASK\_ATTRIBUTES(task\_atttr'address);
pragma TASK\_ATTRIBUTES(task\_object, task\_atttr'address);

The first form of this pragma is only allowed with the specification of a task unit. It specifies the task attri-

butes of the task or tasks of the task type. The second form is applicable to any task object. It takes precedence over the task attributes specified for the task's type.

The address of an ADA KRN DEFS.TASK ATTR T record is the argument of the pragma and is passed to the underlying microkernel at task creation.

The task attributes are microkernel dependent. See ada krn\_defs.a in standard for the type definition of TASK ATTR T and the different options supported. When there isn't a TASK ATTRIBUTES pragma for a task, the DEFAULT TASK ATTRIBUTES found in v\_usr\_conf\_f.a's configuration table are used.

All variations of the TASK ATTR T record contain at least the prio field. prio specifies the priority of the task. If the task also has a pragma PRIORITY(PRIO), the prio specified in the TASK ATTR T record takes precedence.

The optional first argument is the name of a task object. This allows task objects of the same task type to have different task attributes (including different task priorities). ada krn\_defs.a has overloaded versions of the following subprogram for initializing the task attributes:

function task\_attr\_init(
 prio : priority;
 OS dependent fields
) return address;

## 1.18. VOLATILE pragma

Takes one arguement which identifies an object. Guarantees that loads and stores to the named object will be performed as expected after optimization. The object declaration and the pragma must both occur (in this order) immediately within the same declarative part or package specification.

1.19. WARNINGS pragma Takes one of the identifiers ON or OFF as the single argument. selectively suppress warnings on a single statement or a group of statements.

> pragma warnings (off); statement(s) that generate warnings; pragma warnings (on);

2. Implementation of Predefined Pragmas

2.1. CONTROLLED

APPENDIX F OF THE Ada STANDARD

This pragma is recognized by the implementation but has no effect.

2.2. ELABORATE

This pragma is implemented as described in Appendix B of the Ada RM.

2.3. INLINE

This pragma is implemented as described in Appendix B of the Ada RM.

2.4. INTERFACE

This pragma supports calls to 'C' and FORTRAN functions. The Ada subprograms can be either functions or procedures. The types of parameters and the result type for functions must be scalar, access or the predefined type ADDRESS in SYSTEM. All parameters must have mode IN. Record and array objects can be passed by reference using the ADDRESS attribute.

2.5. LIST

This pragma is implemented as described in Appendix B of the Ada RM.

2.6. MEMORY SIZE

This pragma is recognized by the implementation. The implementation does not allow SYSTEM to be modified by means of pragmas, the SYSTEM package must be recompiled.

2.7. OPTIMIZE

This pragma is recognized by the implementation but has no effect.

2.8. PACK

This pragma will cause the compiler to choose a non-aligned , representation for composite types. It will not causes objects to be packed at the bit level.

2.9. PAGE

This pragma is implemented as described in Appendix B of the Ada RM.

2.10. PRIORITY

This pragma is implemented as described in Appendix B of the

Ada RM.

2.11. SHARED

This pragma is recognized by the implementation but has no effect.

2.12. STORAGE UNIT

This pragma is recognized by the implementation. The implementation does not allow SYSTEM to be modified by means of pragmas, the SYSTEM package must be recompiled.

2.13. SUPPRESS

This pragma is implemented as described, except that DIVISION CHECK and in some cases OVERFLOW\_CHECK cannot be supressed.

2.14. SYSTEM NAME

This pragma is recognized by the implementation. The implementation does not allow SYSTEM to be modified by means of pragmas, the SYSTEM package must be recompiled.

3. Implementation-Dependent Attributes

3.1. P'REF

For a prefix that denotes an object, a program unit, a label, or an entry:

This attribute denotes the effective address of the first of the storage units allocated to P. For a subprogram, package, task unit, or label, it refers to the address of the machine code associated with the corresponding body or statement. For an entry for which an address clause has been given, it refers to the corresponding hardware interrupt. The attribute is of the type OPERAND defined in the package MACHINE CODE. The attribute is only allowed within a machine code procedure.

See section F.4.8 for more information on the use of this attribute.

(For a package, task unit, or entry, the 'REF attribute is not supported.)

3.2. T'TASKID

For a task object or a value T, T'TASK\_ID yields the unique task id associated with a task. The value of this attribute is of the type ADDRESS in the package SYSTEM.

4. Specification Of Package SYSTEM with UNSIGNED TYPES; package SYSTEM is pragma suppress(ALL CHECKS); pragma suppress(EXCEPTION TABLES); pragma not elaborated; type NAME is ( axp self ); SYSTEM NAME : constant NAME := axp self; STORAGE UNIT : constant := 8; MEMORY SIZE : constant := 16 777 216; -- System-Dependent Named Numbers : constant := -9 223 372 036 854 775 808; MIN INT : constant := 9 223 372 036 854 775 807; MAX INT MAX DIGITS : constant := 15; MAX MANTISSA : constant := 63; FINE DELTA : constant := 2.0\*\*(-63); TICK : constant := 0.01; -- Other System-dependent Declarations subtype PRIORITY is INTEGER range 0 .. 99; MAX REC SIZE : integer := 64\*1024; type ADDRESS is private; function ">" (A: ADDRESS; B: ADDRESS) return BOOLEAN; function "<" (A: ADDRESS; B: ADDRESS) return BCOLEAN;</pre> function ">="(A: ADDRESS; B: ADDRESS) return BOOLEAN; function "<="(A: ADDRESS; B: ADDRESS) return BOOLEAN;</pre> function "-" (A: ADDRESS; B: ADDRESS) return INTEGER; function "+" (A: ADDRESS; I: INTEGER) return ADDRESS; function "-" (A: ADDRESS; I: INTEGER) return ADDRESS; function "+" (I: UNSIGNED TYPES.UNSIGNED LONG INTEGER) return ADDRESS; function MEMORY ADDRESS (I: UNSIGNED TYPES.UNSIGNED LONG INTEGER) return ADDRESS renames NO ADDR : constant ADDRESS; type TASK ID is private; NO TASK ID : constant TASK ID;

"+";

type PASSIVE TASK ID is private; NO PASSIVE TASK ID : constant PASSIVE TASK ID; subtype SIG STATUS T is INTEGER; SIG STATUS SIZE: constant := 4; type PROGRAM ID is private; NO PROGRAM ID : constant PROGRAM ID; type BYTE ORDER T is ( LITTLE ENDIAN, BIG ENDIAN ); BYTE ORDER: CONStant BYTE ORDER T := LITTLE ENDIAN; type LONG ADDRESS is private; NO LONG ADDR : constant LONG ADDRESS; function "+" (A: LONG ADDRESS; I: INTEGER) return LONG ADDRESS; function "-" (A: LONG ADDRESS; I: INTEGER) return LONG ADDRESS; function MAKE\_LONG\_ADDRESS (A: ADDRESS) return LONG\_ADDRESS; function LOCALIZE(A: LONG ADDRESS ; BYTE SIZE : INTEGER) return ADDRESS; function STATION OF(A: LONG ADDRESS) return INTEGER; --- Internal RTS representation for day. If the calendar package is used, — then, this is the julian day. subtype DAY T is INTEGER; - Constants describing the configuration of the CIFO add-on product. SUPPORTS INVOCATION BY ADDRESS : constant BOOLEAN := TRUE; SUPPORTS PREELABORATION : constant BOOLEAN := TRUE; MAKE ACCESS SUPPORTED : constant BOOLEAN := TRUE; -- Arguments to the CIFO pragma INTERRUPT TASK. type INTERRUPT TASK KIND is ( SIMPLE, SIGNALLING ); function RETURN ADDRESS return ADDRESS; private type ADDRESS is new UNSIGNED TYPES.UNSIGNED LONG INTEGER; NO ADDR : constant ADDRESS := 0; pragma BUILT IN(">"); pragma BUILT IN("<"); pragma BUILT IN(">="); pragma BUILT IN("<=");

```
pragma BUILT IN("-");
pragma BUILT IN("+");
```

type TASK ID is new UNSIGNED TYPES.UNSIGNED\_LONG\_INTEGER; NO TASK ID : constant TASK ID := 0;

type PASSIVE TASK ID is new UNSIGNED TYPES.UNSIGNED\_LONG\_INTEGER; NO PASSIVE TASK ID : constant PASSIVE TASK ID := 0;

type PROGRAM ID is new UNSIGNED TYPES.UNSIGNED\_LONG\_INTEGER; NO PROGRAM ID : constant PROGRAM ID := 0;

NO LONG ADDR : constant LONG ADDRESS := (0, 0);

pragma BUILT\_IN(MAKE LONG ADDRESS);
pragma BUILT\_IN(LOCALIZE);
pragma BUILT\_IN(STATION\_OF);

```
pragma BUILT IN(RETURN ADDRESS);
```

end SYSTEM;

5. Restrictions On Representation Clauses

5.1. Pragma PACK

In the absence of pragma PACK record components are padded so as to provide for efficient access by the target hardware, pragma PACK applied to a record eliminate the padding where possible. Pragma PACK has no other effect on the storage allocated for record components a record representation is required.

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5.2. Size Clauses

For scalar types a representation clause will pack to the number of bits required to represent the range of the subtype. A size clause applied to a record type will not cause packing of components; an explicit record representation clause must be given to specify the packing of the components. A size clause applied to a record type will cause packing of components only when the component type is a discrete type. An error will be issued if there is insufficient space allocated. The SIZE attribute is not supported for task, access, or floating point types. 5.3. Address Clauses

Address clauses are only supported for variables. Since default initialization of a variable requires evaluation of the variable address elaboration ordering requirements prohibit initialization of a variables which have address clauses. The specified address indicates the physical address associated with the variable.

5.4. Interrupts

Interrupt entries are supported with the following interpretation and restrictions:

An interrupt entry may not have any parameters.

A passive task that contains one or more interrupt entries must always be trying to accept each interrupt entry, unless it is handling the interrupt. The task must be executing either an accept for the entry (if there is only one) or a select statement where the interrupt entry accept alternative is open as defined by Ada RM 9.7.1(4). This is not a restriction on normal tasks (i.e., signal ISRs).

An interrupt acts as a conditional entry call in that interrupts are not queued (see the last sentence of Ada RM 13.5.1(2) and 13.5.1(6)).

No additional requirements are imposed for a select statement containing both a terminate alternative and an accept alternative for an interrupt entry (see Ada RM 13.5.1(3)).

Direct calls to an interrupt entry from another task are allowed and are treated as a normal task rendezvous.

Interrupts are not queued.

The address clause for an interrupt entry does not specify the priority of the interrupt. It simply specifies the interrupt vector number. For passive ISRs, the nnn of the passive(interrupt,nnn) pragma specifies the interrupt priority of the task.

5.5. Representation Attributes

The ADDRESS attribute is not supported for the following entities:

Packages Tasks Labels Entries

## APPENDIX F OF THE Ada STANDARD

## 5.6. Machine Code Insertions

Machine code insertions are supported.

The general definition of the package MACHINE CODE provides an assembly language interface for the target machine. It provides the necessary record type(s) needed in the code statement, an enumeration type of all the opcode mneumonics, a set of register definitions, and a set of addressing mode functions.

The general syntax of a machine code statement is as follows:

CODE n'( opcode, operand {, operand} );

where n indicates the number of operands in the aggregate.

A special case arises for a variable number of operands. The operands are listed within a subaggregate. The format is as follows:

CODE N'( opcode, (operand {, operand}) );

For those opcodes that require no operands, named notation must be used (cf. RM 4.3(4)).

CODE 0'( op => opcode );

The opcode must be an enumeration literal (i.e. it cannot be an object, attribute, or a rename).

An operand can only be an entity defined in MACHINE\_CODE or the 'REF attribute.

The arguments to any of the functions defined in MACHINE CODE must be static expressions, string literals, or the functions defined in MACHINE CODE. The 'REF attribute may not be used as an argument in any of these functions.

Inline expansion of machine code procedures is supported.

6. Conventions for Implementation-generated Names

There are no implementation-generated names.

7. Interpretation of Expressions in Address Clauses

Address expressions in an address clause are interpreted as physical addresses.

8. Restrictions on Ur

on Unchecked Conversions

None.

9. Restrictions on Unchecked Deallocations

None.

10. Implementation Characteristics of I/O Packages

Instantiations of DIRECT IO use the value MAX\_REC\_SIZE as the record size (expressed in STORAGE UNITS) when the size of ELEMENT\_TYPE exceeds that value. For example for unconstrained arrays such as string where ELEMENT TYPE'SIZE is very large, MAX\_REC\_SIZE is used instead. MAX\_RECORD\_SIZE is defined in SYSTEM and can be changed by a program before instantiating DIRECT\_IO to provide an upper limit on the record size. In any case the maximum size supported is 1024 x 1024 x STORAGE UNIT bits. DIRECT\_IO will raise USE\_ERROR if MAX\_REC\_SIZE exceeds this absolute limit.

value MAX REC SIZE Instantiations of SEQUENTIAL IO use the record size (expressed in STORAGE\_UNITS) when the as the size of ELEMENT TYPE exceeds that value. For example for unconstrained arrays such as string where ELEMENT TYPE'SIZE MAX REC\_SIZE is very large, used instead. is MAX RECORD SIZE is defined in SYSTEM and can be changed by a program before instantiating INTEGER IO to provide an upper limit on the record size. SEQUENTIAL IO imposes no limit on MAX REC SIZE.

11. Implementation Limits

The following limits are actually enforced by the implementation. It is not intended to imply that resources up to or even near these limits are available to every program.

11.1. Line Length

The implementation supports a maximum line length of 500 - 5

11.2. Record and Array Sizes

The maximum size of a statically sized array type is 32,000,000 x STORAGE UNITS. The maximum size of a statically sized record type is 32,000,000 x STORAGE UNITS. A record type or array type declaration that exceeds these limits will generate a warning message.

11.3. Default Stack Size for Tasks

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In the absence of an explicit STORAGE SIZE length specification every task except the main program is allocated a fixed size stack of 10,240 STORAGE UNITS. This is the value returned by T'STORAGE SIZE for a task type T.

11.4. Default Collection Size

In the absence of an explicit STORAGE\_SIZE length attribute the default collection size for an access type is 100 times the size of the designated type. This is the value returned by T'STORAGE\_SIZE for an access type T.

11.5. Limit on Declared Objects

There is an absolute limit of 6,000,000 x STORAGE UNITS for objects declared statically within a compilation unit. If this value is exceeded the compiler will terminate the compilation of the unit with a FATAL error message.