

Whither Ada?

“State of Ada” Address



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Salt Lake City, UT



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whith'er, *adv.* [AS. *hwider*]

- To what place; 2. To what point, degree, end, conclusion, or design

Webster's New Collegiate Dictionary



Overview of Presentation

What is SIGAda?

What's happening with the language?

Who's using Ada?

What's happening with Ada in academia?

How does Ada relate to current technologies?

What can we learn from Ada history?

What are the prospects for the Ada industry?



ACM SIGAda

ACM's Special Interest Group on Ada

- Professional society dedicated to all aspects of Ada-related technology, formed in 1981
- Around 700 members worldwide

Activities / member services

- Working Groups
- Local Chapters
- *Ada Letters* publication
- Distribution of Walnut Creek Ada CD-ROM
- Annual conference
- Ada promotion, sponsored by Ada Resource Assoc.
- Cooperation with sister societies (e.g., Ada Europe)
- Awards program to recognize distinguished achievement to Ada community and SIGAda



SIGAda Officers

Chair- Ben Brosgol, Ada Core Technologies

Vice-Chair / Meetings and Conferences-

Currie Colket, MITRE

Vice Chair / Liaison –

Ron Oliver, The Caress corp.

Secretary – John McCormick, Univ. of Northern Iowa

Treasurer – Bard Crawford, Stage Harbor Software

International Representative –

Karlotto Mangold, ATM Computer GmbH

Past Chair – Hal Hart, TRW



SIGAda 2001 Conference

Logistics

- Twin Cities (Bloomington), MN
- September 30 - October 4, 2001
- Conference chair- Paul Stachour
- www.acm.org/sigada/conf/sigada2001

Content

- Tutorials
- Refereed papers
- Workshops / Panels
- Exhibits
- Keynote speakers
 - Martin Carlisle (USAFA)
 - Robert Dewar (Ada Core Technologies)



Ada Resource Association

Trade Group of Ada Vendors

Ada Core Technologies

Green Hills Software

Aonix

OC Systems

Averstar

Rational Software

DDC-I

President: S. Tucker Taft (Averstar)

Objectives

- Increase awareness/usage of Ada
 - Web site: www.adaresource.org
 - Success stories
 - Support for SIGAda booth at non-Ada shows
- Support Ada infrastructure
 - Ada Rapporteur Group
 - Ada Conformance Assessment Test Suite



Ada Language Maintenance

ISO WG9 Ada Rapporteur Group

- Responsible for maintaining the language standard
- Meets periodically to discuss/resolve questions about language semantics
- Considering requests for enhancements for next version of the standard

Ada '0Y?

- Some changes possible, but nowhere near the scale of the Ada 9X process
 - Example: mutually dependent package specs
 - Example: “pragma Ravenscar”
- As with Ada9X, changes will be motivated by requests from users



Ada Usage*

Banking and Financial Systems

Information Systems

Air Traffic Control Systems

Commercial Aviation

Space / Satellite Applications

Communications

Railway Transportation / Control

Commercial Shipboard Control Systems

Television Industry

Medical Applications

Nuclear Power Plants

Steel Mill Control

Military

* Detailed list at www.seas.gwu.edu/~mfeldman/ada-project-summary.html



A Sampler of Ada Applications (1)

French TGV high-speed rail system

- Flexibility in mixing languages (C, Ada 95), migrating to different microprocessors
- Formal methods and techniques for assuring safety of systems specs / design
- High degree of code efficiency

NY Subway Carnarsie Line

- Matra Transport International to provide turnkey Ada system, similar to their work for Paris Métro
- Car-borne systems communicate with zone controller to monitor / control trains



A Sampler of Ada Applications (2)

Network Control

- Top Layer Networks produces hardware switch that analyzes network application traffic and enforces Quality of Service policies
- Multiprocessor environment with Motorola MPC 860, ARC, and Linux
- Chose Ada 95 versus C or C++ for reliability

Video Security Systems

- Vision Systems Ltd (Australia) produces a video multiplexing system
- Chose Ada 95 versus C or C++ for reliability
- Power PC / Wind River Systems RTOS



A Sampler of Ada Applications (3)

Jet Engines

- Pratt-Whitney: F119 engine for Advanced Tactical Fighter
- Similar engine for commercial aviation, to be certified to FAA highest level
- Chose Ada 95 for reliability

Commercial Avionics

- Boeing 777
- Approximately 2M LOC in Ada 83
- Ada continues to be the required language for certification at DO-178B levels A and B



A Sampler of Ada Applications (4)

Open Source Software

- GVD (GNU Visual Debugger) written in Ada using GtkAda
- Being distributed as part of GNOME for GNU/Linux

International Space Station

- Major successful project developed in Ada 83
- Some elements may upgrade to Ada 95
- “Management understands the issues” and has no plans to move to C or C++



A Sampler of Ada Applications (5)

David Botton's AdaPower Web Site

- Repository of useful Ada toolkits, frameworks etc
- Example of contents
 - GtkAda
 - Gwindows - Win32 RAD GUI Development
 - Booch components

Lots more...

- Canadian Air Traffic Control System
- Kingcat yacht Monitoring, Control and Alarm System
- Eurocontrol
- Weirton Steel



Issues Confronting Ada Usage

Memories from early days of Ada 83

- Language was deployed before compilers were mature
- Plans for large Ada environments were overly ambitious

Mistaken conception that “Ada isn’t COTS”

- Ada is as commercial as any other language

Mistaken conception that a technology’s merit is a function of its popularity

- Products with a small market share can be extremely successful

Mistaken conception that training a developer in Ada is expensive or difficult

- Obstacle is attitude, not aptitude



Ada in Academia (1)

Usage of Ada as a Foundation Programming Language

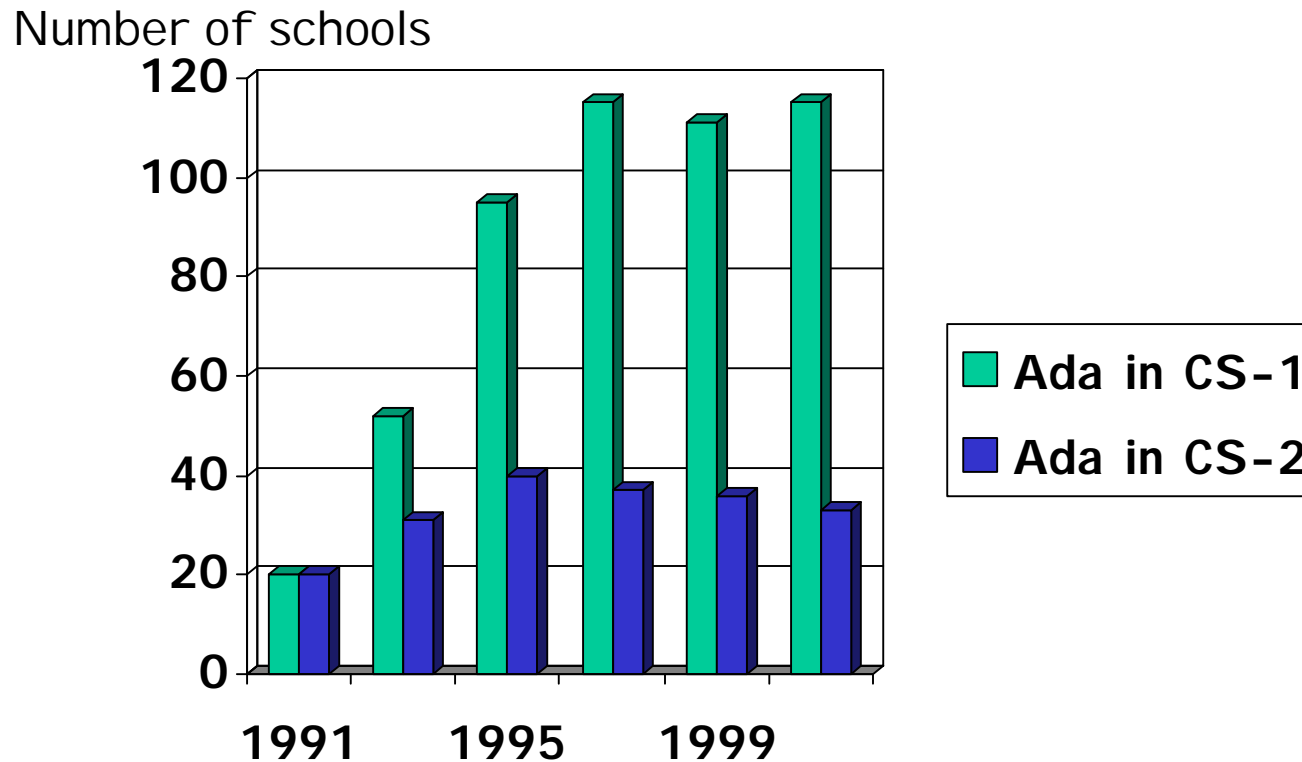


Chart compiled by Prof. Michael Feldman (GWU)

<http://www.seas.gwu.edu/~mfeldman/ada-foundation.html>



Ada in Academia (2)

Admittedly...

- Tendency for some schools to select a language that is widely used in industry

But pedagogically, Ada is the best choice for computer science courses

- Modern language features, including OOP
- Features encourage sound design
- Methodologically neutral
- General-purpose data structuring
- Standard support for concurrency
- Free or low-cost compilers



Ada Example

```
with Text_IO; -- canonical first program  
procedure Hello is  
begin  
    Text_IO.Put_Line("Hello, World!");  
end Hello;
```

much simpler than the Java™ version:

```
class Hello{ // canonical first program  
    public static void main( String[] args ){  
        System.out.println("Hello, World!");  
    }  
}
```



Ada Experience at Universities (1)

Teaching experience

- U.S. Military Academy (*)
 - Students do better with Ada than Pascal in introductory computer science courses
- SUNY Plattsburgh (*)
 - Students far more successful with Ada than with C in a lab course on real-time embedded systems

Universities with active Ada research include:

- York University (U.K.)
- Florida State University
- Technical University of Madrid (Spain)
- U.S. Air Force Academy
- Naval Postgraduate School

(*) *Ada Letters*, ACM SIGAda, Sept. 2000



Ada Experience at Universities (2)

Ada 95's simple, consistent syntax, an easy-to-use environment and intrinsic support for software engineering allowed students to concentrate on designing solutions, rather than arcane programming idiosyncracies.... our students could go farther, faster in Ada than they could in Pascal.... these results have been independently achieved and verified at the U.S. Air Force Academy.

J.A. Hamilton, Jr., J.L. Murtagh, R.G. Zoller
Programming Language Impacts on Learning
Ada Letters, Vol. XX, No. 3, Sept 2000, p. 18



Ada Experience at Universities (3)

... even when I provided nearly 60% of the project code, no team was successful in implementing the minimum requirements [in C].... [when Ada was used instead of C] nearly fifty percent of the student teams had their projects working before the end of the semester.... The only difference between the years in which teams succeeded in implementing their projects and those in which no team succeeded was the implementation language.

J. McCormick

Software Engineering Education: On the Right Track with Ada
Ada Letters, Vol. XX, No. 3, Sept 2000, pp 47, 48



Ada and Modern Technologies

Distribution

- Annex E for a distributed Ada application
- Third-party tools for CORBA (Ada IDL)

Java

- Ada compilers targeted to the JVM

Safety and Security

- HRG report on relationship between language features and techniques for integrity assurance
- Ravenscar profile

Commercial offerings such as COM

- Ada bindings available from compiler vendors or third-parties



Ada as Technology Leader

Ada has influenced other languages

- Exception handling: C++, Eiffel, Java
- Generics: C++ templates
- Packages: C++ namespaces
- Real-time features: Java real-time extensions
- Ravenscar profile: Java RT Core High-Integrity Profile
- “Picture string localization”: COBOL
- Structured syntax: PL/SQL

Interfacing facilities are unique

- Standard way to interface with other languages

Ada-related ISO standards

- Ada Semantic Interface Specification
- Ada Conformance Test Procedures



Lessons Learned from Ada History

What did we do wrong?

- Underestimated effort in introducing new technology
 - Relied too heavily on “top down” approach
- Were overly ambitious in what was expected
 - Machine / OS environments in the early 1980’s were not powerful enough to host Ada compilers
- Made some technical errors in Ada 83
 - Omitted necessary access type functionality

What did we do right?

- Focused on software engineering, “life cycle” issues for the language
- Brought Ada 83 and Ada 95 through ISO standardization
- Developed the world’s best language (Ada 95)



Reasons for Optimism

Ada language meets the requirements that it was originally designed to satisfy

- Large-scale, long-lived, high-integrity real-time embedded applications

Ada survived the period when it was most at risk

- 1997-98, after the closing of the AJPO
- “Validation policy” has continued

Technology is mature

- Good performance, comprehensive toolsets

The language is an international standard

- Well-defined maintenance path

“Stealth users”

- Many organizations are using Ada but keeping it a secret



Some Predictions

Near term

- Most legacy Ada projects will continue with Ada
 - It works, and conversion is too costly
- Ada will be chosen in new projects at organizations where there is a vocal Ada champion
 - Percentage is not negligible

Longer term

- Ada usage will increase in high-integrity area
 - Ravenscar, formal methods, etc.
- Ada usage will increase in university research
 - Open-source compiler technology
- DoD will move back to Ada
 - “Alternation of generation”



Conclusions / Recommendations

“Stay on message”

- Avoid temptation to get distracted by / compete with every new technological wrinkle
 - Don't try to “out-Java” Java

Look to the future instead of dwelling on the past

- Increasing power and capacity of new hardware plays to Ada's strengths



Ada Resources Online

Web sites

www.acm.org/sigada

www.adaresource.org

Newsgroups

comp.lang.ada

comp.object

comp.realtime