The Case for Ada at the USAF Academy

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Overview

- Academy Background
- Using Ada at the Academy
- Language Features
- Compiler Features
- Development Experience
- Conclusions

Cadet Parade

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US Air Force Academy

Mission

“Inspire and develop outstanding young men and women to become Air Force officers with knowledge, character and discipline; motivated to lead the world's greatest aerospace-force in service to the nation.”

US Air Force Academy

- Graduates enter Air Force as 2nd Lts
- Pilots, navigators, missile/space ops, computer, communications officers
- Typically five year commitment
- Our majors will lead other programmers

Aeronautical Engineering

US Air Force Academy

- 500 Faculty – 25% civilian, 75% military
- Military normal tour around 3 years
- Military with PhD’s can stay longer
- Most civilian faculty have PhD

US Air Force Academy

- Every cadet takes 30 core courses in engineering, physics, chemistry, computer science, etc.
- Average course load is 6 courses over 18-week semesters
- Computer Science, Computer Engineering degrees compressed to three years

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Using Ada at the Academy

- Ada used in core course
  - – 1996 – 2001 programming intensive course
  - – 2001 – 2003 Information Technology focus
  - – Fall 2003 using visual flow charting tool
- Ada in major's courses
  - – Primary programming language
  - – Computer Science and Computer Engineering
  - – Used in first three courses of majors

Using Ada at the Academy

- We will continue to use Ada
- Curriculum Committee debate
- Choice was based on the following criteria
  - Language features
  - Compiler features
  - Development experience
- Re-examine this choice every few years

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Language Features

- Strong typing
  - Errors found at compile time, not run time
- Case insensitivity
- Lack of single character errors
- Subtypes and enumeration types
  - Superior to Java, C++ and C#
- Mixed-language pragmas
- Ada port to .NET framework

Language Features

- Support for Imperative paradigm
  - Essential for teaching introductory programming
  - Learn control flow, assignment and modularization
  - Not possible in Java, since OO required from start
- Support for Object-Oriented paradigm
  - Builds on imperative fundamentals
  - Easy transition using ADT concepts
  - Learn OO gradually when intellectually ready
- Helps our majors succeed in limited time

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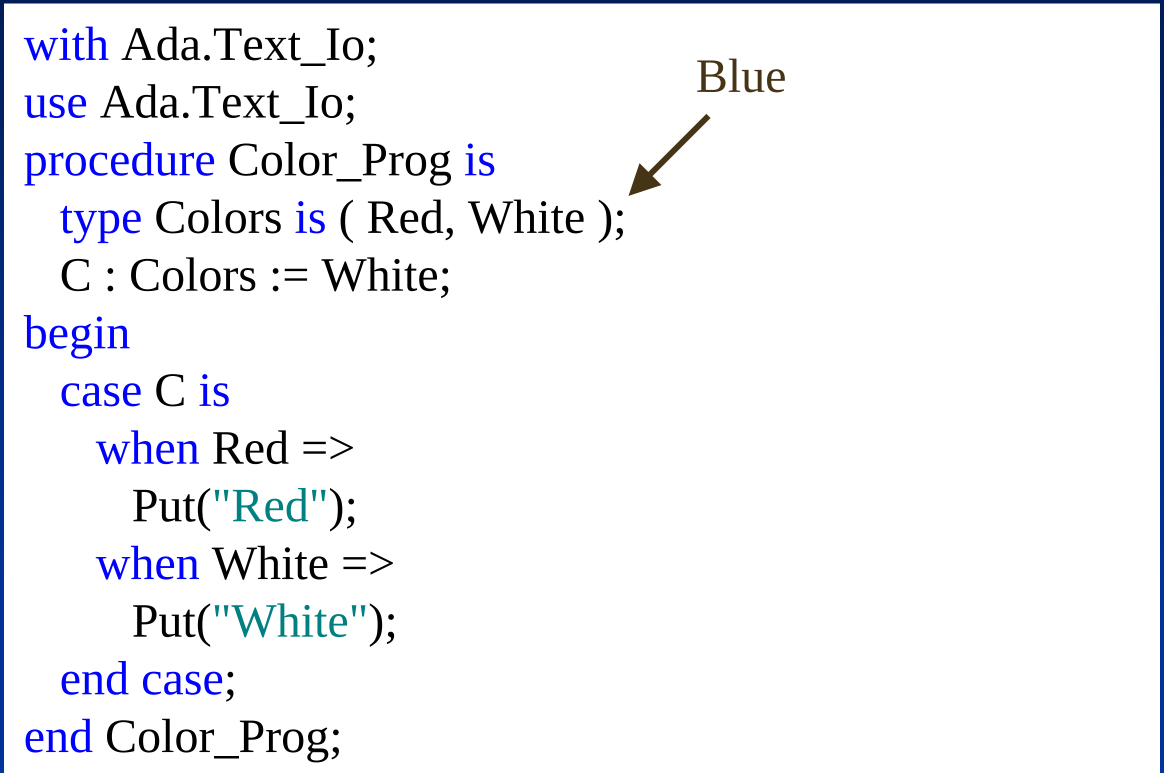
Compiler Features

- Compile time error messages
  - Useful and accurate
  - Steer students in right direction
  - More helpful than run time errors
- Strong typing and good compiler error messages help our students succeed

Compiler Features



```
with Ada.Text_Io;
use Ada.Text_Io;
procedure Color_Prog is
   type Colors is ( Red, White );
   C : Colors := White;
begin
   case C is
      when Red =>
         Put("Red");
      when White =>
         Put("White");
   end case;
end Color_Prog;
```

- Compiler error message if “Blue” added

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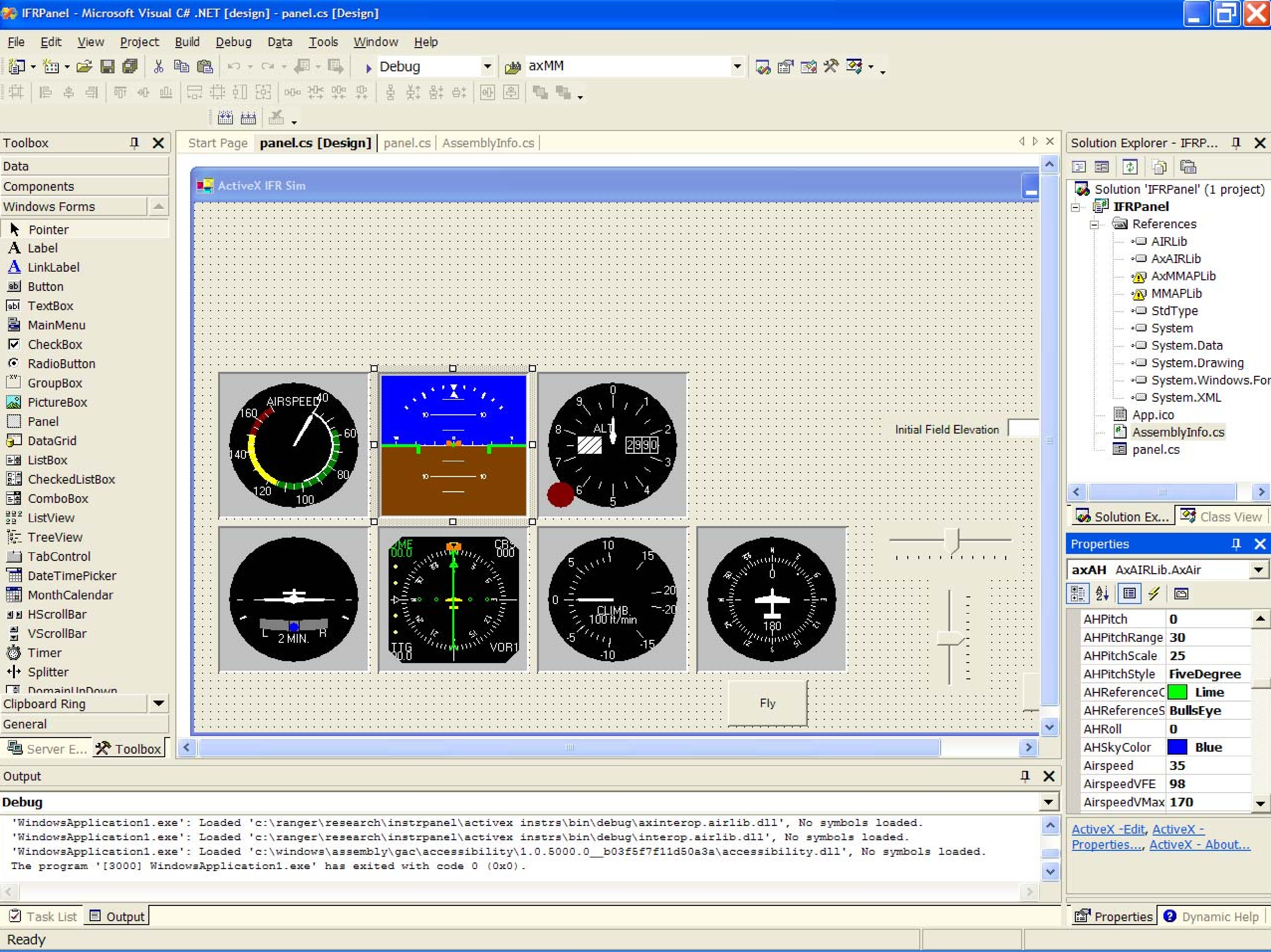
Development Experience

- Industry acceptance
  - Our majors will lead, not program
  - Can focus on education, not training of programmers
- Support for both Imperative and Object-Oriented
  - Decided against Java because OO must be first
  - Possible in C#, so we considered in more detail
- Textbook support
  - Currently no CS-2 textbooks available for C#
  - Major drawback of using C# as primary language

Development Experience

- Development environment considerations
- Visual Studio .NET for C#
  - Very powerful and complicated tool
  - Touch and feel including “intelli-sense”
  - Easy, rapid development of code
  - Graphical User Interface (GUI) builder outstanding



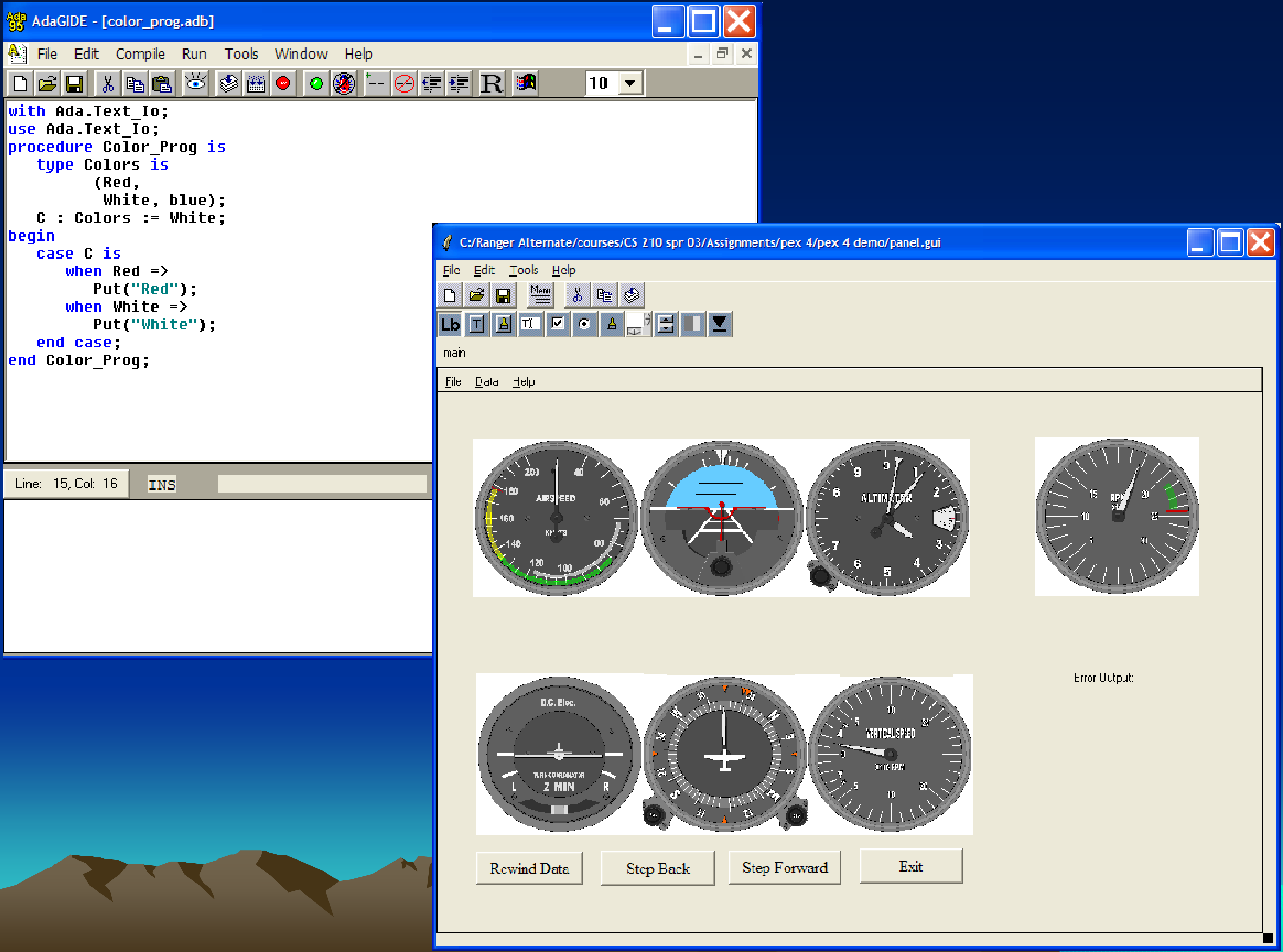
axAH AxAIRLib.AxAir

AHPitch	0
AHPitchRange	30
AHPitchScale	25
AHPitchStyle	FiveDegree
AHReferenceC	🟩 Lime
AHReferenceS	BullsEye
AHRoll	0
AHSkyColor	🟦 Blue
Airspeed	35
AirspeedVFE	98
AirspeedVMax	170

```
'WindowsApplication1.exe': Loaded 'c:\ranger\research\instrpanel\activex instrs\bin\debug\axinterop.airlib.dll', No symbols loaded.
'WindowsApplication1.exe': Loaded 'c:\ranger\research\instrpanel\activex instrs\bin\debug\interop.airlib.dll', No symbols loaded.
'WindowsApplication1.exe': Loaded 'c:\windows\assembly\gac\accessibility\1.0.5000.0__b03f5f7f11d50a3a\accessibility.dll', No symbols loaded.
The program '[3000] WindowsApplication1.exe' has exited with code 0 (0x0).
```

Development Experience

- AdaGIDE for Ada 95
  - Excellent tool easily understood by novice programmer
  - Powerful enough for senior level capstone design courses
  - We control the look and feel of the environment
  - GUI support from Rapid is not as good as Visual Studios



```
with Ada.Text_Io;
use Ada.Text_Io;
procedure Color_Prog is
   type Colors is
         (Red,
          White, blue);
   C : Colors := White;
begin
   case C is
      when Red =>
         Put("Red");
      when White =>
         Put("White");
   end case;
end Color_Prog;
```

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Conclusions

- We will continue to use Ada
- Objections to Ada not technical
  - Appear to be sociological
  - Due to lack of widespread acceptance
- We are educating leaders, not programmers
- Languages are adopting desirable Ada features
  - Strong typing, generics, software engineering support
- We will continue to examine our choice