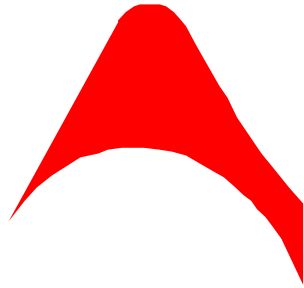


DDC-I's SCORE Technology -including Integration with OSE RTOS



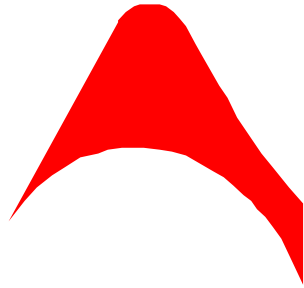
Reliable Experienced Proven



Presentation outline

- About DDC-I
- SCORE Technology Introduction
 - Current target focus:
 - PowerPC & Intel x86
 - Multi-language
 - C/C++ & Certified Ada95 support
 - ANDF as facilitator
 - JTAG
 - OSE RTOS Integration
 - SCORECast

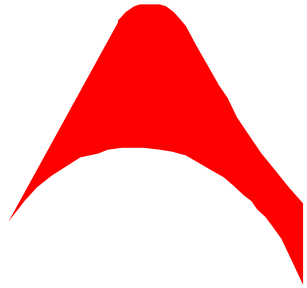




Dedicated to Developers of Safety-Critical Real-Time Embedded Applications

- Founded in 1985. Technology centers in Phoenix, Arizona and Copenhagen, DK
- DDC-I provides:
 - High-end Integrated Development Environments (IDEs)
 - Ada95/C/C++ Multi-Language IDE "SCORE"
 - Ada83 IDEs "DACS" & "TADS"
 - JOVIAL compiler systems
 - Extensive FAA certification experience
 - RTCA/DO-178B level C and A
 - #1 in Customer Care
 - Flexible support and training programs
 - Engineering Services
 - Ada/C/C++ Programming, Ada/C/JOVIAL porting and certification
- Our objective is to reduce your risk and costs – in short helping to ensure the success of your projects.

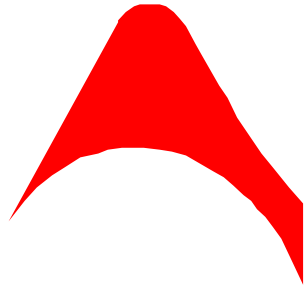




Successes – RAH-66 Comanche

- DDC-I's Ada IDE's were selected by the Boeing led Comanche Helicopter team:
 - Transition of the Mission Equipment Package software from i960 to Pentium
 - Extensive customizations to the Ada IDE "DACS" to support multiple boards, processors and applications on shared bus
 - Multiple debug sessions:
 - Multiple applications per processor
 - Multiple processors per board
 - Multiple boards on a bus
 - Shared run-time system
 - Deterministic task scheduling
 - Paged Virtual Memory





Successes – Boeing 777

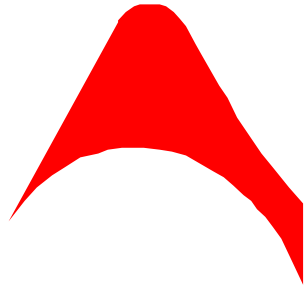
- DDC-I Ada IDE's were selected by many of the Boeing 777 subcontractors:
 - Honeywell
 - Airplane Information Management System (AIMS) - AMD 29000
 - GEC Avionics
 - Primary Flight Computer – Intel 80486
 - AlliedSignal
 - Sensor Controls – Intel 80186
 - Anti Vibration Controls – 1750A
 - Rockwell
 - Auto Pilot – Intel 80386



Successes – Working Closely with Customers

- Lockheed Martin
 - Many system elements in A-10, F-14, F-16, F-22 a.o. Fighters.
- Northrop Grumman
 - LONGBOW Airborne Radar
- Alenia
 - Air Traffic Control system
- Rockwell International
 - Avionics Equipment & FAA certification
- Confidential Command & Control Information System
- Terma
 - "Oersted" Micro Satellite



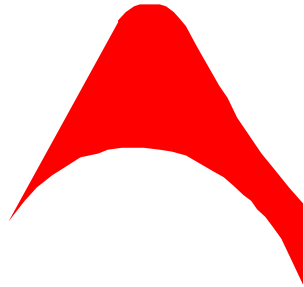


SCORE and Ada Legacy Products

-Tools for each phase of your project

Requirements Analysis and Design	Code Development and Debugging	Code Testing and Certification	Run-Time Support
<ul style="list-style-type: none">▶ Real-Time UML▶ VDMTools -Validated Design through Modeling	<ul style="list-style-type: none">▶ SCORE multi-language system (Ada 95, C/C++)▶ Ada 83 compiler systems▶ JOVIAL compiler systems	<ul style="list-style-type: none">▶ SCORECAST (Ada 95,C)▶ AdaCAST (Ada 83)	<ul style="list-style-type: none">▶ Bare board run-time systems▶ OSE Real-Time operating system▶ LynxOS

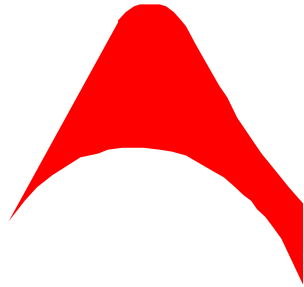




Analysis and Design Phase - Real-time UML from ARTiSAN

- Debug UML class models
- UML- based requirements models
- UML-based solution design
- State machine generation
- State machine simulation and animation
- Generate C, C++ and Ada source code
- Reverse engineer C and C++ into UML



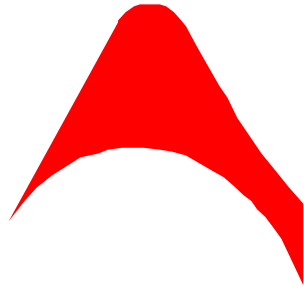


SCORE Ada, C/C++ Multi-Language Integrated Development Environment

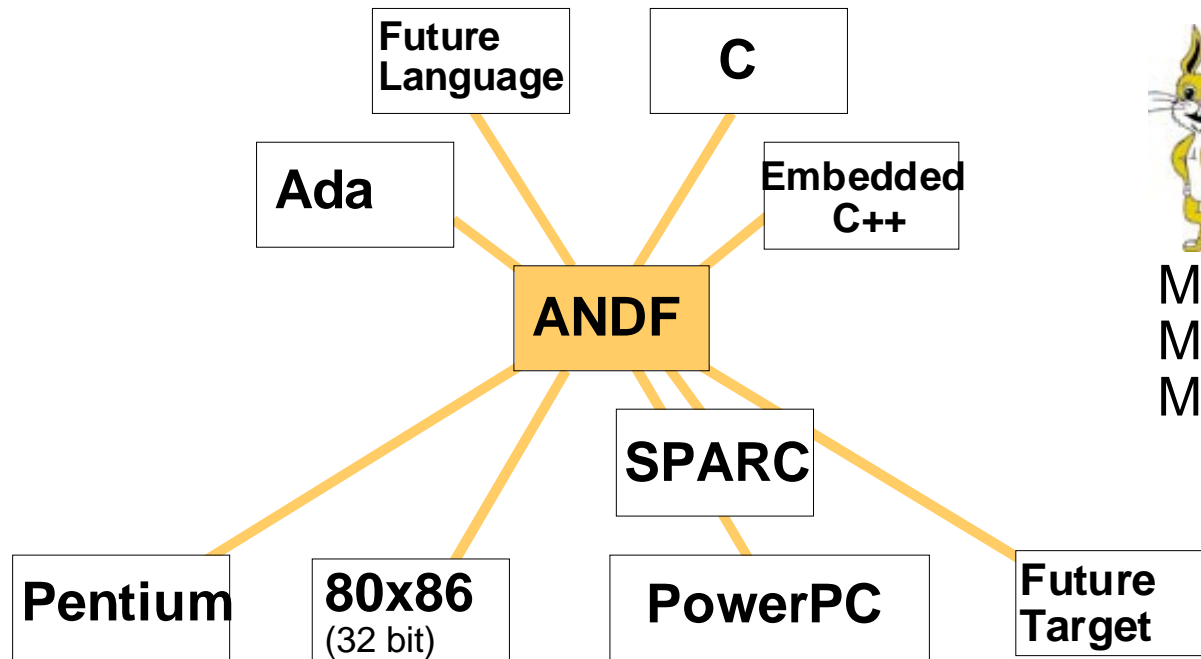
	Sun SPARC/Solaris Host	Windows NT Host
TARGET	Native	Native (summer 2002)
	Power PC 603e, 750	Power PC 603e, 750
	PSIM (Power PC Simulator)	PSIM (Power PC Simulator)
	80386, 80486, Pentium	80386, 80486, Pentium



Safety Critical Object-oriented Real-time Embedded

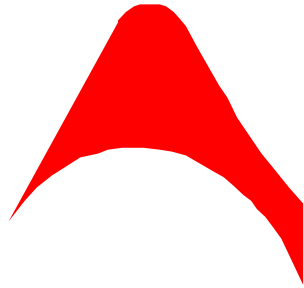


SCORE Compilation System -Architecture



Multi-Language
Multi-Host
Multi-Target

- ▶ Guaranteed real-time performance
- ▶ Proven long-term strategic advantages
- ▶ Reduced life-cycle costs
- ▶ Hosted on Sun SPARC/Solaris & PC Windows NT

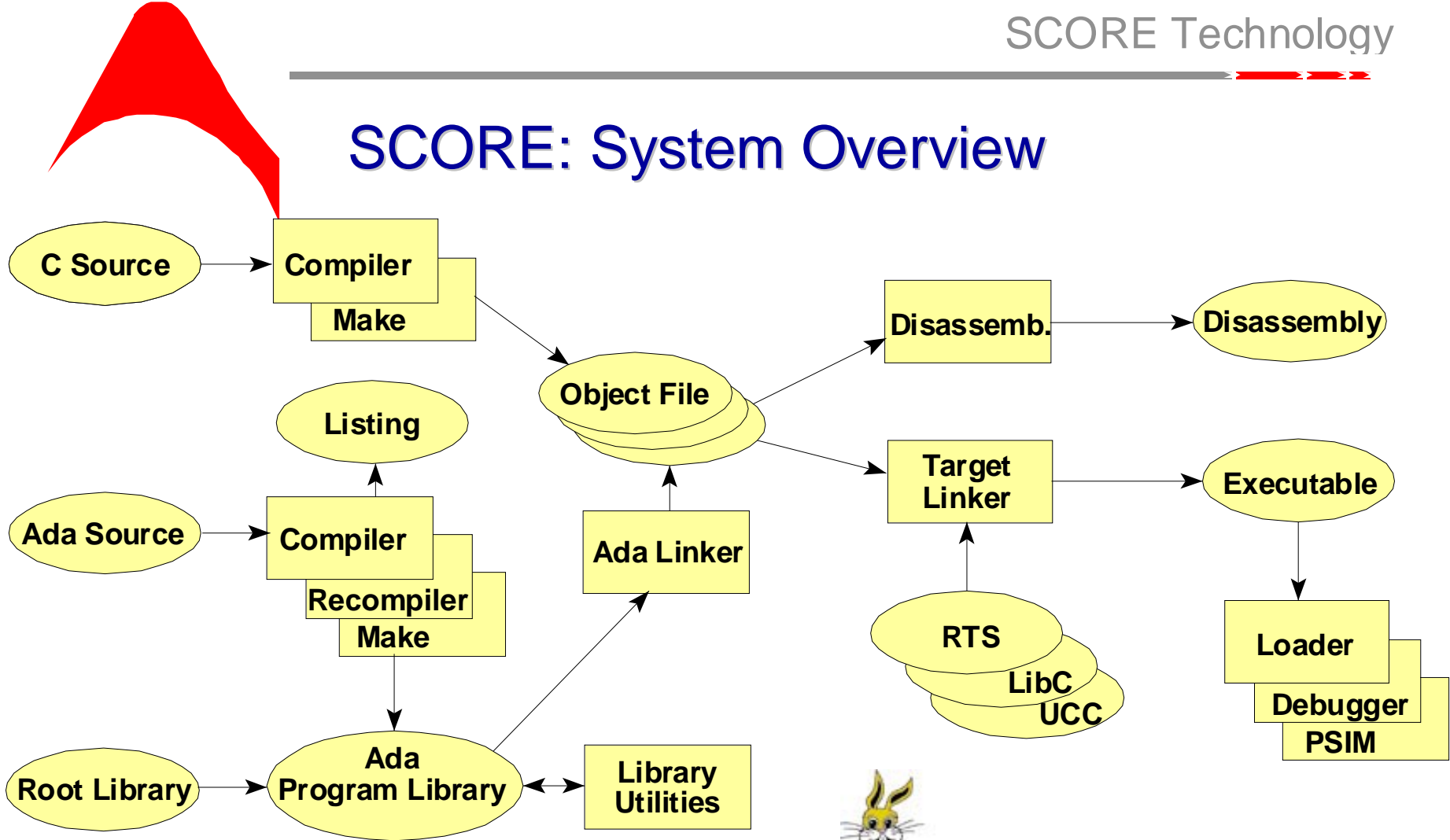


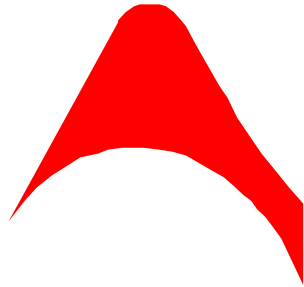
SCORE: Key Features

- Scalable Run-Time System
- Stand-Alone Run-Time System
- ELF Code Format
- DWARF Debug Format
- ROM'able
- No Implicit Heap
- Contiguous Data Layout
- Fully Configurable
- Extensive Ada Library support
- Designed for Embedded Applications



SCORE: System Overview





SCORE GUI

The screenshot displays the SCORE GUI in User Mode. The main window, titled "SCORE DEMO - demo (User Mode)", contains several overlapping windows:

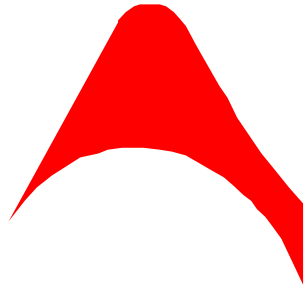
- value.c**: Shows the preprocessor directive `#include <stdio.h>`.
- value_h.ada**: Shows the start of a package body: `package body Value is`.
- demo.ada**: Contains the main program logic:

```
with Value;  
with Operations_Package;  
with Text_IO;  
procedure Demo is  
  Variable_1 : Integer := 12;  
  Variable_2 : Integer;  
  Variable_3 : Integer;  
  Result     : Integer;  
begin  
  Variable_1 := Value.Get_Num( Variable_1 );  
  Variable_2 := Value.Get_Num( Variable_1 );  
  Variable_3 := Value.Get_Num( Variable_2 );
```

A red dot and green arrow indicate a breakpoint is set on the first line of the `begin` block.
- Debugger Output**: A window showing the execution progress:

```
Initializing debugger  
Downloading program /home/sparc6c/qa/score/score_work/demo2/teh/native/demo  
Program Downloaded  
BREAKPOINT BREAK1 successfully created at ../../score_111_14/examples/demo/d  
BREAK1 at File Position ../../score_111_14/examples/demo/demo.ada Line 10
```

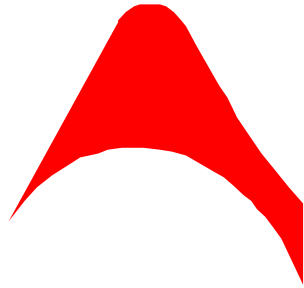
The status bar at the bottom indicates "For Help, press F1", "Ln 5, Col 62", and the time "8/1/00 2:55 PM".



SCORE: Multi-Language Debugger

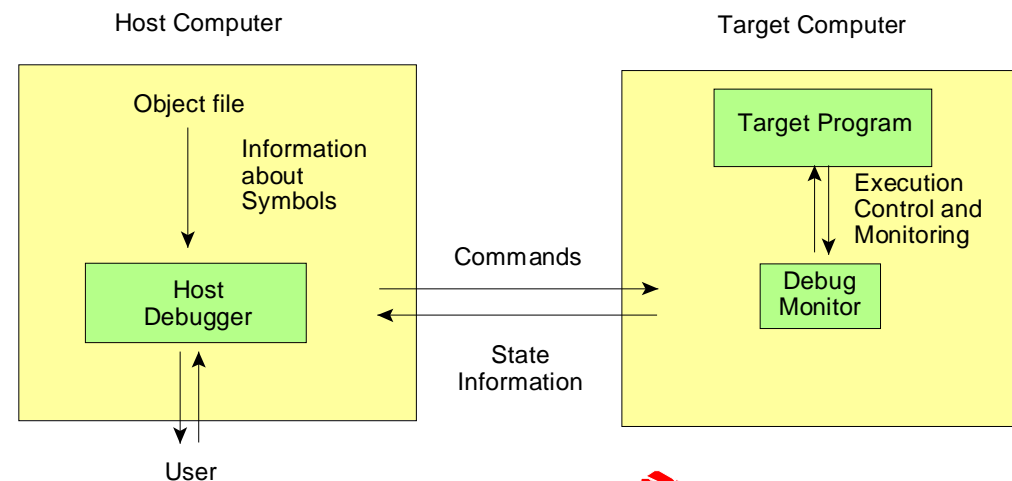
- Advanced GUI and sequential debugger
- Full support for Ada and C symbolic debugging
- Full support for machine level debugging
- Designed for true real-time debugging
- Extensive task debugging facilities
- Powerful command language
- Configurable to your hardware
- Supports debugging of optimized programs





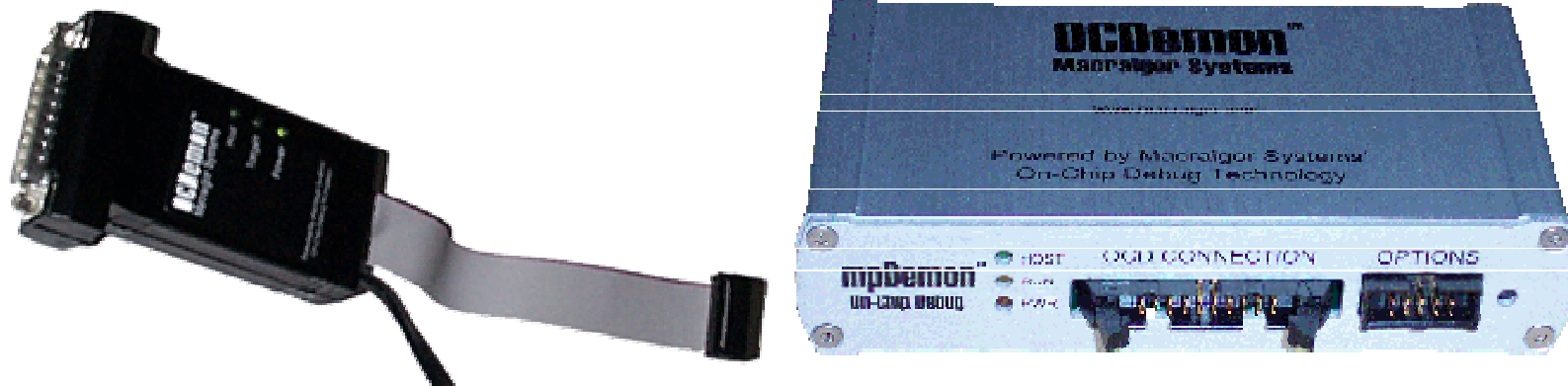
SCORE Multi-Language Debugger

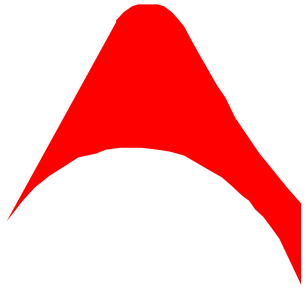
- Dedicated Windows for
 - Source Text
 - Machine Code
 - Debugger Output
 - Debugger Commands (with history)
 - Call Chain
 - Target Program Output
 - Breakpoints (editable)
 - Tracing
 - Help
- Full Symbolic Debugging
 - Setting breakpoints
 - at any statement
 - at Ada tasking events
 - when an Ada exception is raised or handled



SCORE: JTAG Debugging

- JTAG allow for communication directly with target hardware
 - No debug monitor on target required
- SCORE interfaces to Macraigor JTAG devices
 - Wiggler (serial line access)
 - Raven (parallel line access)
 - Ethernet device (Ethernet access)

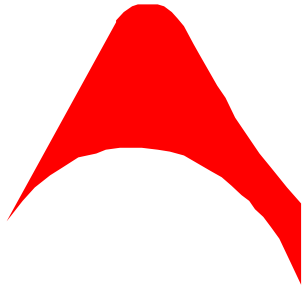




Run Time Support – Bare Board & OSE RTOS Integration

- SCORE is integrated with the commercial RTOS "OSE" from ENEA Group/OSE Systems:
 - Proven in millions of products world-wide
 - Dominant RTOS in telecoms industry; making strong inroads into all other industry segments in recent years
 - Focus for OSE
 - Reliability
 - Scalability
 - Simplicity
 - Used primarily for
 - High-availability Applications
 - Distributed Systems
- DDC-I also offers several bare board run-time system options
 - Allows for compact and minimal overhead bare board solutions

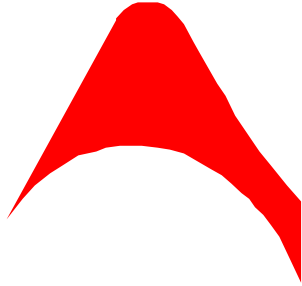




SCORE: OSE RTOS Integration

- OSE Architecture
 - Message based (Direct Message Passing)
 - Multi-level facility for error detection
 - Increase reliability
 - Consistent exception handling facilitated
 - Monitoring of critical processes
 - Allocate memory from memory pool
 - Secure conservation of memory
 - Avoid fragmentation
- SCORE/OSE initial target integration focus
 - PowerPC

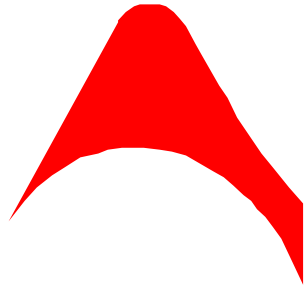




SCORE: OSE RTOS Integration

- OSE RTOS key target and host products:
 - Kernel - the heart of the system
 - BSP - Board Support Package
 - INET - the OSE TCP/IP stack
 - INETUtils - utilities such as ftp, tftp, login etc
 - WebServer - a web-server for embedded use
 - EFS - the OSE embedded file system
 - MMS - Memory management System
 - PRH - Program Handler (Loader)
 - LNH - Link Handler





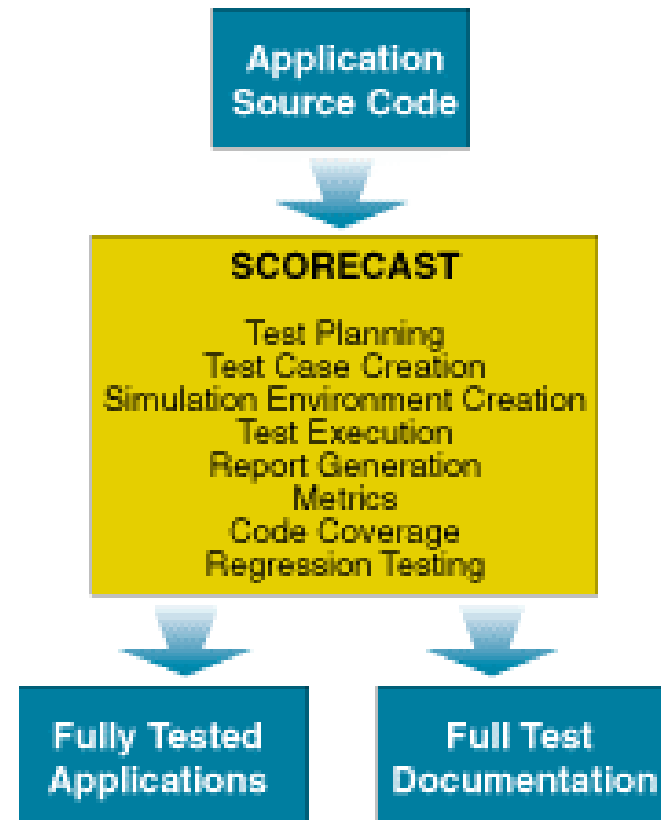
SCORE: OSE RTOS Integration

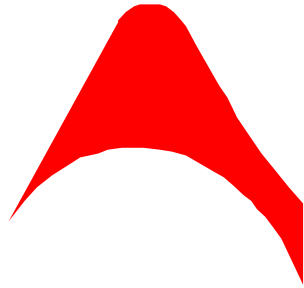
- The OSE kernel is Certified according to
 - IEC 61508
 - Safety integrity level 3
 - Certification done by TÜV in 1996
 - DIN 19250 (level AK 6) + DIN 0801 (level AK 6)
 - Certification done by TÜV in 1997
- The OSE kernel is Certifiable according to
 - DO-178B (levels A-D).



Products – Testing and Certification

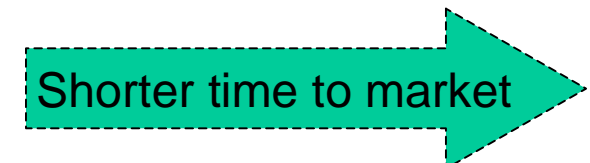
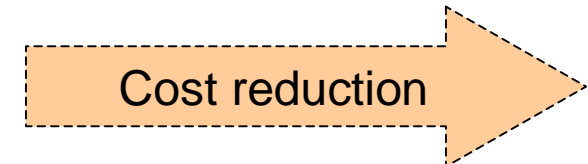
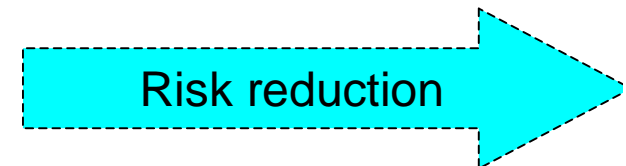
- SCORECast & AdaCast
 - Source code based test system
 - Language, compiler and platform specific
 - Automatic construction of test simulation environments (component level testing)
 - Automatic building of test cases based on max/min/middle values as input parameters
 - MCDC coverage which can be utilized for FAA DO-178B level A testing





SCORE Key Benefits

- Software component reuse
 - Across programming languages
 - Extensive Ada Library facilities speed up development time
- Target processor upgrade
 - Same compilers - no major rewrite of application
- Software testing and certification
 - Extensive cross-language debugging
 - SCORECAST for automatic test case generation

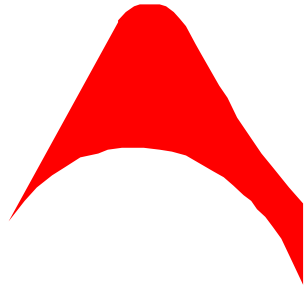




FAA Certification Expertise

- DDC-I has developed DO-178A/B documentation for many different host/target/RTS combinations, including:
 - 1991 DO-178A 80386 non-tasking RTS
 - 1991 DO-178A 80186 non-tasking RTS
 - 1993 DO-178B 80186 non-tasking RTS
 - 1993 DO-178B 80386 non-tasking RTS
 - 1993 DO-178B 80186 tasking RTS
 - 1993 DO-178B 80386 tasking RTS
 - 1993 DO-178B 80486 non-tasking RTS
 - 1993 DO-178B 80486 tasking RTS
 - 1994 DO-178B 29050 non-tasking RTS
 - 1999 DO-178B 80386 non-tasking RTS
- These documentation sets have been developed and maintained over multiple hosts and versions of the 80x86 RTS (v4.5, 4.6 and 4.7).
- These sets have been delivered to multiple customers.





SCORE Technology Summary

- Certified Ada 95 IDE (according to ACATS 2.4F)
 - Validations see:
<http://www.adaic.com/compilers/ada95.html>
- Market Leading Multi-Language facilities
- Market Leading Multi-language debugger incl. JTAG
- Superb Migration tool:
 - Ada83 to Ada95
 - Ada83 to Ada95/C/C++
 - Intel x86 to PowerPC
- Bare Board or OSE RTOS focus for FAA certification needs
- Comprehensive Tool chain via partner integrations incl. ARTiSAN UML and Top Graph'X CORBA.

