TSC695 SPARC V7 Processor
(ERC32) Development Tools
# Tools Overview User Manual

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Section 1
Introduction

This document describes the tools available for software and hardware development around the TSC695 SPARC processor. This document summarizes the major development tools available for the ERC32 processor.

1.1 Disclaimer
The intention of this document is to give an overview of some development tools available around the TSC695 SPARC processor, for information only. There is no intention to be exhaustive. Other tools may exist and may be added in new versions of this document if appropriate. The reader should as well confirm with the tools providers whether the tools listed here are still available on the market, and whether the descriptions given in this document are correct. ATMEL does not guarantee in any case the quality of the tools. ATMEL will not provide any performance comparison, nor any support on these tools.
Introduction

1.2 Overview

This document describes the development tools available for the TSC695 (ERC32) SPARC V7 rad hard 32-bit processor.

Most of the tools needed in a development environment are presented here, including:

- Compilers
- Assemblers
- Linkers
- Debuggers
- Simulators
- Emulators...

![Diagram of development tools](image)
Section 2
Software Development & Testing

2.1 GNAT PRO - ADACORE

2.1.1 Supported Platform
GNAT Pro for ERC32 is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun Solaris</td>
</tr>
<tr>
<td>GNU/Linux</td>
</tr>
</tbody>
</table>

2.1.2 Contact

Company:

AdaCore
8, rue de Milan
75009 Paris
France
Tel: +33 (0)1 49 70 67 16
Fax: +33 (0)1 49 70 05 52

Web Site:
www.adacore.com

GNAT Pro for ERC32
GNAT Pro for ERC32 is a flexible cross-development environment, developed under ESA/ESTEC contract, supporting the Ada 95 Ravenscar tasking model for ERC32 (ATMEL TSC695 processor). It provides a full-featured visual programming environment for developing mission-critical real-time software on Ada, covering the whole development cycle: language-oriented editing, compiling, binding, linking, loading, and graphical tasking-aware debugging.

The toolchain has been tailored and streamlined for taking full advantage of the Ravenscar Profile restrictions. The reduced complexity of the run time, together with its configurability, make it an excellent choice for mission-critical real-time space applications in which certification or small size is needed. Software reliability and predictability is also increased by the exclusion of non-deterministic and non-analysable tasking features.
2.2 RCC - GAISLER RESEARCH

**ERC32 RTEMS Cross Compilation System**

RCC is a GNU-based cross-compilation system for ERC32 based processors. The following components are included:

- GNU C/C++ compiler, linker, assembler, archiver etc.
- Standalone C-library
- RTEMS real-time kernel with network support
- Boot-prom utility (mkprom)
- Remote debugger monitor for gdb
- GNU debugger with Tk front-end
- DDD graphical user interface for gdb

RCC allows cross-compilation of single or multi-threaded C and C++ applications for ERC32. Using the gdb debugger, it is possible to perform source-level symbolic debugging, either on the TSIM simulator or using real target hardware.

2.2.1 Supported Platform

RCC suite is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows/cygwin</td>
</tr>
<tr>
<td>Linux</td>
</tr>
</tbody>
</table>

2.2.2 Contact

- Company:

  **Gaisler Research**

  Första Långgatan 19
  SE-413 27 Göteborg
  Sweden
  Tel: +46 31 7758650
  Fax: +46 31 421407

- Web Site:

  www.gaisler.com
Cantata++ - IPL

Cantata++ has been designed around the requirements of the C/C++ languages to produce a tool which allows developers to efficiently perform unit and integration testing. The product offers high productivity and a unique set of testing, coverage analysis and static analysis features.

Major features:
- Unit and Integration testing: on both host and target platforms
- Integrated Coverage Analysis: statement, decision, MC/DC, entry point and call-return metrics
- Full support for: ANSI C, ISO C++ and EC++
- GUI: Graphical results analysis and wizard-driven test preparation
- Object Oriented: OO-aware testing and coverage analysis
- Wrapping and Stubbing: to simulate and control external interfaces
- Static Analysis: code complexity and size metrics

2.3.1 Supported Platform

Cantata++ is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows (NT, 2000 and XP)</td>
</tr>
<tr>
<td>HP-UX (11.x)</td>
</tr>
<tr>
<td>Linux</td>
</tr>
<tr>
<td>Sun Solaris (2.x)</td>
</tr>
</tbody>
</table>

For a detailed information on the supported platforms, please refer to the following link: http://www.ipl.com/pdf/p0005.pdf

2.3.2 Contact

- Company:
  Software Products Group
  **IPL Information Processing Ltd**
  Eveleigh House
  Grove Street
  Bath
  BA1 5LR
  United Kingdom

- Web Site:
  www.ipl.com
2.4 AdaTest 95 - IPL

AdaTEST 95

AdaTEST 95 has been designed around the requirements of the Ada language to produce a tool which allows developers to efficiently perform unit and integration testing. The product offers high productivity and a unique set of testing, coverage analysis and static analysis features.

Major features:

- Unit and Integration testing: on both host and target platforms
- Integrated Coverage Analysis: statement, decision, MC/DC, entry point and call-return metrics
- Full support for: Ada 95, Ada 83 and several Ada subsets
- GUI: Graphical wizard-driven test preparation
- Object Oriented: OO-aware testing
- Stubbing: to simulate and control external interfaces
- Static Analysis: code complexity and size metrics

2.4.1 Supported Platform

AdaTEST 95 is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows (95, 98, NT, 2000 and XP)</td>
</tr>
<tr>
<td>Linux</td>
</tr>
<tr>
<td>Sun Solaris (2.x)</td>
</tr>
</tbody>
</table>

For a detailed information on the supported platforms, please refer to the following link:
http://www.ipl.com/pdf/p0009.pdf

2.4.2 Contact

- Company:
  Software Products Group
  IPL Information Processing Ltd
  Eveleigh House
  Grove Street
  Bath
  BA1 5LR
  United Kingdom

- Web Site:
  www.ipl.com
2.5 ERC32-ADA - XGC

ERC32-ADA

ERC32 Ada is a production quality compilation system for the Atmel TSC695F and earlier versions of the ERC32. It supports both mission-critical Ada 95 and ANSI C on a bare target computer with a small footprint and fast deterministic execution times.

With a minimum program size of 5K bytes and tasking support in another 5K bytes, ERC32 supports significant applications in memory as low as 32K bytes.

By default, ERC32 Ada supports the XGC Profile. This excludes Ada language features that are not permitted in mission-critical applications. ERC32 Ada also supports the Ravenscar Profile, which includes further restrictions for hard real-time applications.

ERC32 Ada is integrated with IPL's AdaTest, and includes an instruction set simulator that offers a number of execution reports on the timing of subprograms and the coverage of test programs.

2.5.1 Supported Platform

ERC32 Ada suite is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun Solaris 2.6</td>
</tr>
<tr>
<td>GNU/Linux</td>
</tr>
</tbody>
</table>

2.5.2 Contact

- Company:
  
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  +44 1483 234821 (from elsewhere)

- Web Site:
  
  www.xgc.com
2.6 GCC ERC32 - XGC/SPACEBEL

Fresco project - GCC ERC32

With funding from ESA, under ESTEC contracts 11935 and 13174, the FRee Software for ERC32 Systems COoperation (FRESCO) project developed a production-quality C and C++ compilation system for the ERC32. The participating organizations were Spacebel in Belgium and XGC Software in the UK.

This product is open source software and available in source and executable format from the ESTEC web site. It includes a C compiler, C++ compiler, assembler, linker, object code utilities supporting COFF and ELF formats, a debugger, and target monitor, libraries libc, libm, and POSIX threads.

Fresco supports both the ERC32 chipset and the single chip TSC695.

2.6.1 Supported Platform

Fresco suite is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows NT/2K</td>
</tr>
<tr>
<td>Sun Solaris 2.6</td>
</tr>
<tr>
<td>IBM PC GNU/Linux</td>
</tr>
</tbody>
</table>

2.6.2 Contact

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    - 011 44 1483 234821 (from the USA)
    - +44 1483 234821 (from elsewhere)
  - **Spacebel S.A.**
    - Liege Science Park
    - B-4031 ANGLEUR
    - Belgium
    - Tel: +32 4 361 81 11
    - Fax:+32 4 361 81 20

- **Web Site**:
  - www.xgc.com
  - www.spacebel.be
2.7 ADA World C77 - AONIX

Ada World C77

Aonix AdaWorld for SUN Solaris to ERC32 targets (also known as C77 product) is a robust and time-tested engineering tools environment and runtime system for developing hard real-time applications for embedded systems.

The AdaWorld C77 development environment includes an optimizing compiler, ethernet host-target connectivity, library managers, runtime, various third party tools integrations including SpaceBel's Target Simulator and Emulator and productivity toolsets that include Editor, Cross Referencer, Make utility, Source Reformatter & Debugger, and FRESCO libraries. The product highlights are:

- Ada 83 validated
- Multi-tasking runtime
- Board Support Package included
- ROM-able runtime code
- User-definable memory locations
- Low-level interfaces for user accesses
- Ethernet TCP/IP and UDP/IP connectivity
- Exceptions support
- Peripheral tools and integrations
  - Tektronix™ Logic Analyzer interface
  - DWARF information generation
  - RMA oriented scheduling events analyzer

3 run-time types are available:

- ARTK the full Ada runtime system including ATAC (Ada Tasking Accelerator Circuit) and HRTS/WCET
- C-SMART and optionally the associated certification materials
- T-SMART and optionally the associated certification materials

C-SMART and T-SMART satisfy the highest levels of criticality, up to Level A as defined in the DO-178B software safety guidelines required by the FAA for airborne systems.

2.7.1 Supported Platform

Ada World C77 suite is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun Solaris</td>
</tr>
</tbody>
</table>

Ada World can be easily ported on Linux upon request.

2.7.2 Contact

- Company:

  Aonix
  Batiment B
  66/68, Avenue Pierre Brossolette
2.8 RAVEN - AONIX

RAVEN

ObjectAda Real-Time RAVEN implements a small and very fast Ada 95 "bare-target" runtime system that is perfectly suited for hard real-time and safety-critical applications. It also provides the reliable, feature-rich toolset most critical system developers need to help them build an efficient, provable, verifiable and/or certifiable, deterministic real-time application:

- Full IDE
- CDE support on UNIX platforms
- Efficient cross compiler
- High quality code generator
- Source-level target debugger
- Ethernet and serial download/debug facilities
- AdaAssured source code standardization and pretty-printing toolset
- AdaCover coverage analysis tool for certification score

From the start, the design and implementation of RAVEN is focused on deterministic behavior, which is a key requirement for safety-critical systems. As a result, RAVEN satisfies the highest levels of criticality, even Level A as defined in the DO-178B software safety guidelines required by the FAA for airborne systems.

Whatever are your real-time needs, Aonix is there to help. We have the experience, tools and runtime environment for Ada 95 that is second to none in the industry. RAVEN has all the advantages of small size, fast speed, hard real-time response, safety-critical and high-reliability characteristics.

2.8.1 Supported Platform

RAVEN suite is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun Solaris</td>
</tr>
</tbody>
</table>

RAVEN can be easily ported on Linux upon request.

2.8.2 Contact

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www.aonix.com
2.9 VectorCast - AONIX

VectorCAST

The VectorCAST products scan your Ada, C/C++ and Embedded C++ (EC++) source code and automatically generate the test code necessary to construct executable test harnesses for both host and embedded environments. With the VectorCAST test system your component simulation model is always up-to-date. It only takes minutes to construct the test environments that are required to isolate individual software components. Utilities are also provided to construct and execute test cases and generate the reports necessary to provide an audit trail of expected and actual results.

- Automatically generates and compiles test stubs and driver programs
- Integrated with most major compilers, target boards, and RTOS’s
- Automatically generates min-mid-max test cases
- Allows custom test case generation using a graphical point-and-click interface or an intuitive scripting interface
- Allows for completely automatic regression testing
- Provides graphical statement, branch and MC/DC code coverage
- Allows test execution on host, simulator and embedded target systems
- Support for Ada and C/C++
- Testing for DO-178B

2.9.1 Supported Platform

VectorCast suite is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun Solaris</td>
</tr>
</tbody>
</table>

VectorCast can be easily ported on Linux upon request.

2.9.2 Contact

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  France

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- Web Site:

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  www.aonix.com
Section 3
Simulators

3.1 TSIM - GAISLER RESEARCH

TSIM - ERC32/LEON simulator

TSIM is an instruction-level simulator capable of emulating ERC32- and LEON-based computer systems.

TSIM provides several unique features:

- Accurate and cycle-true emulation of ERC32 and LEON processors
- Accelerated processor standby mode, allowing faster-than-realtime simulation speeds
- Standalone operation and remote connection to GNU debugger (gdb)
- 64-bit time for unlimited simulation periods
- Loadable modules to include user-defined I/O device
- Instruction trace buffer
- Stack backtrace with symbolic information
- Non-intrusive execution time profiling
- Unlimited number of breakpoints and watchpoints
- Check-pointing capability to save and restore complete simulator state
- Code coverage monitoring capability

3.1.1 Supported Platform

TSIM simulator is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux</td>
</tr>
<tr>
<td>Solaris</td>
</tr>
<tr>
<td>Windows/Cygwin</td>
</tr>
<tr>
<td>Native Windows</td>
</tr>
<tr>
<td>MacOs·X</td>
</tr>
</tbody>
</table>
For detailed information on the supported platforms, please refer to the TSIM page at www.gaisler.com.

3.1.2  Contact

- Company:
  
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  Fax: +46 31 421407

- Web Site:

  www.gaisler.com
3.2 ERC32 Target Simulator - SPACEBEL

ERC32 Target Simulator

The Target Simulator is a tool that allows to simulate a computer built around the ERC32 (chipset and single chip versions) cores.

The Target Simulator proves its value throughout the whole development cycle. It offers valuable features for debugging software or for qualifying critical systems. It is distributed as a stand alone product or as a library that can be at the core of Software Validation Facilities or integrated into Operational Simulators.

Besides the IU, FPU, MEC, it simulates input/output UART activity, watchdog, timers, interrupts, cache and DMA transfers with a one clock cycle resolution. It provides high accuracy and is fully user re-configurable in terms of clock speeds and memory banks, sizes and access speeds.

The power of the tool stems from its flexibility and its expandability. All its interfaces are Tcl based and can be redirected to communicate with scripts and external processes. It can integrate loadable ASIC Simulators to simulate comprehensive on board computer or, by connecting several Target Simulators over Medium Simulators, to simulate multi-computer systems.

Its generic marker detection system, that can activate breaks, traces and traps for the OS emulation and I/O simulation subsystems, provides the tool more versatility than modern In-Circuit Emulators, while being completely non-intrusive. Debugging features include memory testing as well as a trace history mechanism that buffers the local bus accesses and a coverage feature that provides information on executed code or allows read before write detection. It provides a very good register visibility and allows to single step interrupt routines as well as to generate interrupts and inject errors. The full hardware and software context can be saved and restored, which allows bypassing long preparation phases and automating complex test sequences.

The Target Simulator can interface in a non-intrusive way with its integrated debugger, or with other debuggers and test systems, such as the Aonix ADA cross compiler debugger, the GNU debugger and the SVF from ESA.

3.2.1 Supported Platform

The ERC32 target simulator is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC Intel Pentium - Linux</td>
</tr>
<tr>
<td>Sun - Solaris 2.6 and above</td>
</tr>
</tbody>
</table>

3.2.2 Contact

- Company:

  **Spacebel S.A.**

  Liege Science Park

  B-4031 ANGLEUR

  Tel: +32 4 361 81 11

  Fax:+32 4 361 81 20

- Web Site:

  www.spacebel.be
VxWorks

VxWorks is the industry leading device software operating system deployed in over 30 million devices. With a focus on performance, scalability, and footprint, VxWorks enables you to run device software faster, better, and more reliably.

VxWorks provides an extremely reliable runtime platform for device application development. It is the foundation for our WindRiver Platforms.

VxWorks provides you with:

- Most reliable RTOS with the smallest footprint
- Proven and reliable technology
- Scalability
- Wide range of developers exposed to the VxWorks environment
- Board architecture support

4.1.1 Supported Platform

VxWorks suite is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun Solaris 2.7, 2.8, 2.9</td>
</tr>
<tr>
<td>Windows NT/2k/XP</td>
</tr>
</tbody>
</table>

4.1.2 Contact

Company:

Wind River S.A.R.L.
3 Avenue du Canada
Parc Technopolis - Bat Omega
Z.A. de Courtaboeuf 2
91975 Courtaboeuf Cedex
France
Tel: +33 1 64 86 66 00
Fax: +33 1 64 86 66 66
Web Site:
www.windriver.com
4.2 RTEMS - GAISSLER RESEARCH

RTEMS

RTEMS is the Real-Time Operating System for Multiprocessor Systems. It is a full featured RTOS that supports a variety of open API and interface standards.

RTEMS development aims to provide a free deterministic real-time operating system targeted towards deeply embedded systems which is competitive with closed source products. The RTEMS project encourages the support and use of standard APIs in order to promote application portability and ease porting other packages to the RTEMS environment.

The RTEMS development effort uses an open development environment in which all users collaborate to improve RTEMS. The RTEMS cross development toolset is based upon the free GNU tools and the open source C Library newlib. RTEMS supports many host platforms and target architectures.

4.2.1 Supported Platform

RTEMS suite is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNU/Linux</td>
</tr>
<tr>
<td>Cygwin</td>
</tr>
<tr>
<td>Solaris</td>
</tr>
</tbody>
</table>

4.2.2 Contact

Company:

Gaisler Research

Första Långgatan 19
SE-413 27 Göteborg
Sweden
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Fax: +46 31 421407

Web Site:

www.gaisler.com
5.1 ERC32 Target Emulator - SPACEBEL

ERC32 JTAG Target Emulator

The ERC32 JTAG Target Emulator offers similar functionality as the ERC32 Target Simulator used in stand alone. It presents the same user interface. Its major difference is that the code executes on an actual ERC32SC (Atmel TSC695) chip.

Its perfect representativeness makes it especially well suited to the development of the software/hardware interfaces. It allows extremely fine debugging of the lowest software layers.

The Target Emulator replaces the simulator of the Target Simulator by a JTAG serial connection into the on-chip debugger of any ERC32SC (Atmel TSC695) based multi-chip module and computer.

The ERC32SC on-chip debugger functions completely independent from the processor and is completely non-intrusive. When there is something to be done, the whole ERC32 architecture including its clock is frozen, giving visibility on all chip internals. The full software context can be saved and restored. Single and double EDAC errors and bus errors can be injected.

Today, the ERC32 Target Emulator is used worldwide.

The ERC32 Target Emulator is running on Sun/Solaris 2.7 and above having a PCI slot available. It is distributed as a stand alone product that can be remotely accessed through X-Windows.

5.1.1 Supported Platform

The ERC32 target emulator is developed to fit multi-platform requirements. The following platforms are supported:

<table>
<thead>
<tr>
<th>Host Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun with PCI slot - Solaris 2.7 and above</td>
</tr>
</tbody>
</table>

5.1.2 Contact

Company :

Spacebel S.A.
5.2 TSC695 Evaluation Board
- ATME

The eVAB-695 is a board used to evaluate and demonstrate the TSC695 32-bit RISC embedded processor implementing the SPARC architecture V7 specification.

The TSC695 includes on chip an Integer Unit (IU), a Floating Point Unit (FPU), a Memory Controller and a DMA Arbiter. For Real Time applications, the TSC695 offers a high security Watch Dog, two Timer's, an Interrupt Controller, Parallel and Serial interfaces. Fault tolerance is supported using specific parity on internal/external buses and an EDAC on the external data bus. The design is highly testable with the support of an On-Chip Debugger (OCD), an internal and boundary scan through JTAG interface.

This board is based on the TSC695, a ROM space, a SRAM space, a DPRAM space and a FPGA50k witch integrates some functions for DMA accesses, logic glue, custom peripherals, ...

Several extension connectors and a large range of memory mapping produces an high flexibility to the evaluation or the demonstration. A free user connection linked to the FPGA50k is also proposed to customize the application interfaces.

5.2.1 Supported Platform

The TSC695 evaluation board is provided with a monitor (RDBmon). This monitor intends to interface the evaluation board with the GNU debugger GDB. The following platforms are supported for GDB:

<table>
<thead>
<tr>
<th>Host Platform</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GNU/Linux</td>
<td></td>
</tr>
<tr>
<td>Solaris</td>
<td></td>
</tr>
</tbody>
</table>

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Section 6

Links

TOS-EME - Software Engineering and Standardisation Section

- http://www.estec.esa.nl/wmwww/EME/