

**EUROPEAN SPACE AGENCY
CONTRACT REPORT**

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SUMMARY REPORT

**Technical Support and maintenance of ESA
microprocessors**

Call-off Order 1

**CONTRACT :Design and Verification of Validation
Techniques for On-Board Microprocessors,
18533/04/NL/JD,**

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ESA Technical Officer: André Pouponnot



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1 INTRODUCTION

This document summarizes the work performed under the contact: Design and Verification of Validation Techniques for On-Board Microprocessors, 18533/04/NL/JD, Call-off order 1. The objective of the work was to provide support for ERC32 and LEON2 to the European Space Agency and its contractors.

2 OVERVIEW

The processors of the ERC32 processor family are in use in numerous ESA space projects and consequently require a continued technical support. The LEON2-FT processor is under development as a product and will be commercialised by ATMEL. The LEON2-FT core is also used by European space companies to design new onboard integrated systems in the frame of ESA contracts. LEON2-FT is a new design and the new on-board integrated systems that are presently designed around it require some tuning and some improvements to the original design. Those new versions need also to be validated and need to be maintained under configuration control.

The purpose of the call-off order 1 was to provide technical support for the ERC32 and the LEON2 processor, help to identify the causes of eventual problems, and to implement necessary improvements and to validate them. In addition support has also been provided for the RTEMS operating system. Repositories for LEON2-FT and RTEMS has been implemented and maintained giving proper configuration control

The work was performed during the period from November 2004 to May 2006. The work was divided in two work packages.

2.1 Work package 1, Facilities and repository set up

The task of work package 1 was to set up the facilities and tools to implement support and bug fix data base as well as repository. The repository is based on the SubVersion software. SubVersion allows the tracking of all modifications made, and includes information on who performed the modification, the modification date, and modification comments. It is possible to check-out any revision from the repository, and also to perform diffs (compare) of different versions. SubVersion is supported on all major platforms, including Linux, Solaris and Windows. SubVersion has been installed on the main server at Gaisler Research and all engineers working with LEON have access to the repository. The insertion of LEON2-FT and RTEMS into the repository was a part of work package 1. As the size of RTEMS is quite large scripts has been generated to handle only the SPARC specific part in the repository.

2.2 Work package 2, Technical Support

The main tasks of work package 2 were:

- To provide functional technical support to the Agency and its Contractors for the ERC32 processor family and the LEON2-FT processor
- To provide the technical support to the Agency and its Contractors for the identification and the fixes of bugs in the LEON2-FT processor
- To make the necessary modifications/improvements to the VHDL model of LEON2-FT IP (Intellectual Property) core as required by the Agency and its Contractors

- To make the necessary updates of the relevant LEON2-FT documentation as required by the fixes and the modifications/improvements to the LEON2-FT processor
- To maintain the repository for the various versions of the model of the LEON2-FT
- To maintain and update the RTEMS kernel for the ERC32 processor and the LEON2-FT and validate the new versions
- To control and monitor the technical support described above

3 WORK PERFORMED UNDER CALL-OFF ORDER 1

The following main items has been performed under the call-off order 1:

- Set up and delivery of repository for LEON2-FT and RTEMS
- Support to the Agency and the following companies:
 - ATMEL
 - Astrium
 - Laben
 - Spacebel
 - Verhaert
 - Alcatel Alenia
- RTEMS-4.6.5 release with improved ERC32/LEON2 bsp
- LEON2FT, Meiko FP exception bug fix
- LEON2-FT, Memory controller bug fix (SDRAM CS generation)
- Updated LEON2FT test bench to compile with gcc-3.4.4
- LEON2-FT 1.0.15-2 release
- Update of the LEON2-FT documentation
- Development of BSP for VxWorks 5.4
- RTEMS-4.6.6 release submitted also to Online Application Sevices (OAR) and included in the official RTEMS 4.6 distribution.
- Procurement of Xilinx Virtex4 FPGA board for prototyping purposes

4 RECOMMENDED FUTURE IMPROVEMENTS

The current release of the LEON2-FT is version 1.0.15.2. The European Space Agency has together with its contractors identified a limited number of improvements of the LEON2-FT. It is recommended that these improvements are implemented in the next release of the LEON2-FT and that this work is performed under the next call-off order for this contract.

5 DOCUMENTS ISSUED

Title	Reference/Revision	Date
Call-off order 1 Progress report # 1	REP-2005-0202, iss 2	2005-03-17
Call-off order 1 Progress report # 2	REP-2005-0601, iss 1	2005-06-08
Call-off order 1 Progress report # 3	REP-2005-0901, iss 1	2005-09-19
Call-off order 1 Progress report # 4	REP-2005-1201, iss 2	2005-12-16
Call-off order 1 Progress report # 5	REP-2006-0301, iss 2	2005-03-20



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6 SUPPORT HOURS PER MONTH

2004

JULY TO OCTOBER							Time Senior	Time	Time
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. ref	Engineer	Engineer	Total
2004-07-01 to 2004-10-31	ATMEL/ESA	General support attendance in teleconferences	JG	N.Renaud	A. Pouponnot		16		16
2004-07-01 to 2004-10-31	ASTRIUM/ESA	Memory controller bug, investigation and update of design	JG/EC		A. Pouponnot		2	14	16
2004-07-01 to 2004-10-31	ATMEL/ESA	Divider bug, investigation and update of design	JG	N.Renaud	A. Pouponnot		24		24
2004-07-01 to 2004-10-31	ASTRIUM/ESA	FPU/Call bug, investigation and update of design	JG/EC		A. Pouponnot		8	8	16
Total							50	22	72

2004

NOVEMBER							Time Senior	Time	Time
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Engineer	Engineer	Total
2004-11-03	ATMEL/ESA	ESA/LEON2-FT teleconf	JG	N. Renaud	A. Pouponnot		1		1
2004-11-03	ATMEL/ESA	LEON2-FT reset problem: waveform compare & investigation	JG	N. Renaud	A. Pouponnot		4		4
2004-11-04	ATMEL/ESA	ESA/ATMEL teleconf	JG	N. Renaud	A. Pouponnot		1		1
2004-11-05	ATMEL/ESA	Review LEON2-FT SRAM timing diagrams from Atmel	JG	N. Renaud	A. Pouponnot		2		2
2004-11-16	ATMEL/ESA	ESA/ATMEL teleconf	JG	N. Renaud	A. Pouponnot		1		1
2004-11-22	ATMEL/ESA	Review LEON2-FT SRAM/SDRAM timing diagrams from Atmel	JG	N. Renaud	A. Pouponnot		2		2
2004-11-24	ATMEL/ESA	Email support Atmel/Estec (caches and FT behaviour)	JG	N. Renaud	A. Pouponnot		1		1
Total							12	0	12

2004

DECEMBER							Time Senior	Time	Time
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Engineer	Engineer	Total
2004-12-03	ATMEL/ESA	ESA/ATMEL teleconf + timing analysis SRAM/SDRAM	JG	N. Renaud	A. Pouponnot		1		1
2004-12-16	ATMEL/ESA	Review results from LEON2FT design review	JG	N. Renaud	A. Pouponnot		1		1
Total							2	0	2

2005

JANUARY							Time Senior	Time	Time
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Engineer	Engineer	Total
2005-01-25	ATMEL/ESA	Fixed broken RTEMS leon2 interrupt driven uart driver	JG	N. Renaud	A. Pouponnot	E-mail	2		2
2005-01-26	ATMEL/ESA	Atmel support for ERC32 rdbmon	JG	N. Renaud	A. Pouponnot	E-mail	1		1
Total							3	0	3



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2005

February							Time Senior	Time	Time
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Engineer	Engineer	Total
2005-02-02	Laben	Problem investigation ERC32 rdbmon/gdb	JG	G. Aranci	A. Pouponnot	E-Mail	2		2
2005-02-21	Laben	Investigation of LABEN cache problem report	JG	G. Aranci	A. Pouponnot	E-Mail	1		1
2005-02-28	Laben	Investigation of LABEN cache problem report	JG	G. Aranci	A. Pouponnot	E-Mail	2		2
Total							5	0	5

2005

March							Time Senior	Time	Time
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Eng. / Man.	Engineer	Total
2005-03-06	Laben	Investigation of LABEN cache problem report	JG	G. Aranci	A. Pouponnot	E-Mail	5		5
2005-03-07	ATMEL	Email questions	JG	N. Renaud	A. Pouponnot	E-Mail	1		1
2005-03-11	Laben	Investigation of LABEN cache problem report	JG	G. Aranci	A. Pouponnot	E-Mail	2		2
2005-03-12	ESA	Updated LEON2FT documentation + repository	JG	A.Pouponnot	A. Pouponnot	LEON2FT Manual	1		1
2005-03-24	Laben	Laben cache questions	JG	G. Aranci	A. Pouponnot	E-Mail	0,5		0,5
2005-03-01---17	ESA	Preparation and updates of progress report #1	PD	A.Pouponnot	A. Pouponnot	PR #1	2		2
Total							11,5	0	11,5

2005

April							Time Senior	Time	Time
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Engineer	Engineer	Total
2005-04-07	ESA	Update of LEON2-FT manual	JG	-	A. Pouponnot	iss 1.0.14.1	1		1
2005-04-23	ESA	Investigation of ATV reset problem	JG	-	A. Pouponnot	E-mail	2		2
Total							3	0	3

2005

May							Time Senior	Time	Time
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Engineer	Engineer	Total
2005-05-09	ATMEL	ATMEL email questions	JG	N. Renaud	A. Pouponnot	E-Mail	1		1
Total							1	0	1



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2005

June									
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Time Senior Eng. / Man.	Time Engineer	Time Total
2005-06-01	ESA	Preparation of progress report #2	PD	-	A. Pouponnot	Rep-2005-0601	2		2
2005-06-05	ESA	Divider zero flag bug fix	JG	-	A. Pouponnot	Repository ver 28	4		4
2005-06-07	ATMEL	Atmel email questions (DSU)	JG	N. Renaud	A. Pouponnot	E-Mail	0,5		0,5
2005-06-08	ESA	Teleconfi. SEU test plan discussion	JG	-	A. Pouponnot	---	2		2
2005-06-08	ESA	DSU single-step bug fix	JG	-	A. Pouponnot	Repository ver 28	4		4
2005-06-08	ESA	Regfile error injection bug fix	JG	-	A. Pouponnot	Repository ver 28	2		2
2005-06-08	ATMEL	Atmel email support	JG	N. Renaud	A. Pouponnot	E-Mail	2		2
2005-06-20	ATMEL	Atmel email support (DSU simulation)	JG	N. Renaud	A. Pouponnot	E-Mail	1		1
2005-06-20	ESA	Leon2FT: updated test software to compile with newer gcc versions	JG	-	A. Pouponnot	Repository ver 28	2		2
2005-06-20	ESA	Leon2FT: added Virtex2 PLL to simplify FPGA prototyping	JG	-	A. Pouponnot	Repository ver 28	2		2
2005-06-20	ESA	Leon2FT: fixed incorrect generation of HLOCK by ahb arbiter	JG	-	A. Pouponnot	Repository ver 28	2		2
2005-06-21	ESA	Leon2FT: added diagnostic ram block print-out	JG	-	A. Pouponnot	Repository ver 28	2		2
2005-06-28	ATMEL	Atmel DSU email questions	JG	N. Renaud	A. Pouponnot	E-Mail	0,5		0,5
2005-06-30	ESA	LEON2-FT documentation update	JG	-	A. Pouponnot	iss 1.0.15	2		2
Total							28	0	28

2005

July									
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Time Senior Engineer	Time Engineer	Time Total
2005-07-06	ATMEL	Atmel SEU results questions	JG	N. Renaud	A. Pouponnot	E-Mail	1		1
Total							1	0	1

2005

August									
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. ref	Time Senior Engineer	Time Engineer	Time Total
2005-08-04	ATMEL	Atmel trap questions	JG	N.Renaud	A. Pouponnot	E-Mail	1		1
2005-08-19	Spacebel	Proba/Spacebel LEON2 interrupt questions	JG	T Laroche	A. Pouponnot	E-Mail	1		1
2005-08-30	ESA	LEON2FT SEU testing	JG	--	A. Pouponnot	---	16		16
2005-08-30	ESA	LEON2-FT irq2ctrl conflicting drivers	JG	--	A. Pouponnot	Repository ver 30	5		5
Total							23	0	23



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2005

								Time Senior	Time	Time
September								Eng. / Man.	Engineer	Total
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref				
2005-09-07	Atmel	Atmel email questions about EDAC	JG	N. Renaud	A. Pouponnot	E-Mail		1		1
2005-09-20	ESA	Email to ESA regarding Atmel board problems	JG	-	A. Pouponnot	E-Mail		1		1
2005-09-19	ESA	Progress report #3	PD	-	A. Pouponnot	Progress report # 3		1		1
2005-09-29	ESA	RTEMS-4.6.5 release with improved ERC32/LEON2 bsp	JG/KE	-	A. Pouponnot	Repository ver 39		10	30	40
Total								13	30	43

2005

								Time Senior	Time	Time
October								Eng. / Man.	Engineer	Total
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref				
2005-10-14	ESA	LEON2FT: Meiko FP exception bug fix	EC	-	A. Pouponnot	Repository ver 40			40	40
2005-10-28	ESA	LEON2-FT: Memory controller bug fix (SDRAM CS generation)	EC	-	A. Pouponnot	Repository ver 44			4	4
Total								0	44	44

2005

								Time Senior	Time	Time
November								Eng. / Man.	Engineer	Total
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref				
2005-11-18	ESA	Updated LEON2FT test bench to compile with gcc-3.4.4	JG, EC	-	A. Pouponnot	Repository ver 54		4	12	16
2005-11-25	ESA	LEON2-FT 1.0.15-2 release	JG, EC	-	A. Pouponnot	Repository ver 59		8	16	24
Total								12	28	40

2005

								Time Senior	Time	Time
December								Eng. / Man.	Engineer	Total
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref				
2005-12-05	--	Progress report #4	PD	-	A. Pouponnot	REP-2005-1201		1	0	1
Total								1	0	1

2006

								Time Senior	Time	Time
January								Eng. / Man.	Engineer	Total
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref				
2006-01-02 to 2006-01-31	ESA	VxWorks 5.4 BSP development	JG, KE	-	A. Pouponnot	E-mail 12/01/2006		25	15	40
Total								25	15	40



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2006

February									
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Time Senior Eng. / Man.	Time Engineer	Time Total
2006-02-01 to 2006-02-28	ESA	VxWorks 5.4 BSP development	JG, KE	-	A. Pouponnot	E-mail 12/01/2006	25	15	40
2006-02-01	ESA	Documentation update LEON2-FT	JG, KE	-	A. Pouponnot	E-mail	1		1
Total							26	15	41

2006

March									
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Time Senior Eng. / Man.	Time Engineer	Time Total
2006-03-16	--	Progress report #5	PD	-	A. Pouponnot	REP-2006-0301	1	0	1
Total							1	0	1

2006

April									
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Time Senior Eng. / Man.	Time Engineer	Time Total
2006-04-20	Verhaert	Investigation of SDRAM/PROM conflict reported by Verhaert	JG	-	A. Pouponnot	E-mail	1	0	1
2006-04-25	Alcatel Alenia	Email support AlcatelAlenia (caches and FT behaviour)	JG	J. Esteves	A. Pouponnot	E-mail	1		1
2006-04-28	Estec	Email support ESTEC regarding RTEMS and AT697 networking	JG	-	A. Pouponnot	E-mail	1		1
Total							3	0	3

2006

May									
DATE	COMPANY	ITEM/Subject	GR ref	Comp. Ref	Esa Ref	Doc. Ref	Time Senior Eng. / Man.	Time Engineer	Time Total
2006-05-20	Estec	Investigation of AT697 write protection	JG	-	A. Pouponnot	E-mail	5	0	5
2006-05-21	Estec	Debugging of AT697 SDRAM/PROM conflict	JG	-	A. Pouponnot	E-mail	16	0	16
2006-05-30	Estec	Final Report	PD	-	A. Pouponnot	REP-2006-0501	2		2
Total							23	0	23

7 SUPPORT HOURS PER CUSTOMER

Company	Hours
ESA	275
ATMEL/ESA	57
ATMEL	9
Alcatel Alenia	1
Astrium/ESA	32
Laben	12,5
Spacebel	1
Verhaert	1
Management	9
Total	397,5

