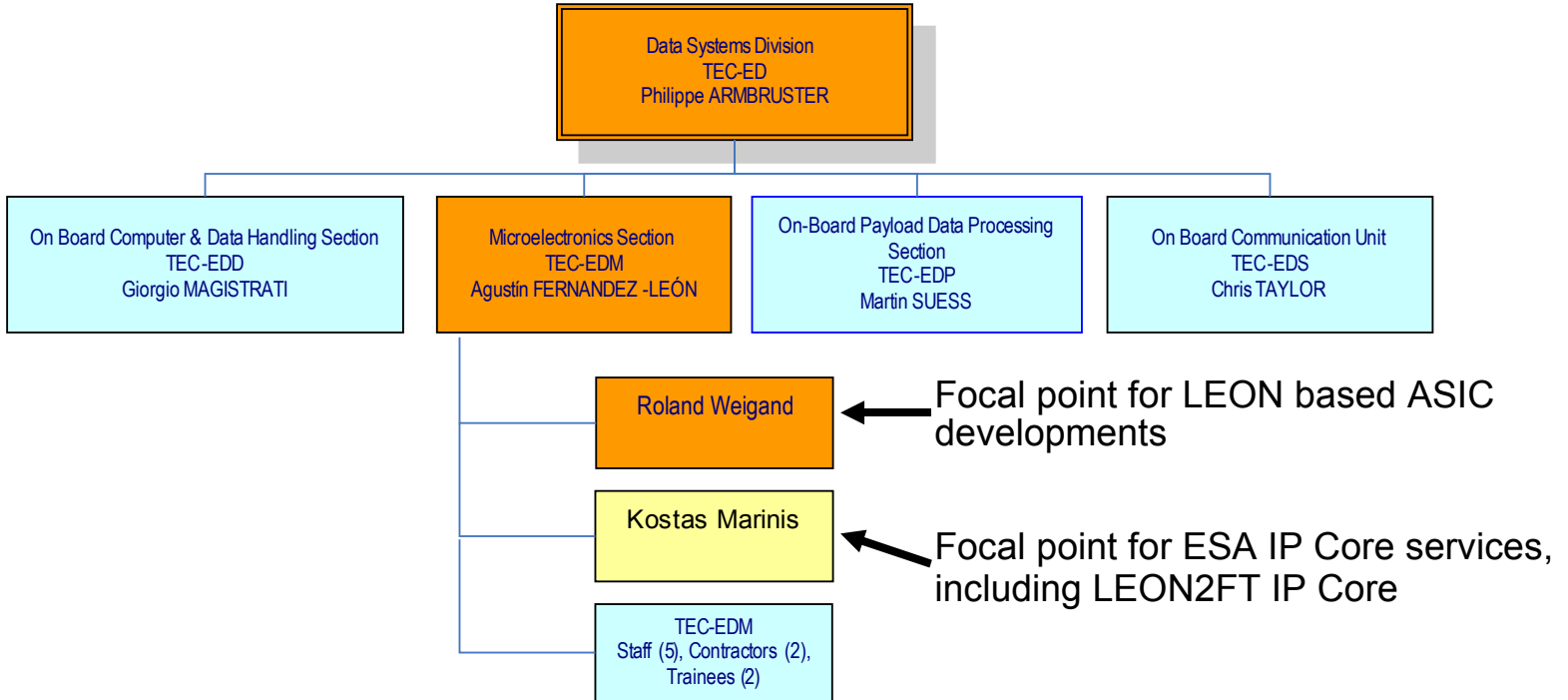


# ***Use of $\mu$ P in EU space OBC: Present & future scenarios***

## ***Section 2 Round Table on MicroProcessors for Space Applications***

# TEC-ED sections: Microelectronics



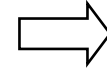
# Outline:

- I. Microelectronics support main axis for space mP
- II. Use of LEON2FT IP in EU missions
- III. Standard and proprietary chips embedding LEON
- IV. Use of LEON (any format) in EU missions

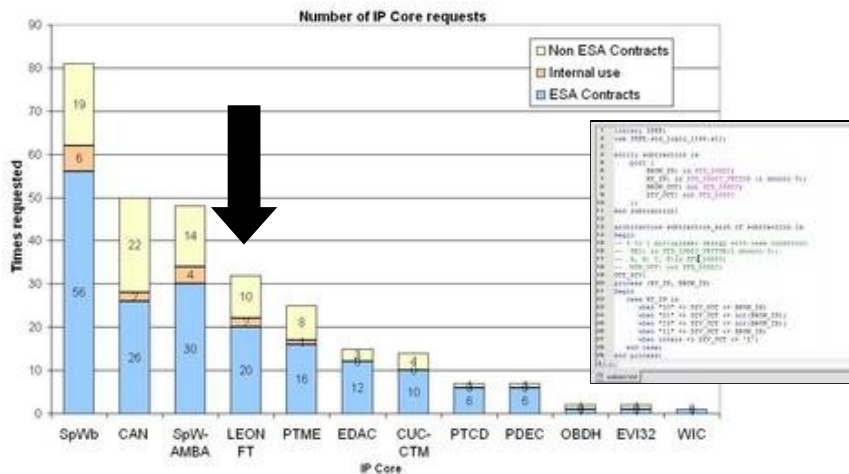
# Microelectronics section support for space microprocessors

1

ESA IP Cores service, including maintenance, licensing and distribution of **LEON2FT IP Core** (with restrictions due to special agreement with Atmel)

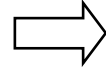


Facilitates ASIC (pre)developments (Standard and proprietary), board model simulation, allows R&D on fault tolerance, etc

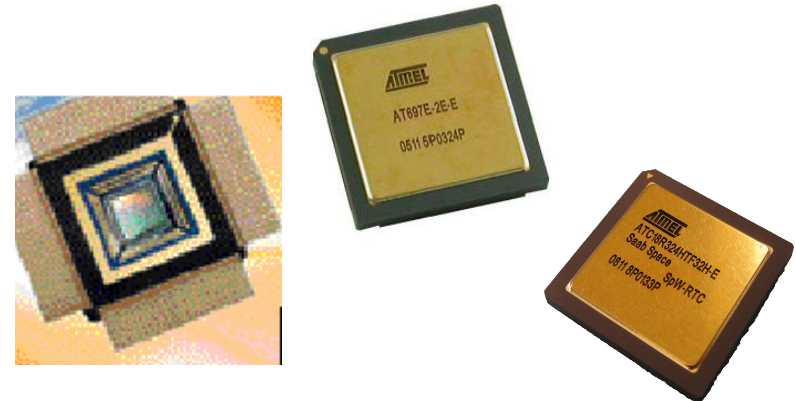


2

ESA supported **Standard Products** (e.g. TSC695 - ERC32, AT697 -LEON2FT, NGMP and **Standard ASICs** (e.g. AT7013 - SpW-RTC, SCOC3)



Off-the-shelf catalogue component availability (procurement leadtime proportional to stock availability and desired quality levels)

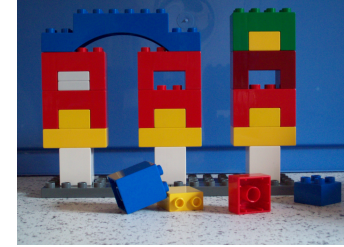




	IP CORES											
	CA N	CUC- CTM	EDA C	EVI3 2	LEON2- FT	OBD H	PDE C	PTC D	PTME	SpaceWire- AMBA	SpaceWire -b	TOTA LS
GAIA					ASIC					X	X	3
Geo MS	X	X	X	X		X	X	X	X	X	X	10
Spanish Space Observation Satellite - PAZ	X	X				X						3
Foton M3	X						X	X				3
BepiColombo	X	X	X		X, ASIC		ASI C		ASIC	X	X, ASIC	6
Exomars	X				ASIC					X	X, ASIC?	3
Sentinel-1	X				ASIC					X	X,ASIC	3
Sentinel-2			X		ASIC							1
Sentinel-3					ASIC					X	ASIC	2
EML	X										X	2
ERB-2 (Erasmus Recording Binocular 2)	X										X	2
WatSen											X	1
Proba-2		X			X, ASIC				X			3
Proba-3		X	X		ASIC		X	X	X	X	X	7

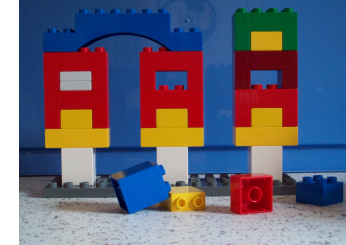
TOTALS	9	6	6	1	12	3	9	6	8	9	14	
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	IP CORES											
	CAN	CUC-CTM	EDA C	EVI3 2	<b>LEON2-FT</b>	OBD H	PDE C	PTC D	PTME	SpaceWire-AMBA	SpaceWire-b	TOTALS
Galileo	ASIC						ASIC		X, ASIC			3
KaTE									X			1
Smart-1									X			1
ATV								X	X			2
LisaPF									ASIC			1
AlphaBus								X				1
ADM-Aeolus							ASIC		ASIC			2
SWARM					<b>ASIC</b>		ASIC		ASIC			3
EarthCare					<b>ASIC</b>							1
SmallGEO					<b>ASIC</b>							1
ASTROTERRA					<b>ASIC</b>		ASIC		ASIC			
Maser-10		X	X				X	X	X	X	X	7
MHS-2 (?)											X	1
NPAL (Mercury)											X	1
AlphaSat			X		<b>ASIC</b>						X, ASIC	3
4 November 2009						ADCSS09 ESA ESTEC					Slide : 6	
<b>TOTALS</b>	9	6	6	1	<b>12</b>	3	9	6	8	9	14	



# Standard Products / ASICs & “proprietary ASICs” embedding LEON (1/2)

#	ASICs	version of LEON IP inside	1 <sup>st</sup> protos available	ASIC design group	comments	More info
1	<b>LEON-UMC ASIC</b>	LEON2-FT	2004	ESA-Gaisler	UMC180nm for ESA internal functional validation	<a href="http://www.esa.int/TEC/Microelectronics/SEMHWJV681F_0.html">http://www.esa.int/TEC/Microelectronics/SEMHWJV681F_0.html</a>
2	<b>AT697E ASIC</b>	LEON2-FT	2005	ESA-Gaisler (S)-Atmel(F)		ww.Atmel.com
3	<b>AT697F ASIC</b>	LEON2-FT	dic 2008	ESA-Gaisler Research(S)-Atmel(F)		<a href="http://microelectronics.esa.int/mpd2007/AT697F.pdf">http://microelectronics.esa.int/mpd2007/AT697F.pdf</a>
4	<b>COLE ASIC</b>	LEON2-FT	Mar-08	RUAG (S)	GSTP activity; Redesign COLE2 ongoing	<a href="http://microelectronics.esa.int/mpd2007/COLE-System-on-chip-MPD2007.pdf">http://microelectronics.esa.int/mpd2007/COLE-System-on-chip-MPD2007.pdf</a>
5	<b>OMNIA ASIC</b>	LEON2-FT		TAS (I)	TAS (I) internal development	
6	<b>AGGA4 ASIC</b>	LEON2-FT		AST (D)	evolution AGGA2 and AGGA3 (never manufactured) ASICs	<a href="http://microelectronics.esa.int/mpd2004/AGGA3-MPD2004_final.pdf">http://microelectronics.esa.int/mpd2004/AGGA3-MPD2004_final.pdf</a>



# Standard Products / ASICs & proprietary ASICs embedding LEON (2/2)

#	ASICs	version of LEON IP inside	1 <sup>st</sup> protos available	ASIC design group	comments	More info
7	<b>SPW-RTC ASIC</b>	LEON2-FT	Mar-08	RUAG (S)	used in BepiC (SIMBO-SYS instrument), Exomars, Solar Orbiter, on ATC18RHA	<a href="http://microelectronics.esa.int/mpd2007/SpaceWireRemoteTerminalController-MPD2007.pdf">http://microelectronics.esa.int/mpd2007/SpaceWireRemoteTerminalController-MPD2007.pdf</a>
8	<b>MDPA ASIC</b>	LEON2-FT	Mar-09	EADS Astrium (D)	Aphasat payload, on ATC18RHA	<a href="http://microelectronics.esa.int/mpd2007/MDPA_Pres_March_2007.pdf">http://microelectronics.esa.int/mpd2007/MDPA_Pres_March_2007.pdf</a>
9	<b>DST ASIC</b>	LEON2-FT		TAS(I)	Deep Space Transponder in BepiC, on MH1RT	
10	<b>LEON3-DARE ASIC</b>	LEON3-FT	Mar-09	ETCA(B)-Aeroflex Gaisler(S)	evaluation of DARE-UMC180nm technology	<a href="http://microelectronics.esa.int/mpd2007/LEON3_DARE_ASIC_Rev1.pdf">http://microelectronics.esa.int/mpd2007/LEON3_DARE_ASIC_Rev1.pdf</a>
11	<b>SCOC3 ASIC</b>	LEON3-FT	May-09	EADS Astrium (F)	Embeds LEON3, TM & TC	<a href="http://microelectronics.esa.int/mpd2007/SCOC3-MPD2007.pdf">http://microelectronics.esa.int/mpd2007/SCOC3-MPD2007.pdf</a>
12	<b>NGMP ASIC</b>	LEON4-FT		Aeroflex Gaisler(S)	First TRP to end Q2-2011	



# Use of LEON (any format) in EU missions 1/2

item	MISSIONs using LEON	format in which LEON is used	launch date
1	Columbus (ERNO-box)	AT697E ASIC (up-screened)	Feb-08
2	VenusX (monitoring camera)	LEON2 non-FT IP on Xilinx FPGA	Nov-05
3	PROBA2	AT697E ASIC (up-screened)	Nov-09
4	PRISMA	LEON3 IP in RTAX2000 FPGA	2010
5	ECLAIR (trigger unit of gamma-ray burst telescope)	AT697E ASIC	2012
6	SWARM (SYDERAL payload)	AT697E/F ASIC	2010
7	GAIA	AT697E/F ASIC	2011
8	BepiColombo	SpW-RTC ASIC	2013
9		Deep Space Transponder ASIC	2013
10		LEON3 IP in RTAX2000 FPGA	2013
11	Sentinels	SpW-RTC ASIC	
12	Sentinel -1	AT697E ASIC	

# Use of LEON (any format) in EU missions 2/2

item	MISSIONs using LEON	format in which LEON is used	launch date
13	SEOSat (renamed to "Ingenio")	SCOC3 ASIC	
14	LaPlace / Tandem	SCOC3 ASIC	
15	Galileo	LEON3FT in RTAX2000LS FPGA	
16	Exomars	SpW-RTC ASIC	2013
17		AT697F	
19	Solar Orbiter	SpW-RTC ASIC	
20	Alphasat	AT697F ASIC (MQFP)	
21		LEON3 in FPGA RTAX2000 FPGA	
22		MDPA ASIC	
23	Small GEO	COLE ASIC	
24	ASTROTERRA	SCOC3 ASIC	

## Session 2:

### Use of $\mu$ P in EU space OBC: Present & future scenarios

11:30	<b>RUAG</b> experience and development strategy	RUAG
11:50	<b>Astrium</b> experience and development strategy	Astrium
12:10	<b>TAS</b> experience and development strategy	TAS
12:30	<b>Syderal</b> experience and development strategy	Syderal