

Alberto Martin-Ortega Space Sensors Engineering Area INTA - Instituto Nacional de Técnica Aeroespacial







CONTENT

- INTA's Strategy for Planetary Exploration (MEREX)
 - Planetary Exploration Payload Requirements
 - State of the Art Micro-Controllers and Processors
- High Configurable Payload Computer
 - Hardware Building Blocks
 - Software Building Blocks
- MicroMED Payload
 - Central Electronics Board Design





PLANETARY EXPLORATION - INSTRUMENT DEVELOPMENT STRATEGY



^{*} MEREX = Miniature Electronic Resources for planetary EXploration



and Missions Workshop



PLANETARY EXPLORATION PAYLOAD SURVEY

Requirements comi	ng from Science				
Sensors (Analo	ogue):				
From a fev	v Hz to several MHz				
From 1 sig	nal to tens				
Current or	Voltage				
Actuators:	0				
Temperatu	re Control				
Laser Con	trol				
Movable M	lechanics Control				
Processing:					
From simp	le acquisition to complex algorithms	Updatable			
Data compression Adaptable					
	16331011	/ (04)(45)0			
Requirements comi	ng from Platform				
Low mass	High Temperature Variation (140 to 3)	350 K) • Autonomy (improved operation)			
Low power	Radiation Tolerance				
 Low volume 	High Poliability				
Low volume					
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ENHANCED COMPUTING FOR PLANETARY EXPLORATION PAYLOADS MICROMED CENTRAL ELECTRONICS





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MICRO-CONTROLLER SPECIFICATIONS

ТҮРЕ	REQUIREMENT	ТҮРЕ			
PROCESSOR	Single or dual core	PERIPHERALS			
Architecture	16 or 32 bits Bus		2x UART		
Frequency	> 16 MHz (80 MHz preferred)		2x SPI		
ALU	Hardware Multiplier and Divisor	Communication Protocols	1x CAN		
FPU	Single or Double Precision		1x Serial High Speed > 20Mbits/s		
DMA	Desirable	ADC	8/10 bits Converter		
MEMORY		Digital I/O	> 16 Input/Outputs		
Non-Volatile	> 128 Kbytes	Other	Real Time Clock and Timers		
Volatile	> 8 Kbytes	PACKAGE	No BGA or CC (CFP preferred)		
POWER	5.0V or 3.3V	RADIATION	Low susceptible to SEL (immune		
Consumption	Reference: 10mW/MHz		TID > 10 krad.		
		TEMPERATURE	-130ºC to +70ºC (operational)		





MICRO-CONTROLLER STATE OF ART







MICRO-CONTROLLER STATE OF ART

Search for Rad-Hard



		MS	5P430F1611	MSP430F1612	NSP430F1	618 MS	P430F261	9 MSP	430FR57	739 <mark>MS</mark> I	P430FR5969	Sitara AM3505	Sitara AM3703		
	2015 NEPP-E	15 NEPP-ETW x x x		X	X X				x x						
Core.			MHT max	16-bit RI		SC CPU (MSP430™)					ARM Cortex®-A8				
Proces	sor Frequer							4		_		600 MHZ	I-GHZ		-
			AT91SAM	19G20 AT91SA (\$128/S	M7 512) AT	megaS128	L ATME	GA164P	ATMEG	A32U/8	ATMEGA16U2	ATmegaS64M1	SAM D21	SAM V71	L
Mem	NEPP 2015 Con	gress	x	x		х	_	х	x		х				
Interf	-				PIC2	4FJ2560	B110	dsPIC	3FJ256	GP710	dsPIC3	0F6014A	0		_
	Processor	Datasheet		t		[RD6]	D6]		[RD7]				Cortex M0+	Cortex M7	
		NEPF	2015 Co	ngress		х			х				32 bit	32 bit	
Sup			Archit	ecture		16 hit		16 hit			1/	5 hit	40 644	200,344-	
		Processo					NXP			Silicon Labs	Cobam	(Aeroflex)	Mo	otorola	
Dooke						LPC292	X LPS219	4 LPC	2478	LPC43xx	C8051	UT80CRH196KD	UT80CRH196	CDS 68F	1CS708
Facke	Memory		NE	PP 2015 Congres	s al coro		_				x			_	
D. #		Memory	Processor	Archited	ture	32 bit	16/32	16	/32	32	8 bit	16 bit	16 bit	-	
Radia				Freque	ncy	125 MH;	z 60 MH:	z 72	MHz	204 MHz	50, 100 MHz	20 MHz	20 MH	z	
	Interfaces Peripher	Perinhera	Memory	Program (F	LASH)	512	256	5	12	1 MB	128 kB				
		renpiierai		Data (EPRON	//FLASH)	16				16		128 kB	128 k	3	
		Supply		Volátil (SRAM	/SDRAM)	8		98 (64	I CPU)	136	8 kB	1 kB	1 kB		
Comn	Supply			UAR	т	2	2		4	4	2	1	1		
com			Interfaces	SPI		3	2		1	1	1				
	Packaging packa	IC	Interfaces	CAN	l	2	4		2	2					
		packagin	ç	High Speed	d Serial							x	x		
	Radiation Rad		Supply	Supply vo	oltage	1.8 V	3 - 3.6	/ 3-3	3.6 V 2	2.4 - 3.6 V	2.7 - 3.6 V				
		Radiation		Power cons	umption										
			IC packaging	Packagin	g type	LQFP	LQFP	LC	(FP	LQFP	TQFP	QFP	QFP		
				g #pin	s	100	64	2	08	208/144	64/100	68	68		
		Comments	1	Mater	ial										
			Radiation	TID								100 rads(Si)	300 krad(Si)	
				SEE											
				Comments							Low Temperature				





MICRO-CONTROLLER STATE OF ART







MICRO-CONTROLLER FULL QUALIFICATION



Qualified LOT of Micro-Controllers for Planetary Exploration Purposes for the next decade





HARDWARE BUILDING BLOCKS













MICROMED CENTRAL ELECTRONICS BOARD

- MicroMED's CEB is based on micro-controller with high speed co-processor FPGA:
 - Enhanced processing capabilities
 - High speed analog acquisition
 - Self mitigation scheme
 - Advance motor and laser control capabilities
 - Power saving modes





MICROMED CENTRAL ELECTRONICS BOARD







MICROMED CENTRAL ELECTRONICS BOARD



