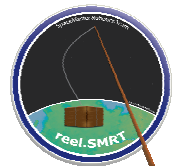


Appendix 1. System Level

1.1 Complete Component List and Budget

1.2 Requirements Verification Table

reel.SMRT
Critical Design Review
24 May 2009



reel.SMRT BUDGET AND COMPONENT LIST AT CDR

Component	Description	Qty	Cost per Item (EUR)	Total Cost (EUR)	Manufacturer	Part No.	Status
MECHANICAL							
PU25	Universal Aluminium Profiles, sold in 3000mm length	2	28.16	56.32	Solectro	2000013000	Purchased
Slide Nut M6	Slide nut made for the PU25 profiles, 20 for 135 SEK and 100 for 305 SEK, at least 28 are needed	2	12.26	24.52	Solectro	2090010005	1 Purchased, 1 To Be Ordered
M6 20mm Flat Head Screw	At least 12 are needed	1				N/A	Purchased
M6 12mm Flat Head Screw	At least 4 are needed	1	6.22	6.22	Verktgshuset Kiruna	N/A	Purchased
M6 45mm Flat Head Screw	At least 4 are needed	1	2	2	Verktgshuset Kiruna	N/A	Confirmed
M6 20mm Button Head Screw	At least 36 are needed	1	5.47	5.47	Würth Svenska AB Kiruna	N/A	Purchased
M6 10mm Button Head Screw	At least 14 are needed	1	4	4	Verktgshuset Kiruna	N/A	Confirmed
M5 30mm Flat Head Screw	At least 8 are needed	1	4	4	Verktgshuset Kiruna	N/A	To Be Confirmed
M6 Washer	4mm thick M6 washer, at least 4 are needed	1	2	2	Verktgshuset Kiruna	N/A	Confirmed
Angle Adaptor	Piece to join the profiles at an angle; 500 N max load Hinge 6 30x30, heavy-duty	8	24			0.0.419.80	Purchased
Mount Bracket	Custom corner bracket to mount the MAIN on the gondola Angle Bracket 6 30x30 Zn, white aluminium, similar to RAL 9006	4	4.5	284.71	Item http://www.item.info/en Distributors: Aluflexsystem AB Total Cost: 3015 SEK	0.0.419.63	Purchased
Spare Mount Brackets	Sold in packs of 4	1	1.41	1.41	Trä och Bygg i Kiruna AB		Purchased
Rigid Shaft Coupler	Rigid steel parallel shaft coupler for 10mm to 10mm keyed shafts	2	8	16	Michaud Chailly	a5-28-10-10-2	Motor To Be Confirmed
Line Guide Bearing	Sleeve bearings used to support the Line Guide Assembly Pdyn = 16.6 kN; Pstat = 52 kN	2	3	6	Michaud Chailly	C3-151-14-16-15	Ready For Order
Spinning Reel	Daiwa Saltiga Surf Spinning Reel 6000	1	664.1	664.1	Daiwa (Australian Distributer)	Saltiga Surf 6000	Purchased
Servo Motor	Futaba S3801: http://www.hudikhobby.com/visa_produk.asp?id=2978	2	84.74	169.48	Sussex Model Center UK	SMC-RE-HS755MG	To Be Confirmed
Brushless Motor	Brushless DC Geared Motor with 30W output and 1.5 Nm rated torque	2	265	530	Oriental Motors inc. jan.friberg@ostergrens.se	AXH230KC-15	To Be Confirmed
Total MAIN Payload				1776.2			
FISH							
Aluminium Sheet	0.5 mm thickness	1	15	15	LTU	N/A	To be Ordered
Aluminium Sheet	1 mm thickness	1	0	0	LTU	N/A	Purchased
Aluminium Sheet	1.5 mm thickness	1	0	0	LTU	N/A	Purchased
Parachord	500 lb strength chord, 200 m	1	5	5		N/A	Ordered
Parachute	160 mm diameter, storgage 50mm	1	0	0	Estrange	N/A	Purchased
Ring	10mm diameter	1	0	0	TBC	N/A	To be Ordered
Battery Holder	C type, 2 large cells 60mm x 60mm	1	5	5	Farnell	BH221B	Ordered
CYPRES Unit	Parachute release mechanism	1	0	0	Estrange	N/A	Purchased
Aluminium Strip	20mm x 3 mm	2	10	20	Stälcenter i Norr AB	N/A	Purchased

Insulation	50mm thickness	1	0	0	Kiruna Trä och Bygg	N/A	Purchased
CYPRES Cutter	CYPRES Cutter for plane drop test	1	120	120	CYPRES	N/A	To be Ordered
M4 Screw Button head	20 mm long	6	5	30	Kiruna Harware Store	N/A	Purchased
M4 nut Nylon nuts		6	4	24	Kiruna Harware Store	N/A	Purchased
M5 washer		6	3	18	Kiruna Harware Store	N/A	Purchased
M4 Rivit	6 mm head, 5 mm length		0	0	University	N/A	Purchased
Epoxy		1	0	0	TBC	N/A	To be Ordered
Cable ties	200 mm long	4	0	0	TBC	N/A	To be Ordered
Superbraid Line	150 Lb strength , 300 m line	1	50	50	Diawa	N/A	Purchased
Swivel	30 mm swivel, high strength	2	10	20	Diawa	N/A	Purchased
Total FISH				307			
Mechanical Costs	Total Cost of Mechanical Components:			2083			

MANAGEMENT & OUTREACH							
Stickers	reelSMRT Stickers	1	35	35	Svenska WIP		Purchased
Stickers (2nd Batch)	reelSMRT Stickers with webpage	1	60	60	Svenska WIP		To Be Confirmed
Outreach Payload Printing Materials	Printing of Letters for Sponsors to fly on Balloon	1	50	50	Svenska WIP		To Be Confirmed
Outreach Competition Materials		1	50	50	Coop		To Be Confirmed
Outreach Competition Shipping	Shipping of Prizewinners's payload	1	50	50	Coop		To Be Confirmed
Patches	reelSMRT Patches for Outreach Payload	50	2	100			To Be Confirmed
Sponsor Board Printing	Printing of a large sign for promotional material photos	1	30	30	Svenska WIP		To Be Confirmed
Printing	Printing SED	5	20	100			To Be Confirmed
Travel to Selection Workshop	Non-EU member travel to selection workshop	2	175	350			Confirmed
Miscellaneous Shipping Costs	Shipping for miscellaneous items ie. To Sponsors	1	50	50			To Be Confirmed
Outreach Costs	Total Cost of Outreach Components			875			

SOFTWARE							
Evaluation Board	Evaluationboard for the Microcontroller NXP lpc2368	1	162	200	KEIL	KEIL MCB2360	Purchased
RF Modules	Evaluation set consisting of two RF modules	1	180	220	digi.com	xBee Pro 868 (XBPO8-DK)	To be Confirmed
RF Modules (testing)	RF modules used during testing	2	19	38	digi.com	xBee (XB24-DMWIT-250)	Purchased
Software Costs	Total Cost of Software Components			458			

ELECTRONICS							
FISH							
Accelerometer ASC 5421	Precise accelerometer,10mg bias,40Hz bandwidth	1	1000	1000	ASC GmbH	ASC 5421	To be Ordered
TMP275	Precice temperature sensor,i2c, 0.5 accuracy	1	4.68	4.68	TI	TMP275	To be Ordered
LIS3L02AQ3	Medium-g, 3 axis, high bandwidth	1	25.99	25.99	ST	LIS3L02AQ3	To be Ordered
ADC1274	Precise,wide bandwidth converter,sync mode	1	45.64	45.64	4 Channel	ADC1274	To be Ordered
batteries	saft	4	10	40	SAFT	LS14250	To be Ordered
LPC2368FBD100	Microcontroller	2	11.68	23.36	Philips	lpc2368	To be Ordered
memory mount	microSD	1	3.19	3.19	Molex	N/A	To be Ordered
memory	microSD 1GB - 2GB	2	10	20	Sandisk	N/A	To be Ordered
HMC6352	Compass I2C	1	110.98	110.98	Honeywell	HMC6352	To be Ordered
Capacitor	22pF, Ceramic, 0805, 100V	4	0.11	0.44	AVX	N/A	To be Ordered
Capacitor	1uF, ceramic, 0805, 25V	12	0.112	1.344	AVX	N/A	To be Ordered

Capacitor	10uF, ceramic, 0805, 16V	2	0.24	0.48	AVX	N/A	To be Ordered
Capacitor	0.1uF, Ceramic, 0805, 50V	4	0.24	0.96	AVX	N/A	To be Ordered
Resistor	10Kohm,0805, 0.125W, 150V	15	0.054	0.81	Yageo	N/A	To be Ordered
LD1117AV18	1.8V Regulator	1	1.42	1.42	ST	LD1117AV18	To be Ordered
LM1086IT-3.3/NOPB	3.3V Regulator	1	2.83	2.83	ST	LM1086IT-3.3/NOPB	To be Ordered
LM1086IT-5.0/NOPB	5.0V Regulator	1	2.94	2.94	ST	LM1086IT-5.0/NOPB	To be Ordered
PCB Manufacture	4-layer PCB	3	50	150	Pragoboard, CZ	PCB 4-layer	To be Ordered
ADR445 B grade	Precise 5V reference,2mV max error,10mA source	1	10.09	10.09	Vin Max 18V	ADR445 B grade	To be Ordered
FISH total				1445.2			
MAIN Payload							
MURATA POWER SOLUTIONS - NPH10S2405EIC - CONVERTER, DC/DC, 10W, 5.1V	dc/dc converter	2	39	78	farnell se	1175755	purchased
IMU	Wolfenbuttel University	1	0	0	Wolfenbuttel University	custom	Purchased (no cost)
HIRSCHMANN ,GDM 3016 schwarz/black	connector	12	1.9	22.8	farnell se	1326451	to be ordered
HIRSCHMANN,GSA3000	connector	12	1.9	22.8	farnell se	1326451	to be ordered
LPC2368FBD100	microcontroller	1	9.4	9.4	farnell se	1524645	to be ordered
LITTELFUSE 354 900	fuse holder	10	1.1	11	farnell se	1453898	to be ordered
iR 40CTQ045PbF	power rectifier	20	0.7	14	farnell se	1625132	to be ordered
POWER-CHOKE WE-HCFT	inductor	10	4.9	49	farnell se	1636256	to be ordered
COMMON MODE CHOKE WE-CMB	inductor	4	4.9	19.6	farnell se	1636292	to be ordered
CAPACITOR, CLASS X2, 0.01UF, 275V	capacitor,ac	2	2.7	5.4	farnell se	1695301	to be ordered
Vishay Bcomponents, ELECTROLYTIC ceramic, X7R Dielectric	electrolytical capacitor	2	2.7	5.4	farnell se	1695301	to be ordered
0805,resistor	various values	20	2.7	54	farnell se	1657944	to be ordered
on semiconductor mc7806ctg	resistors,varios values	40	0.9	36	farnell se	1501925	to be ordered
TSR 1-2465	linear 6V regultor	4	0.4	1.6	farnell se	1468763	to be confirmed
st,LD1117A	dc/dc 6.5V converter	4	8.5	34	farnell se	1696321	to be confirmed
ITT CANNON - ZDC37P	linear adjustable regulator	2	1.3	2.6	farnell se	1087163	purchased
TMR 2422	cannon dsub,connector,9 pin	10	1.4	14	farnell se	1348015	to be ordered
heatsink	dc/dc 24/+ -12,2W	4	11	44	farnell se	8205914	to be ordered
BURR-BROWN, ISO124	various types	10	1.9	19	farnell se	4621300	to be ordered
MAX4051AESE+	isolated amplifier	1	17	17	farnell se	1212426	to be ordered
Zigbee	analog multiplexer	1	5.4	5.4	farnell se	1379961	to be ordered
A1201ELHLT-T	communicatio module	2	0	0	farnell se	1546390	granted
MAX3232CDE4	hall sensor	4	1.5	6	farnell se	1521674	purchased
MCP9800	rs-232 driver	1	2.8	2.8	farnell se	1287437	to be ordered
CRYSTAL, THT	temperature sensor	4	1.4	5.6	farnell se	1439485	to be ordered
REF5025	oscilator	2	1.3	2.6	farnell se	1640870	to be ordered
AD712JNZ	voltage reference	1	5.4	5.4	farnell se	1439622	to be ordered
Vishay, ILQ5	operation amplifier	2	5.9	11.8	farnell se	9604898	purchased
GP2D120XJ00F	optcoupler	4	2	8	farnell se	1469481	purchased
	proximity sensor	3	18.5	55.5	farnell se	9707859	to be ordered

High Power Polymer Li-Ion Pack: 22.2v 2200mAh	battery	5	70	350	batteryspace	PLH-803496HD-6S- WR	to be ordered
PCB	1dm2.poolservis	10	18	180	PragoBoard		to be ordered
MAIN Payload Total				1015			
Electrical Costs	Total costs of Electrical Components			2460			

OPTIONAL EXTRA							
Further Accelerometer Calibration	http://www.spektra-dresden.de/deutsch/produkte_komplettsysteme.php	3	250	750	Spektra		TBC
GPS Finder	For finding FISH after drop test	1	60	60	TBD	TBD	TBD
Additional Reel	For breakage during tests (costs incl. Customs)	1	600	600	Daiwa	SALTIGASURF6000	TBD
Conferences and Travel Costs	For presentation of results at conferences			3000			
Delta Utec Testing	Possibility after flight campaign	1	1	3500	digi.com	xBee (XB24- DMWIT-250)	Purchased
Optional Costs	Total costs of Optional Costs			7910			

TOTAL BUDGET RRP (with extras)				15971
TOTAL BUDGET RRP (no extras)				8061
Discounts (approximate)	CYPRES Unit	1	1200	1200
	Parachute	1	120	120
	Line	1	50	50
	Swivels	3	5	15
	IMU	1	400	400
	Reel	1	400	400
Budget with discounts				5876.1
Monetary Support	ESA	1	3000	3000
	GCS	1	300	300
	LTU	1	500	500
Budget with Monetary Support (no extras)				2076
Resulting Contribution of Team Members	Contribution with 10% buffer	9	250	2250

Requirements Verification Table

Req. ID #	Test ID #	Test Title	Test Model	Verified by Design (YES/NO)	Verified by test (PASS/FAIL/ NYT)	Responsible Member
Mission Level Requirements						
Req.F.1	Req. Verification	Req.F.M.1, Req.F.M.11, Req.O.E.7, Req.O.M.2, Req.O.M.3, Req.O.M.4	NA	YES	NYT	Katherine
Req.F.2	Req. Verification	Req.F.M.1, Req.F.M.2, Req.FM.3	NA	YES	PASS	Katherine
Req.F.3	Req. Verification	Req F.M.1, Req.F.M.2, Req.F.M.3, Req.F.E.10	NA	YES	NYT	Katherine
Req.F.4	Req. Verification	Req.F.E.3, Req.F.E.4, Req.F.E.5, Req.F.E.6, Req.F.E.7, Req.F.E.11, Req.F.E.12, Req.F.E.14, Req.F.E.15	NA	YES	NYT	Katherine
Req.F.5	Req. Verification	Req.F.M.7, Req.F.M.8	FM	YES	NYT	Katherine
Req.F.6	Req. Verification	Req.F.M.9	FM	YES	NYT	Katherine
Req.F.7	Req. Verification	Req.O.M.1				Katherine
Req.F.8	Req. Verification	Req.F.S.1, Req.F.S.4				Katherine
Req.F.9		Scientific Justification and Simulation - CDR	SIM	YES	PASS	Katherine
Req.F.10		Simulation - PDR	SIM	YES	PASS	Katherine
Req.F.11		Outreach plan - CDR	NA	YES	PASS	Fitts, Katherine
Req.F.12		Accelerometer Quality	NA	NO	NYT	Katherine
Req.F.13		Mass Calculation - CDR	FM	YES	NYT	Katherine
Req.T.1	M.17	Reel Functionality Test & Req.F.M.1	FM	YES	NYT	Katherine
Req.T.2	Req. Verification	Req.O.E.1, Req.O.E.3, Req.O.E.4	FM	YES	NYT	Katherine
Req.O.1	Req. Verification	Req.O.E.7 - Accelerometer selection, calibration & test.	FM	YES	NYT	Katherine
Req.O.2		Risk Analysis	NA	YES	PASS	Katherine
Req.O.3		Design - CDR	FM	YES	NYT	Katherine
Req.O.4	Req. Verification	Req F.M.1, Req.F.M.2, Req.F.M.3, Req.F.E.10, Req.O.E.6	FM	YES	NYT	Katherine
Req.O.5	Req. Verification	Req.F.E.3, Req.F.E.4, Req.F.E.5, Req.F.E.6, Req.F.E.7, Req.F.E.11, Req.F.E.12, Req.F.E.14, Req.F.E.15	FM, EB	YES	NYT	Katherine
Req.O.6	Req. Verification	Req.F.S.1, Req.F.S.3	FM	YES	NYT	Katherine
Req.O.7	Req. Verification	Req.F.S.3, Req.T.M.1, Req.T.M.2, Req.O.E.1,				Katherine
Req.O.8	Req. Verification	Req.F.M.10, Req.O.E.4	NA	YES	NYT	Katherine
Req.O.9		Response to Review Recommendations, Submissions	NA	YES	YES	Katherine
Req.O.10		NA				Katherine
Req.O.11		Budget Calculations - CDR		YES	NYT	Katherine
Req.O.12		Accelerometer Quality	NA			Katherine

Req. ID #	Test ID #	Test Title	Test Model	Verified by Design (YES/NO)	Verified by test (PASS/FAIL/ NYT)	Responsible Member
Mechanical Subsystem Requirements						
Req.F.M.1	M.15, M.16, M.17	Reel Functionality Test	FM	YES	NYT	Campbell, Mikael
Req.F.M.2	M.6	Brake Strength Test	FM	NO	NYT	Mikael
Req.F.M.3	M.15, M.16, M.17	Reel Functionality Test	FM	NO	NYT	Campbell, Mikael
Req.F.M.4	M.19, M.22	FISH Aerodynamic Stability Test	FM	YES	NYT	Campbell
Req.F.M.5		Friction Calculation - CDR	FM	YES	PASS	Mikael
Req.F.M.6		Simulation Calculation - PDR		YES	PASS	Waen
Req.F.M.7		Mass Calculation - CDR	FM	YES	NYT	Campbell
Req.F.M.8		Mass Calculation - CDR	FM	YES	NYT	Mikael
Req.F.M.9		Length Calculation - CDR	FM	YES	NYT	Campbell
Req.F.M.10	M.15, M.16, M.17	Reel Functionality Test	FM	YES	NYT	Campbell, Mikael
Req.F.M.11	M.19, M.22	FISH Aerodynamic Stability Test	FM	YES	NYT	Campbell
Req.T.M.1	M.21 and M.17	Thermal Test	FM	YES	NYT	Campbell, Mikael
Req.T.M.2	M.15, M.16, M.17	Reel Functionality Test	FM	YES	NYT	Campbell, Mikael
Req.T.M.3		Budget		N/A	NYT	Campbell, Mikael
Req.T.M.4	M.15, M.16, M.17	Reel Functionality Test	FM	YES	NYT	Campbell, Mikael
Req.O.M.1		Length measurement	FM	YES	NYT	Campbell, Mikael
Req.O.M.2	M.22	FISH Aerodynamic Stability Test	FM	NO	NYT	Campbell
Req.O.M.3	M.15,M.16,M.17	Reel Functionality Test	FM	YES	NYT	Campbell, Mikael
Req.O.M.4	M.19, M.22	FISH Aerodynamic Stability Test	FM	NO	NYT	Campbell
Software Subsystem Requirements						
Req.F.S.1	S.4, S.6, S.10	Control the experiment	EM	YES	NYT	Jan, Waen
Req.F.S.2		Store sensor data	EM	YES	PASS	Jan
Req.F.S.3	S.13, S.14	Guarantee Emergency procedures	EM	YES	NYT	Jan
Req.F.S.4	S.8, S.9, S.10	Downlink sensor data	EM	YES	NYT	Waen
Req.T.S.1	S.4, S.6	Real Time Operating System	EM	YES	NYT	Jan, Waen
Req.T.S.2		cost budget	EM	N/A	NYT	Jan, Waen
Req.O.S.1	S.4, S.5	Control Actuators	EM	YES	NYT	Jan, Waen
Req.O.S.2	S.15	Watchdog (Power-On-Reset)	EM	YES	NYT	Jan
Req.O.S.3	S.13, S.14, S.10,S.11	Contingency Procedures	EM	YES	NYT	Jan

Req. ID #	Test ID #	Test Title	Test Model	Verified by Design (YES/NO)	Verified by test (PASS/FAIL/ NYT)	Responsible Member
Electrical Subsystem Requirements						
Req.F.E.6, Req.F.E.9, Req.F.E.15, Req.T.E.7 Req.F.E.1, Req.T.E.1 , Req.T.E.2, Req.T.E.3 , Req.T.E.4m, Req.O.E.2 Req.F.E.10 , Req.F.E.11 , Req.O.E.6 Req.F.E.12 , Req.O.E.1 , Req.O.E.3	E.1	Subsystem Basic	FISH FM, MAIN FM	YES	NYT	David/Mikulas
Req.O.E.4 Req.O.E.4 Req.O.E.4 Req.F.E.1, Req.T.E.1 , Req.T.E.2, Req.T.E.3 , Req.T.E.4	E.2	Sensor Basic	FISH FM, MAIN FM	YES	NYT	David/Mikulas
Req.F.E.4, Req.T.E.6	E.3	Motor Basic	MAIN FM	YES	NYT	Mikulas
Req.F.E.1, Req.T.E.1 , Req.T.E.2, Req.T.E.3 , Req.T.E.4	E.4	Battery Charging /Discharging	ETB	YES	NYT	David/Mikulas
Req.F.E.2 , Req.F.E.3	E.5	Battery Thermo Shock	ETB	YES	NYT	David/Mikulas
Req.F.E.4	E.6	Battery Temperature	ETB	YES	NYT	David/Mikulas
Req.F.E.1, Req.T.E.1 , Req.T.E.2, Req.T.E.3 , Req.T.E.4	E.7	Battery Drop	ETB	YES	NYT	David/Mikulas
Req.F.E.2 , Req.F.E.3	E.8	Data Acquisition AC and DC Calibration	FISH FM	YES	NYT	David
Req.F.E.4 Req.F.E.4	E.9	Data Acquisition Data Rate	FISH FM	YES	NYT	David
Req.F.E.4,Req.T.E.6	E.10	Communication Synchronization	FISH FM, MAIN FM	YES	NYT	David/Mikulas
Req.F.E.4, Req.T.E.6	E.11	Communication Distance vs Data Rate	FISH FM, MAIN FM	YES	NYT	David/Mikulas
Req.F.E.16 Req.F.E.16 Req.F.E.16	E.12	Communication Interference	FISH FM, MAIN FM	YES	NYT	David/Mikulas
Req.F.E.1, Req.T.E.1 , Req.T.E.2, Req.T.E.3 , Req.T.E.4	E.13	Power Supply Capacity	FISH FM, MAIN FM	YES	NYT	David/Mikulas
Req.F.E.1, Req.T.E.1 , Req.T.E.2, Req.T.E.3 , Req.T.E.4	E.14	Power Supply Maximal Current	FISH FM, MAIN FM	YES	NYT	David/Mikulas
Req.F.E.1, Req.T.E.1 , Req.T.E.2, Req.T.E.3 , Req.T.E.4	E.15	Power Supply Voltage Regulators	FISH FM, MAIN FM	YES	NYT	David/Mikulas
Req.F.E.1, Req.T.E.1 , Req.T.E.2, Req.T.E.3 , Req.T.E.4	E.16	Accelerometer Temperature Stability	FISH FM	YES	NYT	David
Req.F.E.7	E.17	Accelerometer Bias	FISH FM	YES	NYT	David
Req.F.E.8, F.E.14	E.18	Optical Proximity Sensors	MAIN FM	YES	NYT	Mikulas
	E.19	Hall Proximity Sensors	MAIN FM	YES	NYT	Mikulas
	E.20	Magnetic Compass	MAIN FM	YES	NYT	Mikulas