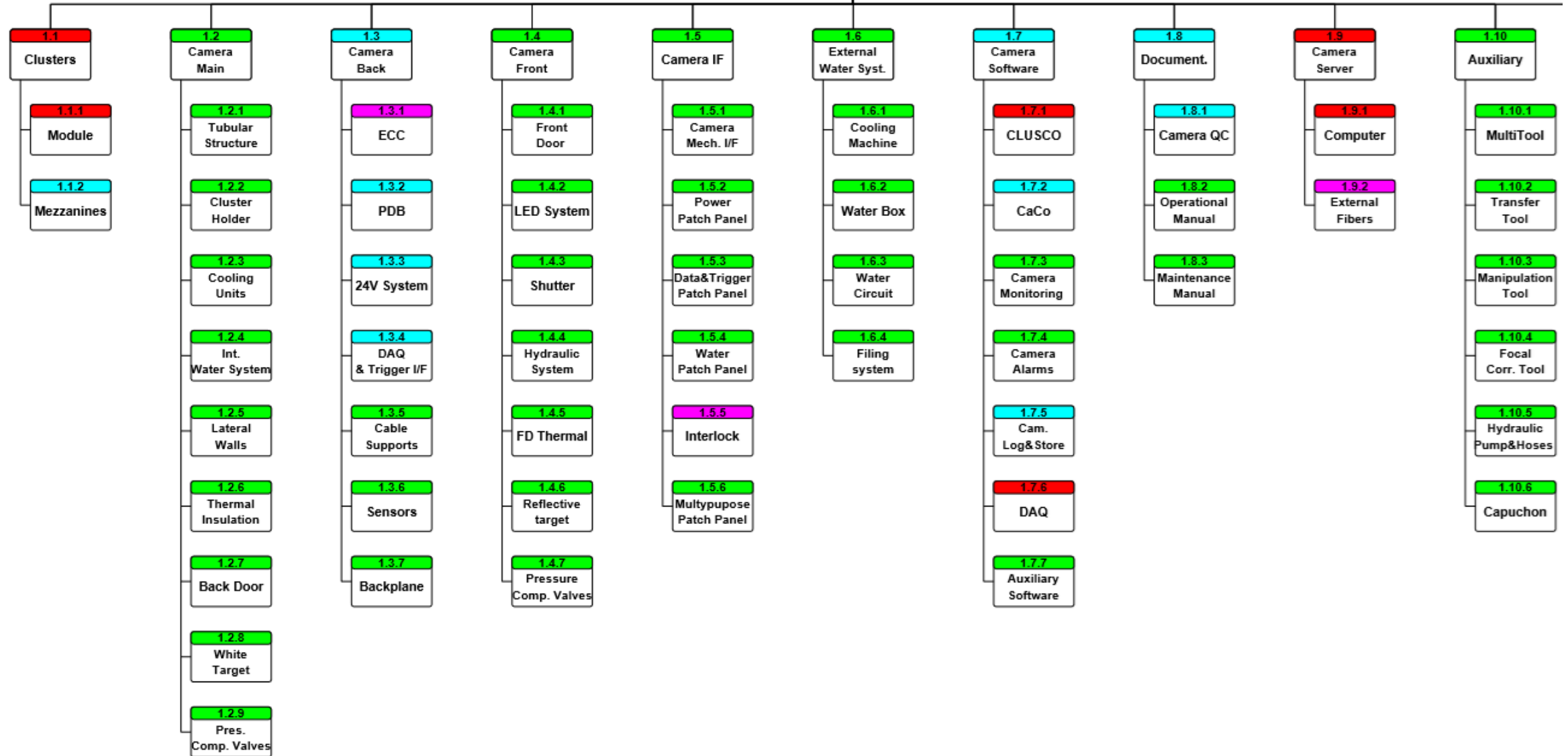


Camera maintenance

1
LST24
CAMERA

Rev: 17-Jan-2019



Foreseen spares (CAM)

Line-Replacable Unit (LRU)	
COMPONENT	QUANTITY
Backplane	30
Central Backplane	2
Trigger Interface Board (TIB)	1
Unified Clock and Trigger System (UCTS)	1
Data Ethernet Switch	4
Main Ethernet Switch	2
Camera Control Server	1
Camera Server	1
Intelligent Relay	2
Modules	15
Fans	2

Lower Line-Replacable Unit (LLRU)

COMPONENT	SUB-COMPONENT	QUANTITY	LST2-4
PDB	Schneider Magnetothermic Circuit Breaker, 3-phase In (A9F85420)	1	
PDB	Schneider Magnetothermic Circuit Breaker, 3-phase Out (A9F75310)	1	
PDB	Schneider Magnetothermic Circuit Breaker, 1-phase Out (A9N21554)	2	
PDB	PRD1-25r Fuses: Type 1 Spark Gap (Schneider 16315)	4	
PDB	PRD1-25r Fuses: Type 2 MOV (Schneider 16316)	4	
PDB	PRD1-25r Fuses: Type 1 Spark Gap for Neutral (Schneider 16317)	2	
ECC	cRIO 9068 8 slot compact RIO crate Controller	1	
ECC	NI 9147 4 slots extension crate	1	0
ECC	NI 9216 PT100 RTD Analog Input, 50 S/s/ch, 8 Ch Module	1	
ECC	NI 9476 32 channel 24V digital output module	1	
ECC	NI 9425 32 channel 24 V digital input module	1	
ECC	NI 9209 16 channel +/-10V analog input module	1	
ECC	NI 9512 Stepper Drive Interface Module with Encoder Feedback	2	0
ECC	SMD7611 stepper Drive	2	0
ECC	NI9512 cable	2	0
ECC	NI PS15 24V power supply	1	
ECC	LED box filled with one LED PCB	1	
ECC	Schneider DT40 Circuit breaker	1	
ECC	Phoenix Contact Thermo Magnetic circuit breaker UT6 TMC	1	
ECC	Finder 80.01.0240.0000 Time delay relay	1	
ECC	37 pin DSUB interface module	1	0
ECC	37-pin DSUB to 37PIN DSUB cable	1 each type	
ECC	Patch panel connectors and cables (TBD)	1 each type	
ECC	Terminal blocks	5	
ECC	ECC internal patch panel PCB		1
PSB	PULS QT40.241 24V Power Supply	2	
PSB	PULS YR80.241 Redundancy Module	1	
PSB	Current Transformer MCR-SL-CUC-200-U	1	
PSB	24V, 10A Solid-State Relay	2	
Module	PMT	99	
Module	SCB	30	

	LST Maintenance Estimate		Number of Items for product	Activity	Action type	Single Activities			Total Person [h / year]	
						Frequency per year(single item)	Duration [hours]	Persons needed		
8.3		Camera							87,72	
8.3.1		Mechanics Structure	-	-	-	-	-	-		
8.3.1.0		Assembly and Testing								
8.3.1.1		Camera Body	-	-	-	-	-	-	-	
8.3.1.1.1		Main Structure	1	Inspect	Preventive	1,0000	1,000	2	2,00	
8.3.1.1.2		PMT Modules Holder	1	Inspect	Preventive	1,0000	1,000	2	2,00	
8.3.1.1.3		Module Mechanical Structure	265	Inspect	Preventive	0,0038	1,000	2	2,00	
8.3.1.1.4		Auxiliary Electronics Mechanical Support	4	Inspect	Preventive	0,2500	1,000	2	2,00	
8.3.1.1.5		Camera Cabling System	1	Inspect	Preventive	1,0000	1,000	2	2,00	
8.3.1.1.6		Internal Walls	1	Inspect	Preventive	1,0000	1,000	2	2,00	
8.3.1.2		Camera Fixation	1	Inspect	Preventive	1,0000	1,000	2	2,00	
8.3.1.3		Camera Enclosure (Camera Skin, Backdoor y External Patch Panel)	1	Inspect	Preventive	1,0000	1,000	2	2,00	
8.3.1.3.1		Camera Skin								
8.3.1.3.2		Back Door								
8.3.1.3.3		External Patch Panel								
8.3.1.4		Camera Front door								
8.3.1.4.1		Camera Shutter	1	Clean	Preventive	1,0000	1,000	2	2,00	
			Camera Shutter	1	Replace	Corrective	0,0740	4,000	2	0,59
8.3.1.4.2		Entrance Window	1	Clean	Preventive	2,0000	1,000	2	4,00	
		Entrance Window	1	Replace	Corrective	0,1000	2,000	2	0,40	
8.3.1.4.3		Targets for Displacement Monitoring	1	Clean	Preventive	2,0000	1,000	2	4,00	
8.3.1.4.4		Support for LEDs and DM targets								
8.3.1.4.5	Mechanics for front door									
8.3.1.4.6	Hydraulic System									
8.3.1.5	Star Imaging Screen	1	Clean	Preventive	2,0000	1,000	2	4,00		

	LST Maintenance Estimate		Number of Items for product	Activity	Action type	Single Activities			Total Person [h / year]
						Frequency per year(single item)	Duration [hours]	Persons needed	
8.3.2		Focal Plane Instrumentation	-	-	-	-	-	-	-
8.3.2.1		Light Guides	1855	Clean	Preventive	0,5000	0,001	1	0,93
8.3.2.2		Photosensors	1855	Replace	Corrective	0,0025	3,000	1	13,91
8.3.2.2.1									
8.3.2.2.2									
8.3.2.3		Preamplifier Board	1855	Replace	Corrective	0,0001	3,000	1	0,56
8.3.2.3.1		PACTA							
8.3.2.3.2		Preamplifier PCB							
		High Voltage	1855	Replace	Corrective	0,0001	3,000	1	0,56
		Magnetic Shielding	1855	Replace	Corrective	0,0001	0,000	0	0,00
8.3.2.4		FPI Slow Control Board	265	Replace	Corrective	0,0020	3,000	1	1,59
8.3.3		Signal Processing	-			-	-	-	-
8.3.3.1		Readout Board	265	Replace	Corrective	0,0045	0,500	1	0,60
8.3.3.2		L0/L1 Trigger							
8.3.3.2.1		L0 ASIC							
8.3.3.2.2		L1 ASIC							
8.3.3.2.3		L0L1 mezzanine							
8.3.3.3		Backplane	265	Manage	Preventive	1,0000	0,017	1	4,42
		Backplane	265	Replace	Corrective	0,0200	0,167	2	1,77
8.3.3.4		Trigger Interface Board	1	Manage	Preventive	1,0000	1,000	1	1,00
		Trigger Interface Board	1	Replace	Corrective	0,0040	4,000	2	0,03

	LST Maintenance Estimate	Number of Items for product	Activity	Action type	Single Activities			Total Person [h / year]
					Frequency per year(single item)	Duration [hours]	Persons needed	
8.3.4	Camera Auxiliary Systems	-	-	-	-	-	-	-
8.3.4.1	Ethernet Switches	7	Replace	Corrective	0,0143	2,000	2	0,40
8.3.4.2	Power Distribution System	-	-	-	-	-	-	-
8.3.4.2.1	Power Suply Box							
	Power Supplies	8	Replace	Corrective	0,0230	2,000	2	0,74
8.3.4.2.2	Power Distribution Box	1	Inspect	Preventive	1,0000	0,500	2	1,00
	Surge Protection Devices	0	Inspect	Preventive	1,0000	0,500	2	0,00
8.3.4.2.3	Bus Bars	1	Inspect	Preventive	1,0000	0,500	2	1,00
8.3.4.3	Environmental Control							
8.3.4.3.1	Cooling system							
8.3.4.3.2	Dehumidification							
8.3.4.3.3	Pressure Control							
	Environmental Control (Cooling System, Dehumidification, Pressure)	1	Inspect	Preventive	1,0000	2,000	2	4,00
8.3.4.4	Embedded Camera Controller (Compact Rio and Reference LEDs)	1	Manage	Preventive	1,0000	1,000	1	1,00
	Embedded Camera Controller (Compact Rio and Reference LEDs)	1	Replace	Corrective	0,0200	0,025	2	0,00
8.3.4.4.1	Compact RIO							
8.3.4.4.2	Reference LEDs	12	Inspect	Preventive	0,0833	1,000	2	2,00
	Reference LEDs	12	Replace	Corrective	0,0400	0,250	2	0,24
8.3.4.5	Unified Clock & Trigger Stamping Auxiliary	1	Manage	Preventive	1,0000	1,000	1	1,00
8.3.4.6	Camera Cabling							
8.3.4.6.1	Internal	1	Inspect	Preventive	1,0000	4,000	2	8,00
8.3.4.6.2	External	1	-	-	0,0000	0,000	0	0,00
8.3.4.7	External Cooling Unit	1	Inspect	Preventive	1,0000	2,000	2	4,00
8.3.4.8	Camera Server	1	Manage	Preventive	1,0000	8,000	1	8,00
8.3.4.9	Central CCD Camera Pixel							
8.3.4.10	Hydraulic Pump							
8.3.4.11	Transportation and installation Tool							

Current experience

- Shutter broke due to bad operation (there was no software protection)
- Replacement of 3 modules due to single pixel not working (infant mortality)
- One backplane replaced (working, but shouldn't have passed QC)
- Two mezzanines swapped (probably damaged due during installation)
- Water leaks identified and solved (required refilling)
- Camera server took one day to recover after unexpected power cut (RAID board to be replaced)
- Shutter broke

THE END