ICECUBE UPGRADE CHANGE LOG
March 2022

ID	Title	Reason for Change	Approval Date	Affected WBS	Budget Impact	Schedule Impact
CR1	pDOM Quantity Reduction	Reduce the quantity of pDOMs to be built from 120 to 20.	06/19/19	1.3.3.3	($212,350)	YES
CR2	Intermediate Distribution Facility (IDF) Removal	Remove the IDF in lieu of 2 Surface Junction Boxes and surface cables.	07/07/19	1.4.2.1 1.4.2.2 1.4.2.3	$431,098	YES
CR3	String Depth/Length	The cables lengths will be consistent for 7 strings.	07/11/19	1.2.9.5	N/A	N/A
CR4	Hole Order, & (X,Y) Geometry	The hole drilling order has been revised by the Drill Team.	07/19/19	1.2.8.6	N/A	N/A
CR5	Minor Schedule Changes in Calibration	End Date revisions need to be made to bring the WBS 1.5 schedule in line with LED Flasher Design activities.	07/03/19	1.5.2.1.1	N/A	YES
CR6	xDOM-ERD & D-Egg Test Procedures	Document changes in funding and in the testing procedures for D-Egg and xDom.	10/08/19	1.3.2.1.1	N/A	N/A
CR7	Mini-Main Boards	Use Mini-Main Board. The Mini mainboard (based on D-Egg and pDOM mainboard designs) is a mainboard without FPGA or digitizers.	03/13/20	1.5.1.1	YES	N/A
CR8	Upgrade Project Salary Allocation	Assign staff cost to contingency funds due to increased effort in project management, technical coordination, safety and system engineering as a	04/09/20	1.1.1.1 1.1.2.1 1.1.3.1 1.1.4.1	$468,975	N/A

		result of PY2 detail planning. Assign travel cost for project office personnel for project reviews to contingency funds.		1.1.5.1		
CR9	Contingency from PY2 will be used to make up funding shortfall at SKKUensure continuity of funding for camera production for D-egg mass production batch 1 and mDOM DVT	The main reason for the shortfall is the larger expected cost of the holding structures. It should be noted that the holding structures are still under discussion to try and find better or cheaper options. The cost of mDOM DVT and D-egg mass production batch 1 is $32,199 (USD) and the current Korean funding period is funded for $22,000, with a shortfall of $10,200. Therefore $10,200 is requested from contingency for PY2.	02/27/20	1.5.2.3	$10,200	N/A
CR10	CMS "Penetrator Cable Assembly" documents for a second PCA type added	Due to varying schedule and internal space constraints, the Penetrator Cable Assemblies (PCAs) used for D-Egg-type DOMs will feature different internal cables and main-board connectors than the PCAs used for mDOM and pDOM-type DOMs. Funds are required for engineering and to purchase prototypes for a second type of PCA. Additional activities are added to the schedule at WBS 1.4.1.3.3. The schedule of previously planned activities is not affected.	02/28/20	1.4.1.3.3	$64,000	N/A
CR11	Additional Engineering effort for Main Cable.	Original IceCube main cable supplier no longer has capability of producing fully assembled main cables (only subcomponents), so a second level cable assembly partner	03/02/20	1.4.1.1 1.4.2.1 1.4.2.2 1.4.2.3	$160,000	YES

		is required. Relocation of surface electronics to ICL and addition of surface cables and surface junction boxes necessitates additional engineering effort for design and procurement.				
CR12	Additional software development effort for embedded micro-controller programming	Need additional software development effort for embedded micro-controller programming to support D-Egg, mDOM, pDOM and mini-mainboard applications in the IceCube Upgrade effort Added additional manpower in the 1.6 development effort, as the effort needed to develop the embedded software was greater than the M&O manpower available are able to provide. A dedicated embedded programmer with expertise in this area has been identified and hired to provide needed software development effort.	01/28/20	1.6.1.4	$172,000	N/A
CR13	Risk retirement, contingency increase. At the time of PY2 detail planning and project review, cost estimates for PY2 were done with better accuracy. In addition, costs for PY1 are known, and is less than the budgeted amount. Therefore, surplus amount from PY1 is transferred to contingency and cost uncertainty risks for PY2 are reduced.	Retire non capital cost uncertainty risk for PY2. Risk reduction $597,420. Retire cost uncertainty risk for capital purchases of drill hose (PM9) and movers (PM14) form PY2 because they were purchased in PY1 and actual costs are known. Risk reduction $195,918. Total risk retirement with this CR is $793,338.	03/10/20	1.1 1.2 1.3 1.4 1.5 1.6	$793,338	N/A

CR14	Add WBS item to reflect consolidation of electronics development for standalone calibration devices	All standalone calibration devices (including 1.5.2.2.1 POCAM, 1.5.2.2.2 PencilBeam and 1.5.2.4 Acoustic Sensors are required to communicate through the Ice Comms Module, as are all photosensors. We have consolidated effort to create one common "mini-mainboard" for standalone calibration devices, which performs the same interface and control functions as the mainboards for the photosensors, but without unnecessary items such as digitizing electronics. The mini-mainboard has the following functionality: • Provide Power for ICM and host system • Provide MCU for control of host system • Provide signal and power interface to host system • Provide interface to penetrator This change will retire risk associated with multiple design efforts for the same required functionality. Retire WBS 1.5.2.6 Muon Tagger that is not needed to reach Upgrade project objectives. Cost is zero, all effort is in-kind.	03/13/20	1.5.2.6 1.5.2.7	N/A	YES
CR15	Administrative changes were made to the WBS Dictionary.	Reference CR#15 for all of the details.	04/20/20	1.3.4 1.4 1.4.3	N/A	N/A

				1.4.3.2 1.4.3.3 1.4.4.3		
CR16R	Purchase and oscilloscope cope for remote COVID-19 related work	$15,280 taken from Project Engineering Funds for COVID-19 related purchase.	06/25/20	1.1.4.1.1	$15,280	N/A
CR17	IceCube Upgrade String Design Complete	The IceCube Upgrade Strings Design is finalized. The CMD (Configuration Management Document) is going through final approval.	07/21/20	1.1.4.1.2	N/A	N/A
CR18	D-Egg Gel formulation change	The IceCube Upgrade Project made a process change to include a superiorly performing gel in the assembly of the D-Eggs.	07/06/20	1.3.2.5	N/A	N/A
CR19	WBS Dictionary Revision: 1.3 & 1.4	Introduction of three L4 elements to the so-far standalone L3 element WBS 1.3.4 Ice Comms Module (ICM). This reflects and helps to manage the significant effort that is required for the ICM firmware. Introduction of the mini-FieldHub into the WBS Dictionary as a significantdevelopment step towards thefull IceCube Upgrade communication system.	09/23/20	1.3.4.2 1.3.4.3	$104,762	N/A

CR 20	IceCube Upgrade String Break-out revisions	Moving the instruments attached to quad 21 down by 6 m provides enough room toinstall these YaleGrips back to back. To preserve interchangeability of the maincable assemblies, this change should be made to all cables. By removing the quad 21 breakout connector from the load path, this change also increases the mechanical safety factor of the main cables.	09/18/20	1.4.1.1	N/A	N/A
CR 21	Addition of Dust Logger to Plan	Pending in System	N/A	1.5.3.4	N/A	N/A
CR 22	mDOM PMT ERD Change	Linearity requirement clarification for the PMT.	11/05/20	1.3.1.2	N/A	N/A
CR 23	Change in mDOM PCA Connector	A more robust connector is required for the mDOM.	01/25/21	1.4.1.3	N/A	N/A
CR 24	Drill Cable	$137,099 are drawn from contingency to cover the cost of a second Main Drilling Cable.	09/30/21	1.2.3.5	$137,099	N/A
CR 25	Purchase Fibron Deployment Cable prototype	$64,975 Draw on Contingency to cover costs and reduce risk. Due to difficulties in identifying a supplier to fabricate Main Cables from twisted quads produced by	06/22/21	1.4.1.1	64,975	N/A

		Hexatronic Cables & Interconnect, we will purchase a sample cable for evaluation from an alternative supplier (Fibron Ltd.).				
CR 26	xDOM ERD Change	The following requirements will be added to xDOM ERD, mDOM ERD, D-Egg ERD, and PDOM ERD: FR-2A Maximum Data Rate: mDOMs shall on average not produce more than 550 kb/s of payload data. All other devices shall on average not produce more than 200 kb/s of payload data.	08/16/21	1.3	N/A	N/A
CR 27	WBS Dictionary Updates	There were a number of missing assignments, names and institutions, on WBS entries. Several WBS L4 items were mixed between multiple NSF supported institutions, and some minor pending changes were also rolled up into this change request to catch the WBS Dictionary up for the PY3 Annual Report submission.	11/30/21	1.3.1.0 1.3.1.1 1.3.1.8 1.3.2.1 1.3.2.7 1.3.3.1 1.3.3.3 1.3.5.2 1.3.5.4 1.6.1.6	N/A	N/A
CR 28	SPAT ERD	On hold pending PY4 Rebaseline Review				
CR 29	PCA Testing	Cost increases due to acceptance testing performed at MSU for PGAs that were reworked by WIPAC.	3/16/22	1.4.1.3	6,349	Slight
CR 30	Strings CMD Changes	The module configurations on the string are being changed.	In-process		0	N/A
CR 31	Expedited Contingency Purchases	We request the use of contingency to pay for the costs of these expedited purchases for piece parts	In-process		TBD	N/A

		that are delayed due to a prior lack of availability. The purpose is to buy parts quickly as they become available on the market.				
CR 32	Design Baseline Library Admin. Changes	Changes to design Baseline Library nomenclature	In-process		0	N/A
CR 33	Revise mDOM Dark Rate Threshold Requirements	To accept the discrepant Hamamatsu PMTs (NCMR#22-01), the PMT Dark Rate spec. needs to be opened to accommodate these PMTs.	In-process		TBD	N/A