

How to relate the IceCube Upgrade Basis of Estimates to the Cost Workbook

The basis of estimates are all of the same template. They briefly describe the scope of the element being costed, along with the WBS dictionary. There are three tables that form the heart of the BOE: one for Equipment (either Capital Expense – CapEx – or Materials and Supplies – M&S). Capitalized equipment does not have indirect charges, whereas M&S does. The WBS and Activity Columns can be found in the Cost Workbook.

Travel is divided into domestic and foreign. Deployment travel (to the South Pole) is considered foreign travel. The cost of travel is standardized as discussed in the “Key Assumptions Document” and backed up by analysis of recent travel (“Travel Analysis document”).

Labor is estimated in hours in the BOEs. These hours are then recorded in the cost workbook and costs are calculated according to the labor rate, fringe, and indirect at the respective institution. You can find these rates in the respective columns in the cost workbook.

Where available, quotes or invoices are used to back up the numbers in the BOEs. These can be found either in the body of the BOE or in the directory that the BOE is found.

The cost workbook is an excel spreadsheet and the formulas are visible that are used for calculating total costs, including labor rates, fringes, and indirect costs. Various pivot tables are used to populate the year-by-year 1030 forms, which are separate tabs in the cost workbook. In addition, stand alone 1030’s have been made that remove the reference to the cost workbook pivot tables for convenience. These numbers come directly from the 1030 tabs in the cost workbook, so the information can be easily traced from the 1030’s through the cost workbook.

Below is a snapshot of the cost workbook and how to navigate it. First the different tabs:

A	B	C	D	E	F	G	H	I	J	K
L2	WBS	Institu	Schedule Task Name	Cost Activity	Resource	Type	Subtype	Resource ID	Estimating Technique	Actual
1	1.1.1.1.1	UW	Project Administration (B)	Project admin - principal investigator	Hanson	Labor Hours	Labor - LoE	KE	A - Analogy	
2	1.1.1.1.1	PSU	Project Administration (B)	Project admin - Doug Cowen	Cowen	Labor Hours	Labor - LoE	KE	A - Analogy	
3	1.1.1.1.1	UMD	Project Administration (B)	Project admin - Greg Sullivan	Sullivan	Labor Hours	Labor - LoE	KE	A - Analogy	
4	1.1.1.1.1	UW	Project Administration (B)	Project Director-ODell	ODell	Labor Hours	Labor - LoE	KE	A - Analogy	
5	1.1.1.1.1	UW	Project Administration (B)	Project manager-Feyzi	Feyzi	Labor Hours	Labor - LoE	KE	A - Analogy	
6	1.1.1.1.1	UW	Project Administration (B)	Project Office M&S		M & S	M & S		E - Extrapolation from Actuals	
7	1.1.1.1.1	UW	Project Administration (B)	Project Advisory Panel Reviews - Panel Members		Domestic	Travel		E - Extrapolation from Actuals	
8	1.1.1.1.1	UW	Project Administration (B)	Compensation		Domestic	Travel		E - Extrapolation from Actuals	
9	1.1.1.1.1	UW	Project Administration (B)	PO-Travel		Foreign	Travel		E - Extrapolation from Actuals	
10	1.1.1.1.1	UW	Project Administration (B)	PO-Travel		Finance	Labor Hours	MA	A - Analogy	
11	1.1.1.2.1	UW	Project Controls and Finance (B)	Finance -		Controls	Labor Hours	MA	A - Analogy	
12	1.1.1.2.1	UW	Project Controls and Finance (B)	Project Controls -		Zernick	Labor Hours	MA	A - Analogy	
13	1.1.1.3.1	UW	Quality, Safety Management, Document Control	Quality / Safety - Zernick						
14	1.1.1.4.1	UW	Systems (B)	Logistics-Tosi		Tosi	Labor Hours	SC	A - Analogy	
15	1.1.1.5.1	UW	Systems Engineering (B)	System Engineering-Sandstrom		Sandstrom	Labor Hours	SE	A - Analogy	
16	1.1.1.5.1	UW	Systems Engineering (B)	Technical Coordination-DuVernois		DuVernois	Labor Hours	SS	A - Analogy	
17	1.2.1.2.1	UW	Implementation Management and Controls	EHWDC Project Management and Controls		McEwen	Labor Hours	SE	D - Expert Opinion	
18	1.2.1.2.5.1	PSL	2022-23 Management & Systems Engineering	(WIPAC_Implementation_Manager)		Benson	Labor Hours	EN-ME	D - Expert Opinion	
19	1.2.1.2.5.1	PSL	2022-23 Management & Systems Engineering	2022-23 Systems Engineering (Terry Benson)		Gibson	Labor Hours	EN	D - Expert Opinion	
20	1.2.1.2.5.1	PSL	2022-23 Management & Systems Engineering	2022-23 Management			Labor Hours	EN	D - Expert Opinion	
21	1.2.1.2.5.2	PSL	2022-23 Management & Systems Engineering	2022-23 Systems Engineering Support			Labor Hours	EN	D - Expert Opinion	
22	1.2.1.2.5.3	PSL	Drill Procedure Review	Drill Procedure Review			Labor Hours	EN	D - Expert Opinion	
23	1.2.1.2.5.3	PSL	Drill Hole Modeling	Drill Hole Modeling			Labor Hours	EN-ME	D - Expert Opinion	
24	1.2.1.2.6.1	PSL	2023-24 Management & Systems Engineering	2023-24 Management & Systems Engineering		Benson	Labor Hours	EN-ME	D - Expert Opinion	
25	1.2.1.2.6.1	PSL	2023-24 Management & Systems Engineering	2023-24 Management		Gibson	Labor Hours	EN	D - Expert Opinion	
26	1.2.1.2.6.1	PSL	2023-24 Management & Systems Engineering	2023-24 Systems Engineering Support			Labor Hours	EN	D - Expert Opinion	
27	1.2.1.2.6.2	PSL	PY6 Season Debrief	PY6 Season Debrief			Labor Hours	EN	D - Expert Opinion	
28	1.2.1.2.6.3	PSL	Drill Procedure Review	Drill Procedure Review			Labor Hours	EN	D - Expert Opinion	

Table of values used for Estimate Uncertainties (documented in the Key Assumptions Document)

Excel Cost Workbook (with all relevant formulas) of every costed task labeled by WBS#.

Tabs by Project Year (PY5=FY23) with pivot tables from main costbook used to fill in the 1030 forms. There are two tabs for each PY – one containing the pivot tables and one with the 1030 form filled in from the pivot table.

Below is some detail on the first few rows. The BOE connects to the cost workbook via the WBS number – i.e. the BOE for 1.1 will describe WBS 1.1.1.1 – 1.1.1.5.1. Depending on how complicated the areas are, BOEs may be at L2 or L3, but they always describe all elements in the cost workbook.

L2	WBS	Institu	Schedule	Task Name	Cost Activity	Resource Name	Type	Subtype	Resource ID	Estimating Technique	Actual
1	1.1.1.1.1	UW		Project Administration (B)	Project admin - principal investigator	Hanson	Labor Hours	Labor - LoE	KE	A - Analogy	
2	1.1.1.1.1	PSU		Project Administration (B)	Project admin - Doug Cowen	Cowen	Labor Hours	Labor - LoE	KE	A - Analogy	
3	1.1.1.1.1	UMD		Project Administration (B)	Project admin - Greg Sullivan	Sullivan	Labor Hours	Labor - LoE	KE	A - Analogy	
4	1.1.1.1.1	UW		Project Administration (B)	Project Director-ODell	ODell	Labor Hours	Labor - LoE	KE	A - Analogy	
5	1.1.1.1.1	UW		Project Administration (B)	Project manager-Feyzi	Feyzi	Labor Hours	Labor - LoE	KE	A - Analogy	
6	1.1.1.1.1	UW		Project Administration (B)	Project Office M&S		M & S	M & S		E - Extrapolation from Actuals	
7	1.1.1.1.1	UW		Project Administration (B)	Project Advisory Panel Reviews - Panel Members		Domestic	Travel		E - Extrapolation from Actuals	
8	1.1.1.1.1	UW		Project Administration (B)	PO-Travel		Domestic	Travel		E - Extrapolation from Actuals	
9	1.1.1.1.1	UW		Project Administration (B)	PO-Travel		Foreign	Travel		E - Extrapolation from Actuals	
10	1.1.1.1.2.1	UW		Project Controls and Finance (B)	Finance -		Finance	Labor Hours	MA	A - Analogy	
11	1.1.1.1.2.1	UW		Project Controls and Finance (B)	Project Controls -		Controls	Labor Hours	MA	A - Analogy	
12	1.1.1.1.2.1	UW		Project Controls and Finance (B)	Quality, Safety Management, Document Control		Zernick	Labor Hours	MA	A - Analogy	
13	1.1.1.1.3.1	UW		Systems (B)	Q&A / Safety - Zernick		Zernick	Labor Hours	MA	A - Analogy	
14	1.1.1.1.4.1	UW		Logistics (B)	Logistics-Tosi		Tosi	Labor Hours	SC	A - Analogy	
15	1.1.1.1.5.1	UW		Systems Engineering (B)	System Engineering-Sandstrom		Sandstrom	Labor Hours	SE	A - Analogy	
16	1.1.1.1.5.1	UW		Systems Engineering (B)	Technical Coordination-DuVernois		DuVernois	Labor Hours	SS	A - Analogy	
17	1.2.1.2.1.1	UW		Implementation Management and Controls	EHWD Project Management and Controls		McEwen	Labor Hours	SE	D - Expert Opinion	
18	1.2.1.2.1.2.5.1	PSL		2022-23 Management & Systems Engineering	(WIPAC_Implementation_Manager)		Benson	Labor Hours	EN-ME	D - Expert Opinion	
19	1.2.1.2.1.2.5.1	PSL		2022-23 Management & Systems Engineering	2022-23 Systems Engineering (Terry Benson)		Gibson	Labor Hours	EN	D - Expert Opinion	
20	1.2.1.2.1.2.5.1	PSL		2022-23 Management & Systems Engineering	2022-23 Management			Labor Hours	EN	D - Expert Opinion	
21	1.2.1.2.1.2.5.2	PSL		2022-23 Management & Systems Engineering	2022-23 Systems Engineering Support			Labor Hours	EN	D - Expert Opinion	
22	1.2.1.2.1.2.5.2	PSL		2022-23 Management & Systems Engineering	Drill Procedure Review			Labor Hours	EN	D - Expert Opinion	
23	1.2.1.2.1.2.5.3	PSL		2022-23 Management & Systems Engineering	Drill Hole Modeling			Labor Hours	EN-ME	D - Expert Opinion	
24	1.2.1.2.1.2.6.1	PSL		2023-24 Management & Systems Engineering	2023-24 Management & Systems Engineering		Benson	Labor Hours	EN-ME	D - Expert Opinion	
25	1.2.1.2.1.2.6.1	PSL		2023-24 Management & Systems Engineering	2023-24 Management		Gibson	Labor Hours	EN	D - Expert Opinion	
26	1.2.1.2.1.2.6.1	PSL		2023-24 Management & Systems Engineering	2023-24 Systems Engineering Support			Labor Hours	EN	D - Expert Opinion	
27	1.2.1.2.1.2.6.2	PSL		2023-24 Management & Systems Engineering	PY6 Season Debrief			Labor Hours	EN	D - Expert Opinion	
28	1.2.1.2.1.2.6.3	PSL		2023-24 Management & Systems Engineering	Drill Procedure Review			Labor Hours	EN	D - Expert Opinion	

Resource Name when known. Also used to distinguish Domestic / Foreign travel.

Resource ID (see KA)

GAO Cost Estimating Technique (see Key Assumptions Document)

L2 Area

Full WBS. This WBS number will also appear in the relevant BOE.

Cost type (labor, travel, M&S, CapEx). In the BOEs, labor hours are detailed and direct costs of travel, M&S, and CapEx. Translation of labor hours into costs and fully burdening of all costs happens in the cost workbook.

Additional descriptions by column labels:

Column P is the contingency code added by the estimator and detailed in the BOEs. It is translated to a % using the midpoint of the contingency range for each contingency code (see the first contingency tab and the formula in the workbook).

Column R is the total estimate uncertainty according to the contingency code and the total PY5-PY8 burdened cost (EO). Column S is the Indirect portion of the Estimate Uncertainty for the total PY5-PY8 indirect costs (=Indirect rate column N times the total EU column S, unless the item is CapEx in which case there is no indirect cost. Note that PSL is “capitalized labor” which means that the indirect costs are zero – this is reflected in column N for the PSL labor).

For PY5:

Columns U – AF contains the monthly distributions of one of the following:

- Labor hours
- Direct M&S (\$)
- Direct Travel (\$)
- CapEx (\$)

[As shown above, column G defines what the item is in one of these categories].

Column AG contains the total number of hours for PY5. Column AH translates this into months (using 1 FTE-year = 1800 hours as stated in the Key Assumptions Document).

Columns AI-AT translate each monthly number into direct \$\$ -- for labor it takes the #hours x Actual Rate (column K) x (1+Fringe[column M])xEscalation[column EQ]. For all other items, it just copies the value as a \$\$ amount (i.e. no adjustment).

Column AU is the sum of all 12 months in PY5 of all the direct costs. Column AV is the indirect amount (=Column AU x Column N if not CapEx). Column AW is the total direct + indirect of PY5. Column AX is the Estimate Uncertainty on the direct cost (column Q x AU) and Column AY is the Estimate Uncertainty on the Indirect cost (column Q x AV).

This is repeated for PY6-8.

Column EO is the total direct+indirect of PY5-PY8. Columns EP – ET are the escalation factors for each year – EP is the current year (FY22) which our estimates were made in, so has an escalation factor of 1. Each subsequent year is escalated by 2.15% (see Key Assumptions Document). These factors are applied to labor only.

EU-EX are a summary of salary costs PY5-PY8 without Fringe. EY-FB are a summary of fringe costs for PY5-PY8. Finally FC is the Level 3 area.