Basis of Estimate

1. WBS ID

1.2.7

$163,036 total cost for this WBS

2. WBS Name

Support Equipment - Off-ice

3. Estimated by

Terry Benson (University of Wisconsin)

4. WBS Dictionary Description

Includes the design, procurement, resurrection, construction, integration, and testing of other drill support systems and equipment: Mobile Expandable Container Configuration (MECC), Mechanical Shop, Electrical Shop, Spares and equipment milvans, Independent Firn Drill (IFD), and special handling equipment. Deployment hardware that directly interfaces with the drill infrastructure is included here.

5. Assumptions and Related Documents

The estimates described in this document rely on the following assumptions, which are consistent with the Project's "Key Assumptions" document" (1) and the "Cost Estimating Plan" (2).

- The cost estimate technique classifications (A-L) follow the US Government Accountability Office (GAO) best practices. These are summarized in the Project's Key Assumptions document (1). The techniques are: A=Analogy; C=Engineering build-up; D=Expert opinion; E=Extrapolation from actuals; F=Parametric; L=Learning Curves.
- Contingency codes are assigned to each item: C1—C8. These reflect the estimated uncertainty in the estimate. The meanings of the contingency codes and the percentage of contingency in each case are described in the Key Assumptions document (1).

6. Scope

The scope of this BOE covers the following L4 areas:

1.2.7.1	Independent Firn Drill	Identify/procure replacements/spares, system testing and commissioning.
1.2.7.2	Maintenance/Repair Inventory	Recon, identify/procure replacements/spares.
1.2.7.3	Shops (MECC, SEW, TOW, OML)	Identify/procure replacements, spares for tooling shops. Repair structure, workbenches, internal systems.
1.2.7.4	TestBed	Identify/procure replacements/spares, annual commissioning, maintenance, and decommissioning.
1.2.7.5	Tools and Equipment	General and specialty tools and equipment, resupply.

Noteworthy, the TestBed is a permanent hot water drilling test and training facility at PSL in Wisconsin. It is used as a stand-in for the actual drill equipment, which is located in Antarctica. It serves as our drill system development and proving grounds in the off-season.

7. Equipment, Materials, Supplies, Travel

The majority of the base cost for 1.2.7 procurements is equipment capitalized as part of larger drill or drill-related subsystems. There is also an annual recurring M&S base cost for consumables and tools. No travel is included in 1.2.7.

7.1. Equipment

1.2.7 capital equipment procurements are listed below.

1.2.7 CapEx

Grid View | 2 Sheets | 9 Columns | 4 Filters | Group | Summarize | 1 Sort

WBS	Activity	Subty...	12mo Subtotal PY5	12mo Subtotal PY6	12mo Subtotal PY7	12mo Subtotal PY8	Estimating Technique	Contingency
1.2.7.1.7	Support Equipment: IFD Follow-up Tasks (PY5)	CapEx	$2,000	$0	$0	$0	C - Engineering B	C3
1.2.7.2.2	Support Equipment: Procure Spares and Replacements	CapEx	$4,000	$4,000	$0	$0	D - Expert Opinior	C4
1.2.7.2.4	Support Equipment: Procure Hose Stock and Fittings	CapEx	$5,000	$0	$0	$0	D - Expert Opinior	C4
1.2.7.3.2	Shops: Procure Upgrade-Replacements, Spares	CapEx	$3,500	$0	$0	$0	D - Expert Opinior	C4
1.2.7.4.10	Testbed: Commission/Maintenance /Decommission (PY8)	CapEx	$0	$0	$0	$2,000	D - Expert Opinior	C4
1.2.7.4.7	Testbed: Commission/Maintenance /Decommission (PY5)	CapEx	$10,000	$0	$0	$0	D - Expert Opinior	C4
1.2.7.4.8	Testbed: Commission/Maintenance /Decommission (PY6)	CapEx	$0	$10,000	$0	$0	D - Expert Opinior	C4
1.2.7.4.9	Testbed: Commission/Maintenance /Decommission (PY7)	CapEx	$0	$0	$10,000	$0	D - Expert Opinior	C4

Total equipment cost is $50,500. While the IFD follow-up tasks are better-understood, the remainder of 1.2.7 is annually informed by field seasons and difficult to predict accurately. This includes annual resupply of general subsystem spares, maintaining the PSL TestBed, and TestBed configuration adaptations to support arising testing needs.

7.2. Materials & Supplies

1.2.7 M&S *base* costs are listed below.

1.2.7 MandS

Grid View | 2 Sheets | 11 Columns | 4 Filters | Group | Summarize | 1 Sort

WBS	Activity	12mo Subtotal PY5	12mo Subtotal PY6	12mo Subtotal PY7	12mo Subtotal PY8	Institution	Estimating Technique	Contingency	L3
1.2.7.5.5	Tools & Equipment: Procure Tools & Consumables	$5,000	$5,000	$5,000	$0	PSL	D - Expert Opinior	C4	1.2.7

Like equipment, the M&S costs here are for annual resupply, but include consumables, tools, batteries, etc.

7.3. Travel

There is no travel in this WBS area.

8. Labor

8.1. Labor Estimate

Labor is mainly the effort needed to identify annual resupply procurements, process those, and assemble and pack for shipment.

All labor estimates are based on expert opinion.

8.2. Summary of Labor Resources

1.2.7 Labor Hours

Grid View | 2 Sheets | 11 Columns | 4 Filters | Group | Summarize | 1 Sort

WBS	Activity	Resource ID	LPY5	LPY6	LPY7	LPY8	Institution	Estimating Technique	Contingency
1.2.7.1.7	Support Equipment: IFD Follow-up Tasks (PY5)	EN-ME	40	0	0	0	PSL	D - Expert Opinion	C3
1.2.7.1.7	Support Equipment: IFD Follow-up Tasks (PY5)	TE	24	0	0	0	PSL	D - Expert Opinion	C3
1.2.7.2.1	Support Equipment: Identify Spares and Replacements	EN-ME	24	0	0	0	PSL	D - Expert Opinion	C4
1.2.7.2.2	Support Equipment: Procure Spares and Replacements	EN-ME	20	20	0	0	PSL	D - Expert Opinion	C4
1.2.7.2.4	Support Equipment: Procure Hose Stock and Fittings	EN-ME	24	0	0	0	PSL	D - Expert Opinion	C4
1.2.7.2.5	Support Equipment: Spare Parts Inventory and Catalog - Electrical/Controls	EN-ME	16	0	0	0	PSL	D - Expert Opinion	C4
1.2.7.3.1	Shops: Identify Upgrade-Replacements, Spares	EN-ME	16	0	0	0	PSL	D - Expert Opinion	C4
1.2.7.3.2	Shops: Procure Upgrade-Replacements, Spares	EN-ME	32	0	0	0	PSL	D - Expert Opinion	C4
1.2.7.4.10	Testbed: Commission/Maintenance/Decommission (PY8)	TE	0	0	0	40	PSL	D - Expert Opinion	C4
1.2.7.4.10	Testbed: Commission/Maintenance/Decommission (PY8)	EN	0	0	0	40	PSL	D - Expert Opinion	C4
1.2.7.4.7	Testbed: Commission/Maintenance/Decommission (PY5)	TE	80	0	0	0	PSL	D - Expert Opinion	C4
1.2.7.4.7	Testbed: Commission/Maintenance/Decommission (PY5)	EN	80	0	0	0	PSL	D - Expert Opinion	C4
1.2.7.4.8	Testbed: Commission/Maintenance/Decommission (PY6)	TE	0	80	0	0	PSL	D - Expert Opinion	C4
1.2.7.4.8	Testbed: Commission/Maintenance/Decommission (PY6)	EN	0	80	0	0	PSL	D - Expert Opinion	C4
1.2.7.4.9	Testbed: Commission/Maintenance/Decommission (PY7)	TE	0	0	80	0	PSL	D - Expert Opinion	C4
1.2.7.4.9	Testbed: Commission/Maintenance/Decommission (PY7)	EN	0	0	80	0	PSL	D - Expert Opinion	C4
1.2.7.5.5	Tools & Equipment: Procure Tools & Consumables	EN	24	24	24	0	PSL	D - Expert Opinion	C4

9. References

[Ref-1] 1. **IceCube Upgrade Project.** *Key Assumptions for the IceCube Upgrade Project.*

[Ref-2] 2. —. *Cost Estimating Plan.*

Revision History

Date	Revised by	Summary of changes
2022-03-04	Barb Birrittella	Initialized document
2022-04-01	V. O'Dell	Updated tables
2022-04-10	Terry Benson	Updated tables