

IceCube Upgrade Project Management

F. Feyzi, Project Manager
WBS 1.1

ICNO/Upgrade Project - NSF Site Visit Review
March 17, 2020

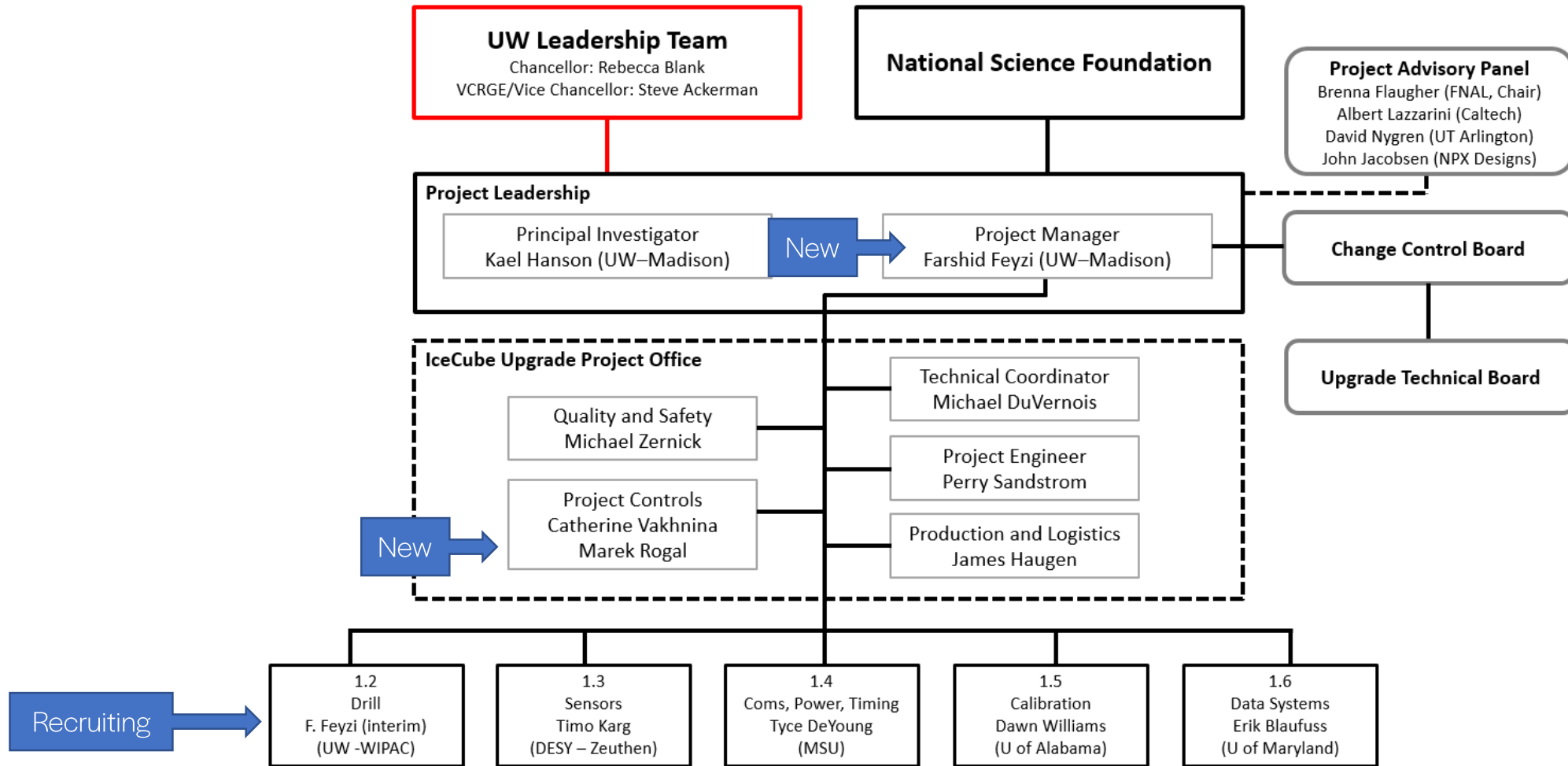


Outline

- Project office organization and functions
- Project scope and objectives
- Integrated cost estimates and schedule
- Earned value management
- Interactions with NSF and within project
- Risk and contingency

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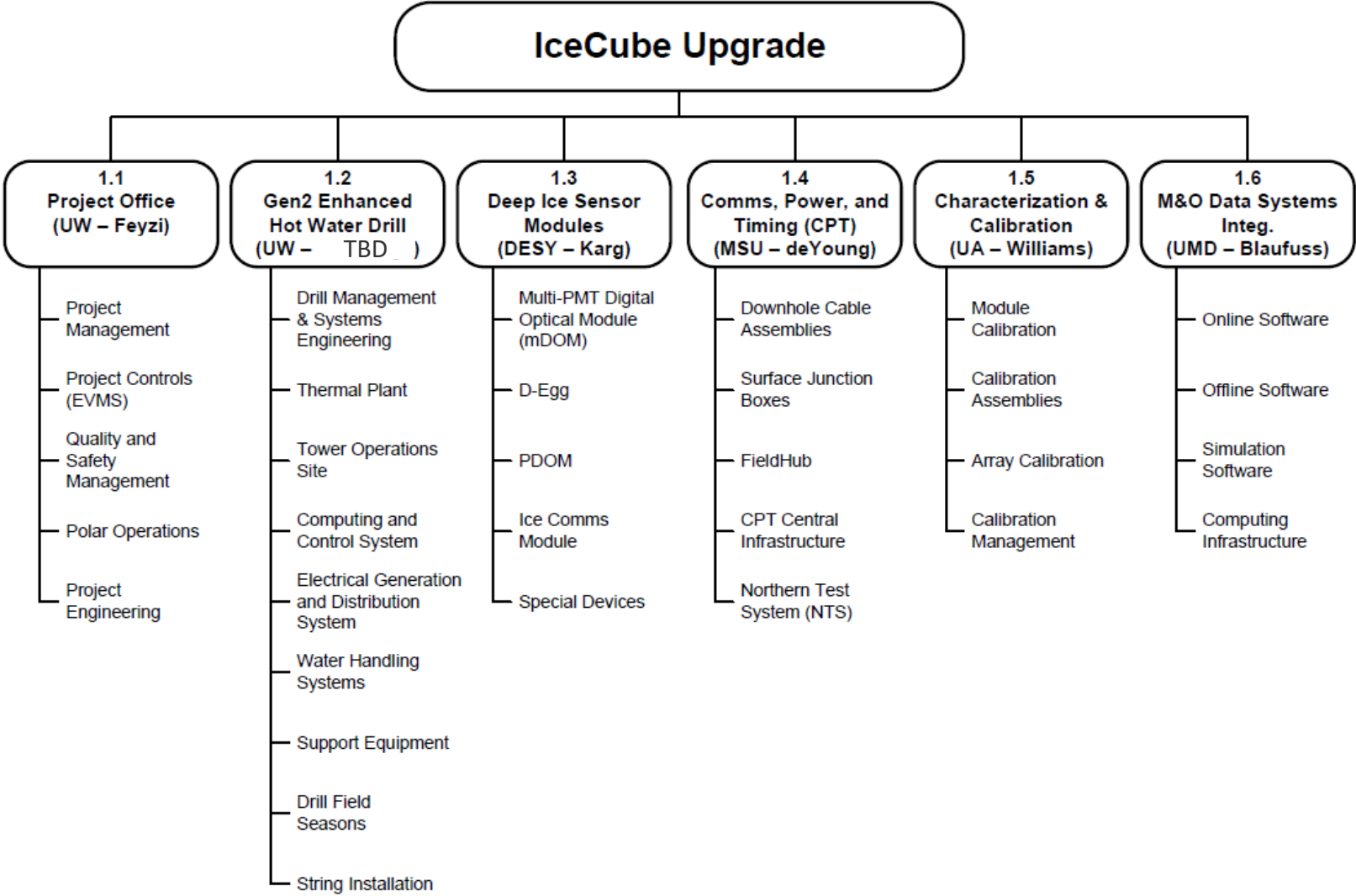
Project Office Established



WBS 1.1 Project Office Staffed and Working

- The project office has two main functions
 1. Technical coordination, project engineering, production and logistics
 2. Project controls, safety, quality and risk management
- Both support the PM and L2s in managing the scope, cost and schedule
- The Change Control Board is authorized through project office to manage overall project configuration
- Technical Board is authorized through project office to manage the technical scope of Upgrade, recommend changes to CCB
- Cost and schedule tracking and earned value management are conducted by the project office with input from L2, provide reports to stakeholders and to NSF
- Size of the project office is appropriate and meets project needs (see L2 talks)
- L2s and CCB meet weekly in a combined meeting,
- L2s meet monthly to review earned value

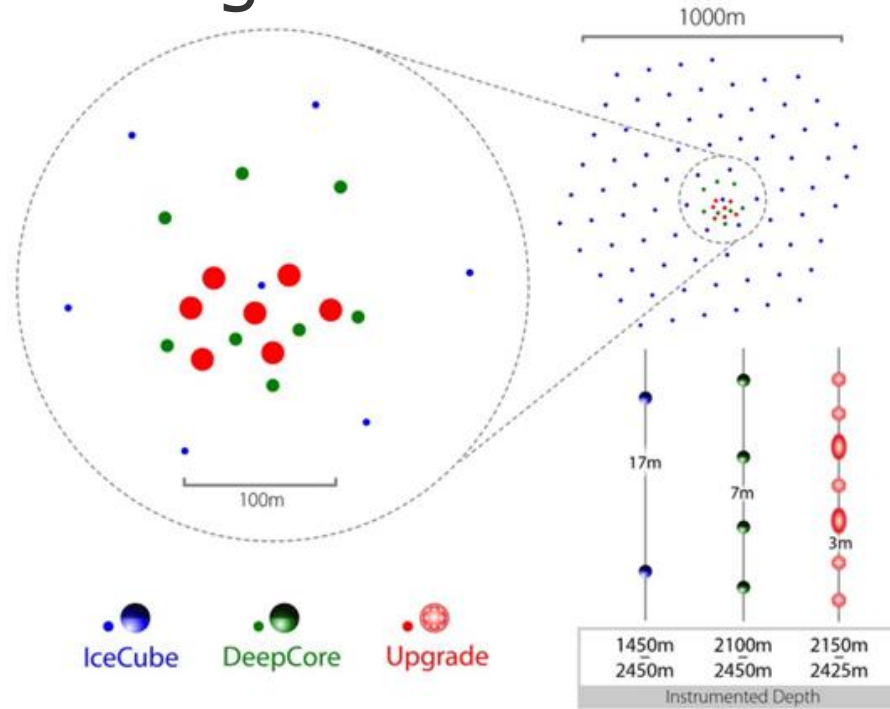
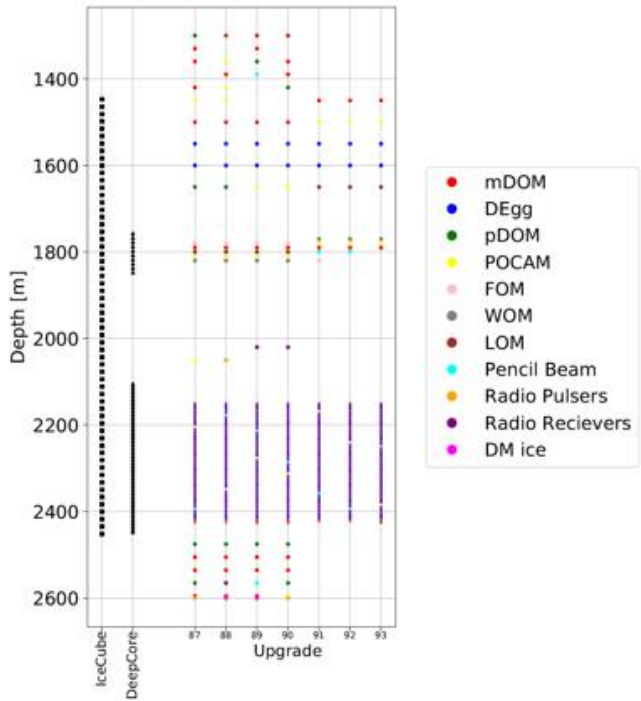
Level 3 Organization: Organized by L2 and approved by PM



See L2 talks, Defined in WBS dictionary



Upgrade Scope Unchanged



String	87	88	89	90	91	92	93	TOTAL
mDOM	55	56	58	53	61	59	60	402
DEgg	39	39	40	39	40	40	40	277
pDOM	1	1	2	1	2	4	3	14
WOM	2	2	1	2	1	1	1	10
FOM	2	2	0	0	1	1	1	7
POCAM	2	2	5	3	2	3	4	21
PB	1	2	1	2	3	1	1	11
PS	1	1	1	1	1	1	1	7
DM ice	0	0	1	0	0	1	0	2
RP	0	1	0	0	1	0	1	3
RR	1	0	0	0	0	2	0	3
AH	0	0	1	1	0	0	0	2
LOM	2	1	1	3	0	1	1	9
AP	2	1	2	1	1	1	2	10
ALL	108	108	113	106	113	115	115	778

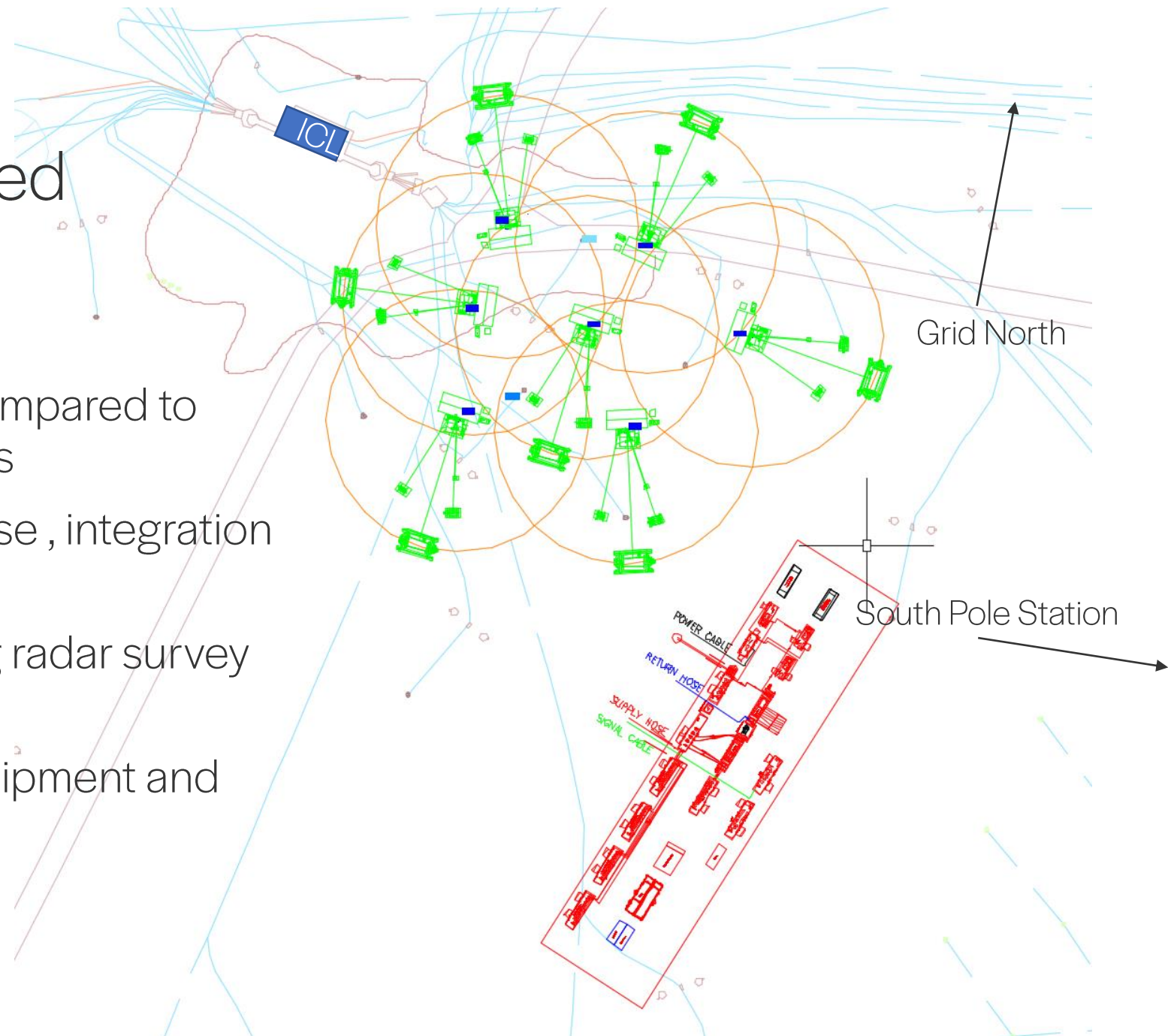
More on this in talk by
M. DuVernois

Upgrade Objectives:

1. Neutrino Properties
2. Recalibration and Reanalysis of IceCube Data
3. IceCube-Gen2 Research and Development, not directly funded

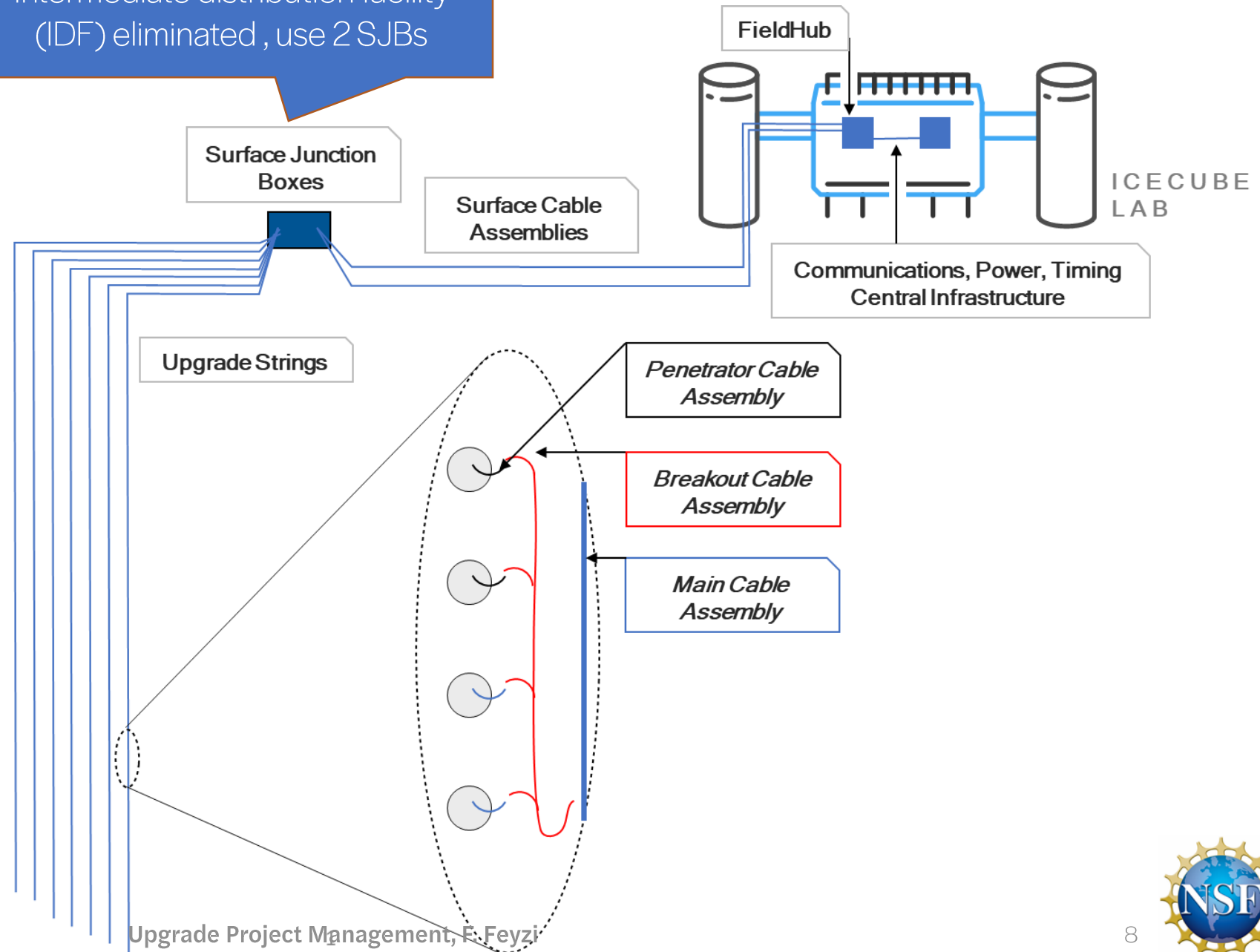
Surface Plan Carefully Studied

- Very close holes compared to IceCube Gen1 holes
- Logistics needs close , integration Gen1
- Ground penetrating radar survey completed
- Location of drill equipment and sequence defined



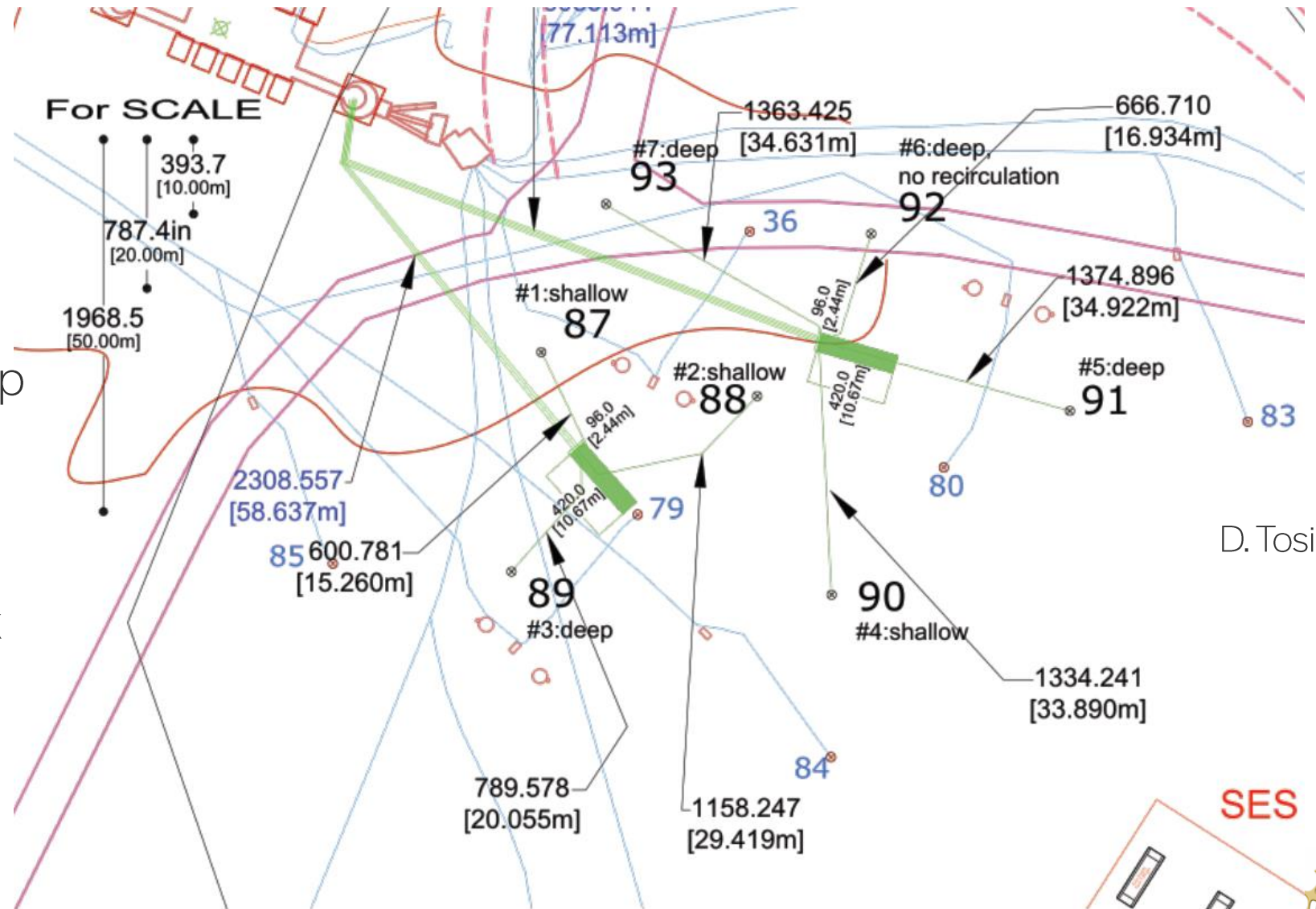
Configuration Updated

Intermediate distribution facility (IDF) eliminated, use 2 SJBs



Surface Cable Plan Done

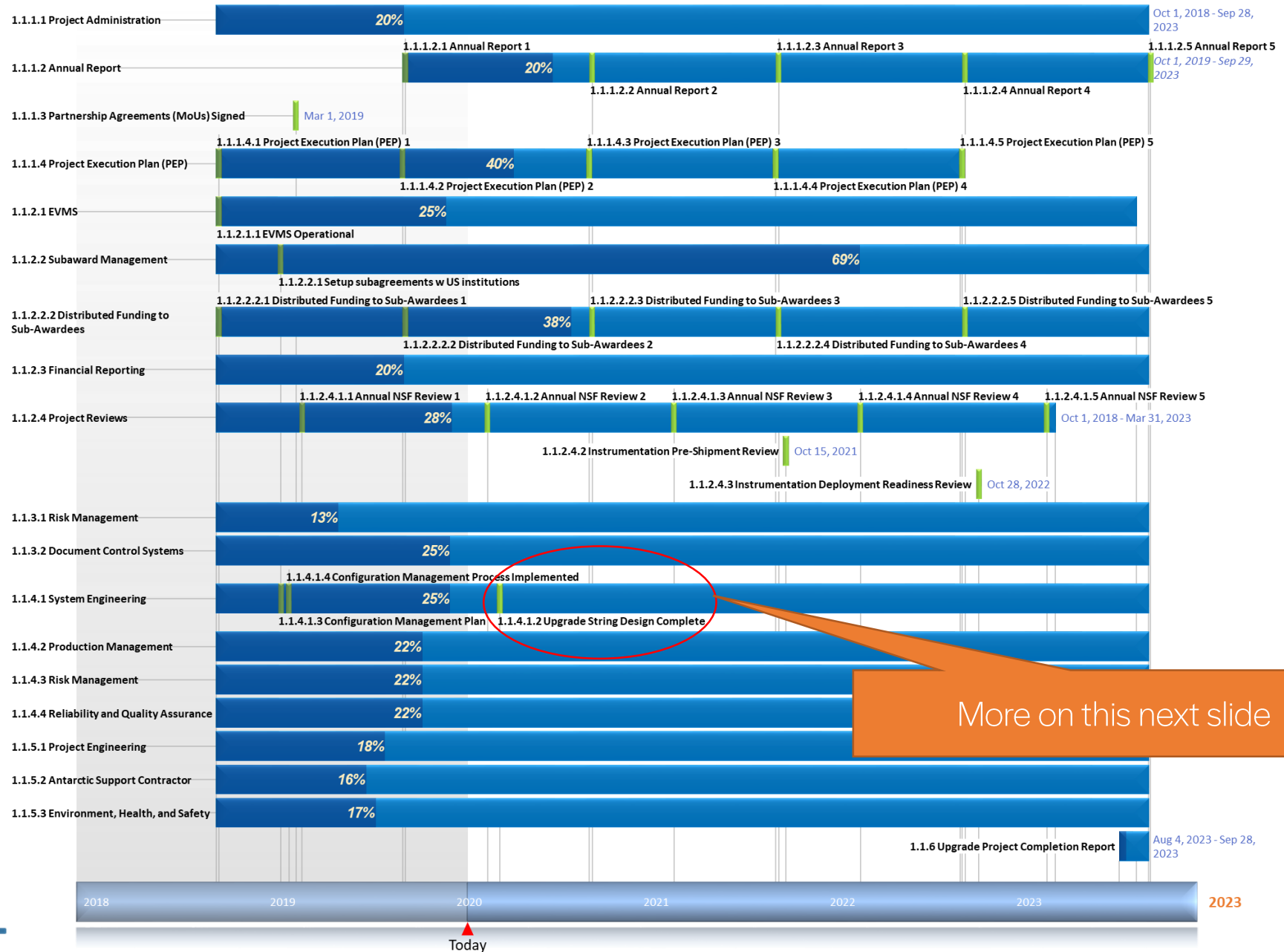
- Integration with IceCube holes, IceTop and cables need close attention
- Cable route to ICL investigated (see talk by T. Benson)



Project Schedule, Critical Path and L2 Interactions

- Project schedule is integrated for all WBS elements in one database and is available online (see talk by M. Rogal)
- Progress is recorded by L2s monthly and monitored in dashboard
- There are four seasons with very distinct deliverables for each, last being installation
- The connection of L2 scope of work to project schedule are through milestones tied to delivering for each of the four seasons
- You will see in each L2 talk schedule charts chosen by L2s and coming from project schedule and showing the critical activities and relationships
- The coordination between project office and L2s is working effectively

WBS 1.1 schedule



More on this next slide

WBS 1.1 Milestone

Upgrade String Design Complete

- Finalize what goes into every string:
 - DOMS, calibration devices, special devices, cables, harnesses, FieldHubs, SJBs
 - And what they need to be to meet Upgrade project objectives
- Deliverable to meet this milestone is a design report organized by WBS.
- This does not include the drill itself, which is not directly an element of the string
- See more in talk by M. DuVernois

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Communication with NSF working

- Project office has biweekly meeting with NSF to provide coordination and communication
- NSF participants: program officers, large facilities representative, contracts officer, logistics and cargo, Antarctic support contractor
- The group is named Integrated Project Team
- Issues that are managed through this interaction:
 - Cooperative agreement and funding profile
 - Yearly plan of expenditures
 - Fieldwork and support plans
 - Change requests requiring NSF approval
 - Monthly and annual reports
 - Annual site visit and reviews
 - Safety protocols

Project Review Schedule with NSF Established

2019CY									2020CY									2021CY									2022CY									2023CY									2024CY																											
2019FY									2020FY									2021FY									2022FY									2023FY									2024FY																											
Upgrade PY1									Upgrade PY2									Upgrade PY3									Upgrade PY4									Upgrade PY5																																				
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9																
									1				2								3				4									5				6	7a		7b						8				9									10												
									Drill Assess													Drill Repair												Drill Hot Test, Firm Drill 7 holes															Drill and install 7 Holes																							

- Fall (October, 2019) FY2020:
ICNO/Upgrade – Review of the updated Project Execution Plan (PEP) and the Budget Profile
- Spring (March, 2020) FY2020:
 Annual ICNO/M&O & ICNO/Upgrade Site Visit by the cognizant program officers and LFO
 CNO/M&O & Upgrade – NSF’s Business System Review
Request for a renewal proposal for ICNO/M&O, 2021–2026
- Fall (October 2020) FY2021:
External Panel Review of the ICNO/M&O Renewal proposal
ICNO/M&O renewal - Cost analysis and Financial viability review
- Spring (March-April 2021) FY2021:
M&O Renewal proposal projected start
 Annual ICNO/Upgrade Site Visit by the cognizant program officers and LFO
- Fall (September 2021) FY2021:
“Dry Run and Progress” - Mid-term External Review for ICNO/Upgrade project and ASC support
- Spring (March-April 2022) FY2022:
 Annual ICNO/M&O & ICNO/Upgrade Site Visit by the cognizant program officers and LFO
- Summer and Fall (June and September 2022) FY2022:
ICNO/Upgrade – NSF/Internal Construction/Deployment (drill and sensors)
7a. June 2022: Technical readiness review of drill and instrumentation
7b. Sept 2022: “go/no-go” for drilling in Nov 2022 – Jan 2023
- Spring (March-April 2023) FY2023:
 Annual ICNO/M&O & ICNO/Upgrade Site Visit by the cognizant program officers and LFO
- Fall (September 2023) FY2023:
ICNO/M&O – NSD’s Business System Review
ICNO/Upgrade award ends, Sep 30
- Spring (March-April 2024) FY2024:
Mid-term External Review for ICNO/M&O project

Upgrade
M&O
Both



NSF Funding profile in Cooperative Agreement Unchanged

FYI (NSF Appropriation year)	Baseline	Contingency	Total	PY
FY18	\$4,069,959	\$664,979	\$4,734,938	1
FY19	\$5,130,419	\$575,002	\$5,705,421	2
FY20	\$3,638,072	\$362,229	\$4,000,301	3
FY21	\$3,604,047	\$464,748	\$4,068,795	4
FY22	\$3,985,016	\$788,853	\$4,473,869	5
Total	\$20,127,513	\$2,855,811	\$22,983,324	



Performance
Measurement Baseline

WBS NSF Supported Cost Estimate to L3

WBS L3	Project Year					WBS Total
	Year 1*	Year 2	Year 3	Year 4	Year 5	
1.1.1	\$349,317	\$543,307	\$455,114	\$521,051	\$490,022	\$2,009,494
1.1.2	\$106,083	\$236,918	\$219,363	\$237,501	\$240,975	\$934,757
1.1.3	\$57,354	\$166,005	\$157,192	\$173,505	\$176,043	\$672,745
1.1.4	\$17,554	\$92,698	\$88,223	\$95,502	\$96,885	\$373,307
1.1.5	\$140,594	\$329,277	\$250,043	\$276,968	\$281,006	\$1,137,294
1.2.1	\$436,309	\$416,819	\$356,402	\$414,971	\$298,897	\$1,487,090
1.2.2	\$71,879	\$164,422	\$0	\$0	\$0	\$164,422
1.2.3	\$72,821	\$1,497,854	\$53,540	\$0	\$0	\$1,551,393
1.2.4	\$189,302	\$650,062	\$777,186	\$196,650	\$72,812	\$1,696,710
1.2.5	\$266,083	\$95,199	\$4,519	\$0	\$0	\$99,718
1.2.6	\$248,896	\$339,931	\$6,722	\$0	\$0	\$346,653
1.2.7	\$212,773	\$198,670	\$64,416	\$69,255	\$22,565	\$354,906
1.2.8	\$123,431	\$729,676	\$362,298	\$840,534	\$1,068,546	\$3,001,054
1.2.9	\$33,868	\$119,862	\$50,736	\$77,730	\$66,487	\$314,815
1.3.1	\$258,220	\$118,959	\$3,222	\$0	\$0	\$122,181
1.3.2	\$0	\$77,851	\$0	\$0	\$0	\$77,851
1.3.3	\$296,616	\$160,077	\$102,100	\$0	\$0	\$262,177
1.3.5	\$0	\$88,130	\$37,709	\$40,829	\$0	\$166,668
1.4.0	\$16,771	\$96,327	\$36,963	\$27,778	\$25,536	\$186,604
1.4.1	\$292,107	\$403,341	\$162,341	\$6,037	\$732	\$572,452
1.4.2	\$8,705	\$31,825	\$343,013	\$727	\$0	\$375,565
1.4.4	\$90,939	\$97,421	\$46,385	\$11,649	\$0	\$155,455
1.4.5	\$35,867	\$39,525	\$694	\$736	\$732	\$41,687
1.5.3	\$0	\$0	\$0	\$90,716	\$92,044	\$182,759
1.5.4	\$33,740	\$26,523	\$26,995	\$28,450	\$31,195	\$113,163
1.6.0	\$33,502	\$80,028	\$59,977	\$64,936	\$54,866	\$259,806
1.6.1	\$96,131	\$239,633	\$54,030	\$96,626	\$13,840	\$404,130
1.6.2	\$5,212	\$22,769	\$9,707	\$10,510	\$10,663	\$53,649
1.6.3	\$4,884	\$8,923	\$9,095	\$9,847	\$9,991	\$37,856
1.6.4	\$76,312	\$12,754	\$0	\$18,841	\$0	\$31,595
Annual Total	\$3,575,270	\$7,084,784	\$3,737,984	\$3,311,351	\$3,053,838	\$17,187,957
	\$2,924,892		Actual Total PY1			

* - Year 1 is not included in totals

Funding Management

- Total NSF Performance Measurement Baseline (PMB) \$22.983M unchanged since Sept 2018, this includes contingency
- PMB does not include contributions in kind
- PMB and contributions in kind tracked in project schedule
- PMB scope tracked in Earned Value Management System (EVMS)
- Yearly detail planning in August and September
- PY2 detail planning completed
- Added to PY3-PY5 yearly plans to arrive at estimate to complete-must stay within PMB
- Maintain contingency level in accordance with risk and cost uncertainty
- PY2 detail planning added to PY1 actuals to arrive at scope of PY2 work to stay within PY1+PY2 commitment, apply contingency as needed

Contributions in Kind

- Contributions in kind, L2s manage the budget within their scope
- Project schedule includes the work funded by contributions in kind
- Progress is tracked by L2s and reported for project
- Project office has established MOUs with most collaborating institutes
- MOUs are very high-level and are not contractual
- Individual L2 talks address the status

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Project Contingency Analyzed

Cost Estimate History

	PY1	PY2	PY3	PY4	PY5	Subtotal	Contingency	Total	% Cont
Rev 2 as submitted in September 2018	\$ 4,069,958	\$ 5,130,420	\$ 3,638,072	\$ 3,604,047	\$ 3,685,018	\$ 20,127,515	\$ 2,855,811	\$ 22,983,326	14%
As agreed by NSF in Cooperative Agreement V4	\$ 4,066,527	\$ 5,130,419	\$ 3,641,504	\$ 3,604,047	\$ 3,685,016	\$ 20,127,513	\$ 2,855,811	\$ 22,983,324	14%
PY2 replan as submitted (PY1 is actual)	\$ 2,925,655	\$ 7,084,784	\$ 3,737,985	\$ 3,311,351	\$ 3,053,838	\$ 20,113,613	\$ 2,869,713	\$ 22,983,326	14%

Risk Based Contingency Requirement

	YEAR1	YEAR2	YEAR3	YEAR4	YEARS5
Cost estimate uncertainty risk per year	\$0	\$223,883	\$474,132	\$284,535	\$342,438
Remaining external risk exposure at start of year	\$1,252,465	\$1,026,605	\$965,689	\$965,689	\$940,845
Contingency requirement to cover remaining external risk plus remaining cost uncertainty risk	\$2,577,453	\$2,351,593	\$2,066,794	\$1,592,662	\$1,283,283

Preserve for one additional deployment season

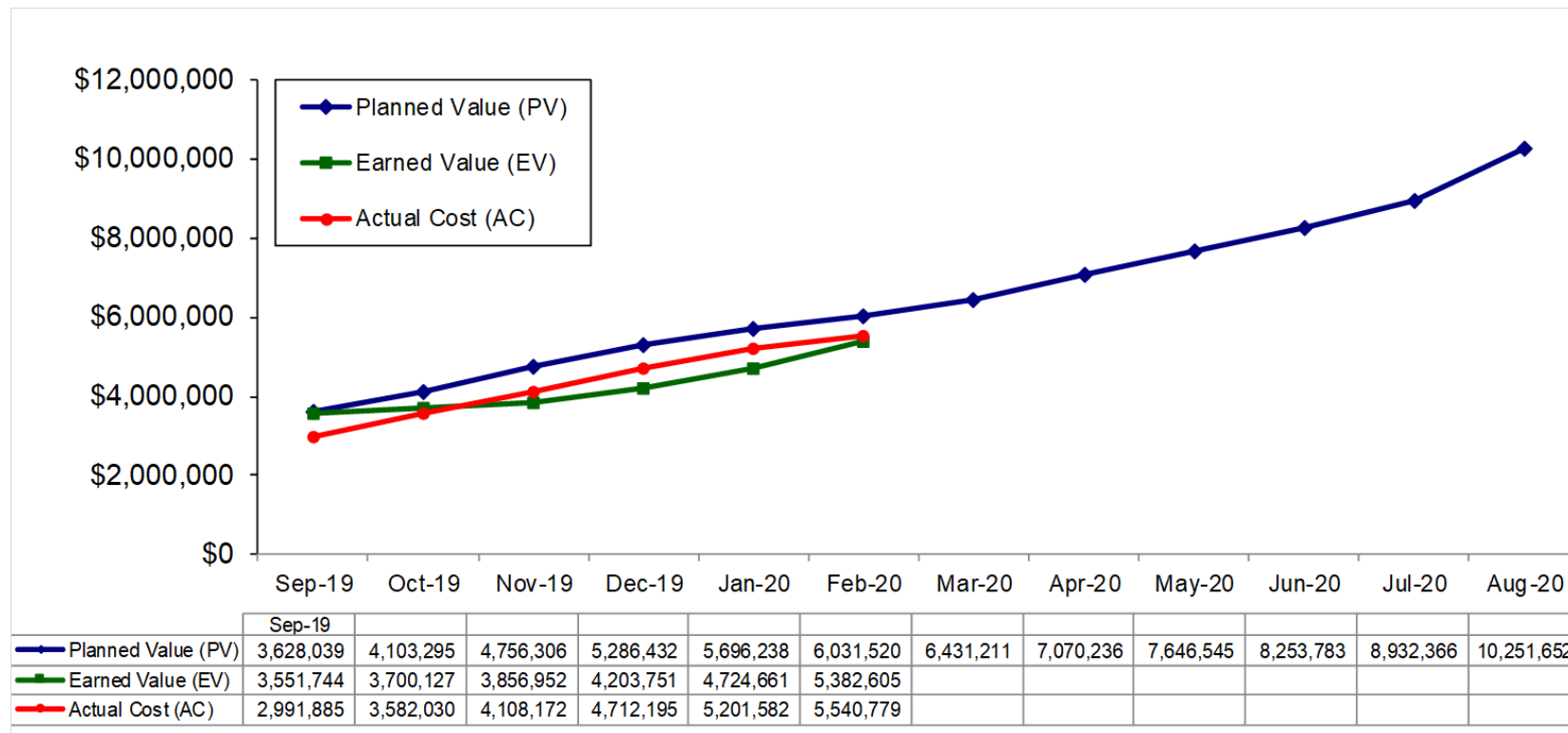
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Contingency Actively Managed

Estimate at completion (EAC)		\$	20,113,605		
Month	Actual cost		ETC	Contingency bal.	Cont as % of ETC
Jun-19	\$ 1,445,498	\$	18,668,107	\$ 2,855,811	15%
Jul-19	\$ 1,735,725	\$	18,377,880	\$ 2,855,811	16%
Aug-19	\$ 2,123,315	\$	17,990,290	\$ 2,855,811	16%
Sep-19	\$ 2,925,655	\$	17,187,950	\$ 2,855,811	17%
Oct-19	\$ 3,583,458	\$	16,530,147	\$ 2,855,811	17%
Nov-19	\$ 4,107,997	\$	16,005,608	\$ 2,844,167	18%
Dec-19	\$ 4,700,211	\$	15,413,394	\$ 2,844,167	18%
Jan-20	\$ 5,202,679	\$	14,910,926	\$ 2,844,167	19%
Feb-20					

Earned Value Management System (EVMS)

- EVMS system set up and functioning (see talk by C. Vakhnina)
- It is done the same for all WBSs but is most applicable to 1.2



Project Advisory Panel (PAP) Meeting and Report

- Second meeting was convened Feb. 26-27, 2020 to assess progress, ask for advice on going forward and seek critical feedback on project deliverables
- PAP members: Brenna Flaughner (Chair), David Nygren, Albert Lazzarini, John Jacobsen
- Executive Summary:
 - “We compliment the IceCube Upgrade team on the great technical and management progress it has made since the last review.
 - We are pleased to see the appointment of a knowledgeable project manager who has a long history of working with IceCube from its early beginnings.
 - The plan as presented is aggressive and success-oriented.
 - The stakes for success are high: funding prospects for Gen2, plus everyone’s safety... not to mention the fundamental science waiting to be done.
 - The PAP encourages the Upgrade team to be vigilant against overconfidence driven by the successes of IceCube Gen1.”

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Remaining Issues and Challenges for Project Office

- Remain within the total performance management baseline of cost and schedule
- Provide accurate and timely reports to NSF and other stakeholder
- Improve EVMS so it is a useful tool for L2s
- Manage technical reviews and scope commensurately with project schedule
- Ensure all systems are technically sound and will work as intended; L2 responsibility
- Manage risks and contingency and preserve sufficient funds for a possible extra season

Summary

- Project office established and working
- Interaction between L2s and project office on cost estimates and schedule established and effective
- Technical scope is defined, resources identified, schedule integrated and progress is on track (see L2 talks)
- Risk and contingency managed
- Safety and quality functions established and improving
- EVMS is established and improving

Backup

Drill - Schematic

ENHANCED HOT WATER DRILL – IceCube Upgrade

PSL v20190301

SYSTEM SCHEMATIC

Intent: Drill 7 IceCube-magnitude holes in one season to support installation of the IceCube Upgrade

Capacities: 4.6 MW thermal delivered to drill nozzle; 250 kW system electrical load

Run two gensets at a time, each at 125 kW, third genset is online backup

Makeup water obtained from stationary Rodwell, supported by ARA Hot Water Drill (pump, heat, hose reel – RWS no longer available)

