Project Organization, Finances, and In-Kind Contributions

John Kelley
IceCube Director of Operations

Laura Mercier, PMP
Research Administrator Manager

NSF Mid-Term Review
29 April 2024

IceCube
South Pole Neutrino Observatory

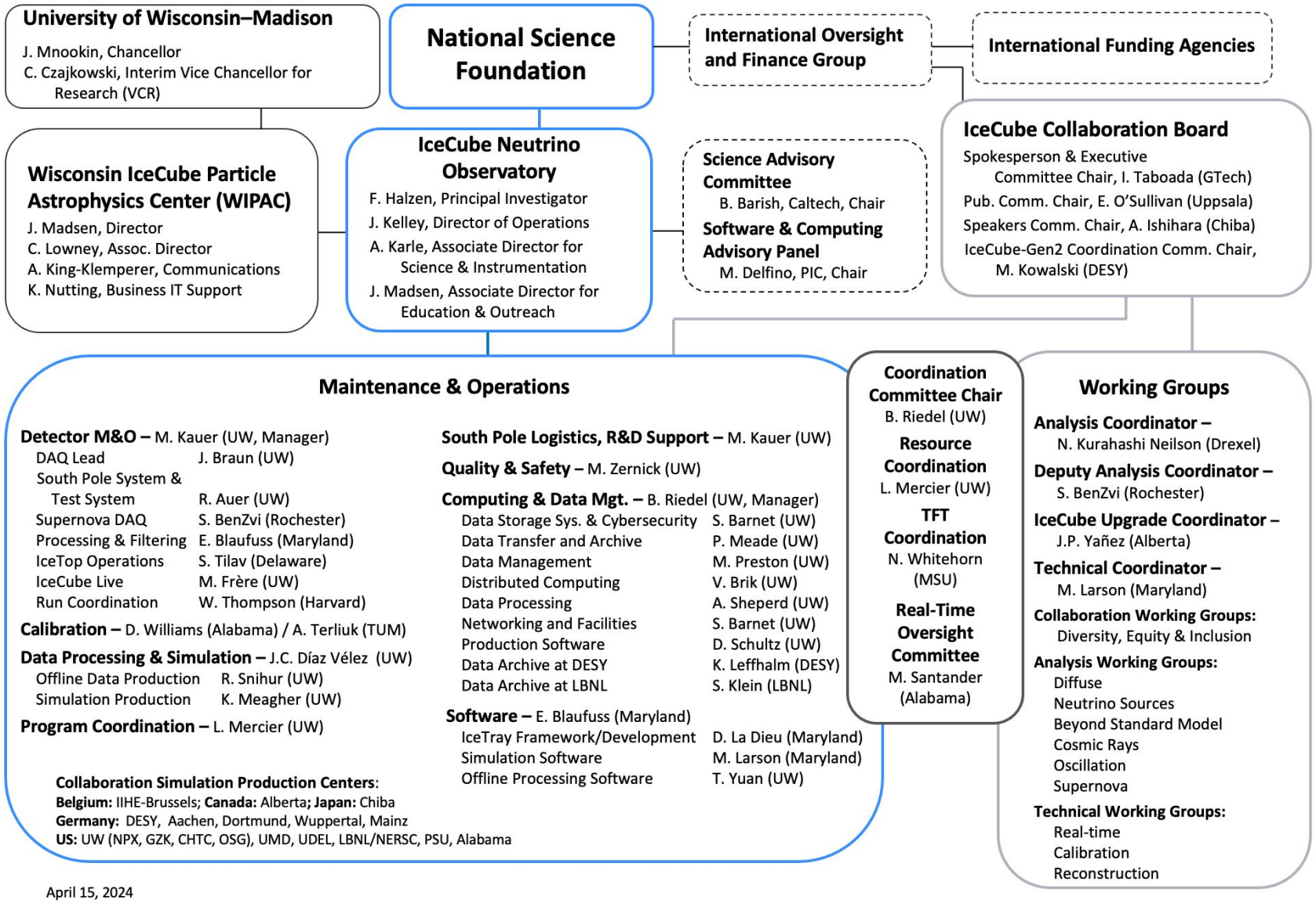
NSF

Outline

- Project Organization
  - ICNO organization chart
  - Work Breakdown Structure
  - M&O management and coordination

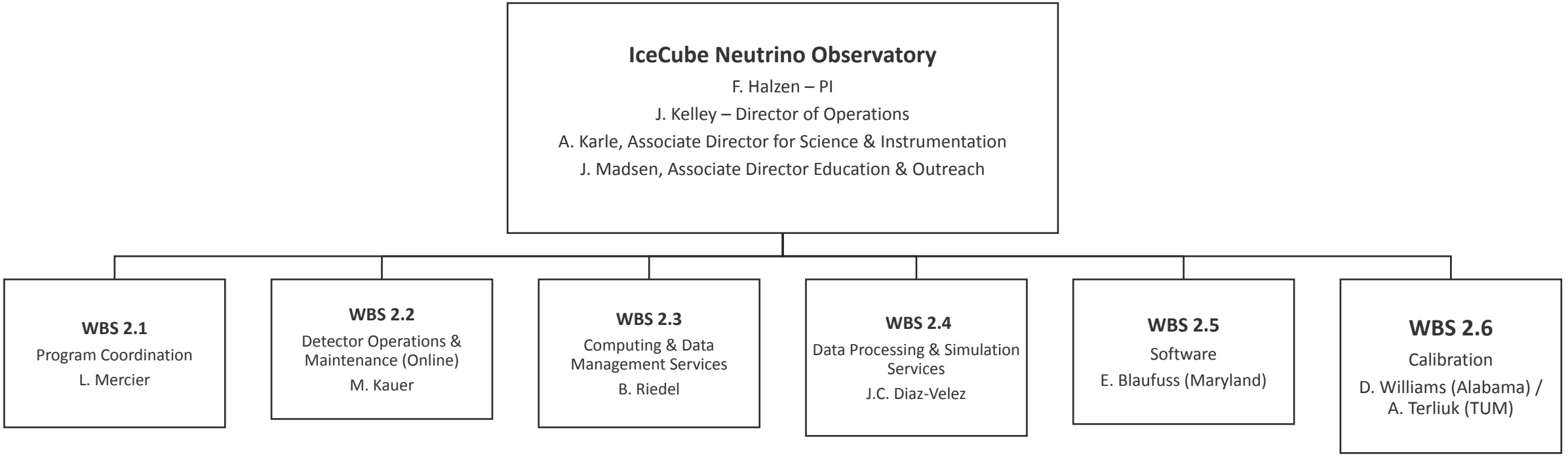
- Financial Management and Status
  - accounts
  - M&O award and subawards
  - common fund contributions and expenses
  - in-kind contributions
  - budget and actuals
  - labor inflation and PY4/PY5 plan

ICNO Organization Chart



April 15, 2024

Work Breakdown Structure (WBS)

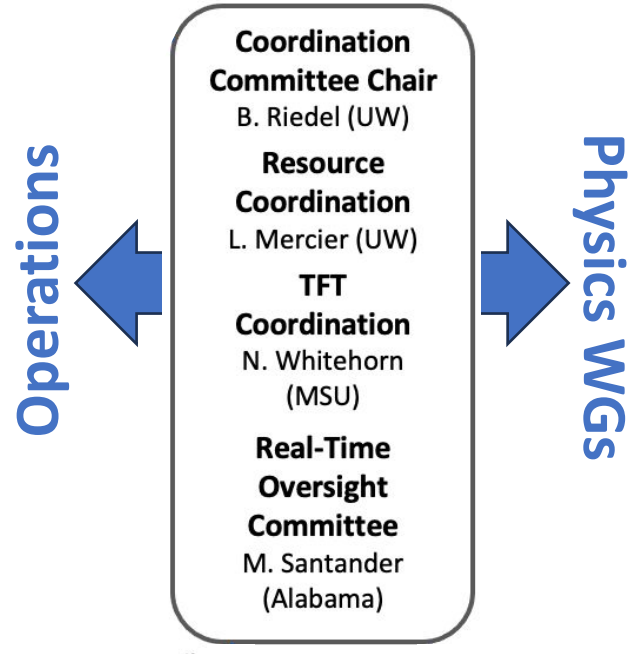


M&O Management and Coordination

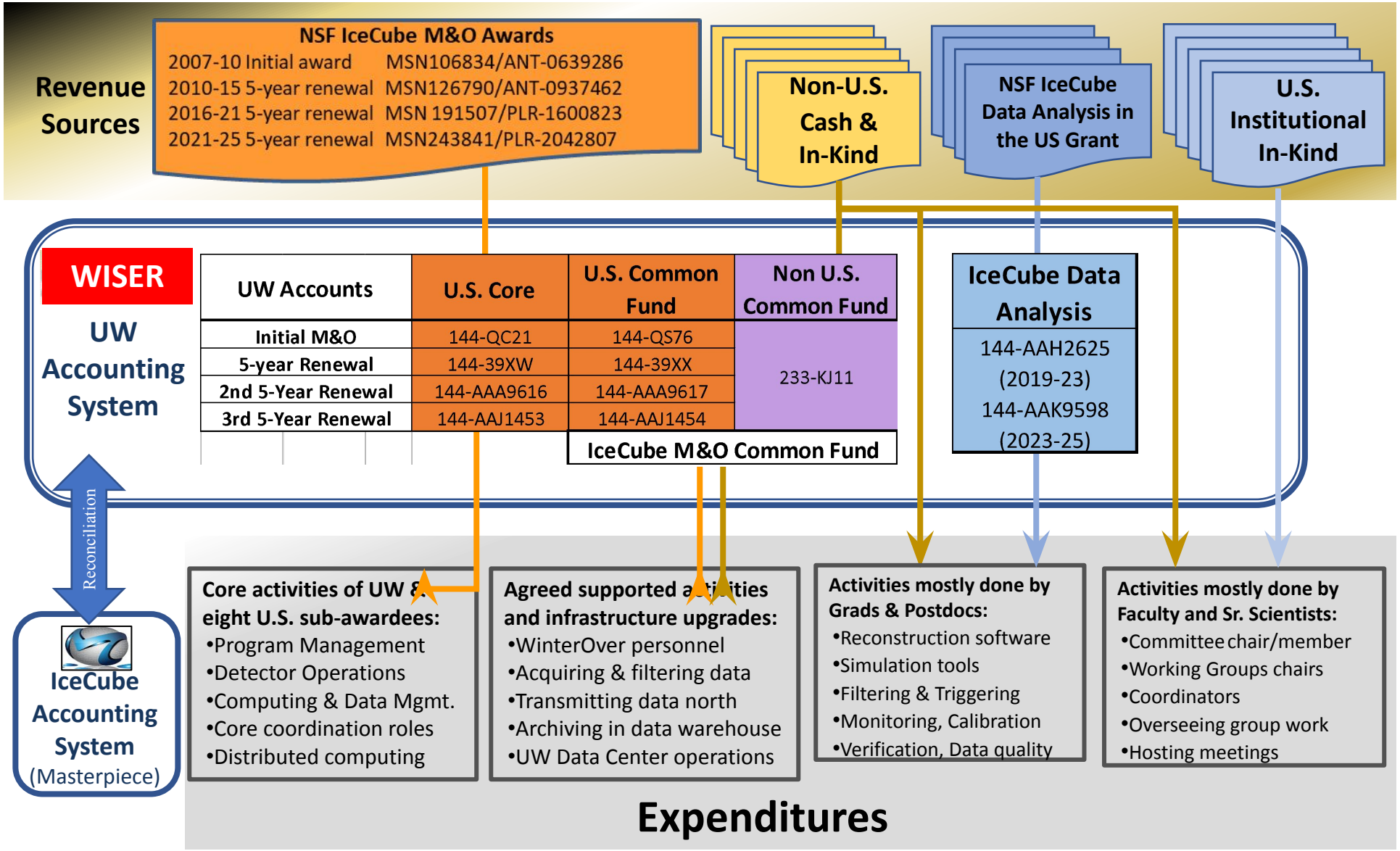
- Technical work by WBS
  - 2.2 Detector Operations: weekly operations calls
  - 2.3 Computing: daily standups, bi-weekly sprints
  - 2.4 Data Processing and Simulation: bi-weekly calls
  - 2.5 Software: bi-weekly software calls
  - 2.6 Calibration: weekly calibration calls

- Cross-WBS coordination + interface with physics working groups
  - bi-weekly IceCube Technical calls
  - monthly IceCube Coordination Committee (ICC) calls

- M&O leadership
  - weekly WIPAC M&O meetings
  - weekly calls with NSF program officers
  - bi-annual reports to NSF, collaboration (general and ICB), and annually to IOFG



Monetary Flow and Accounts

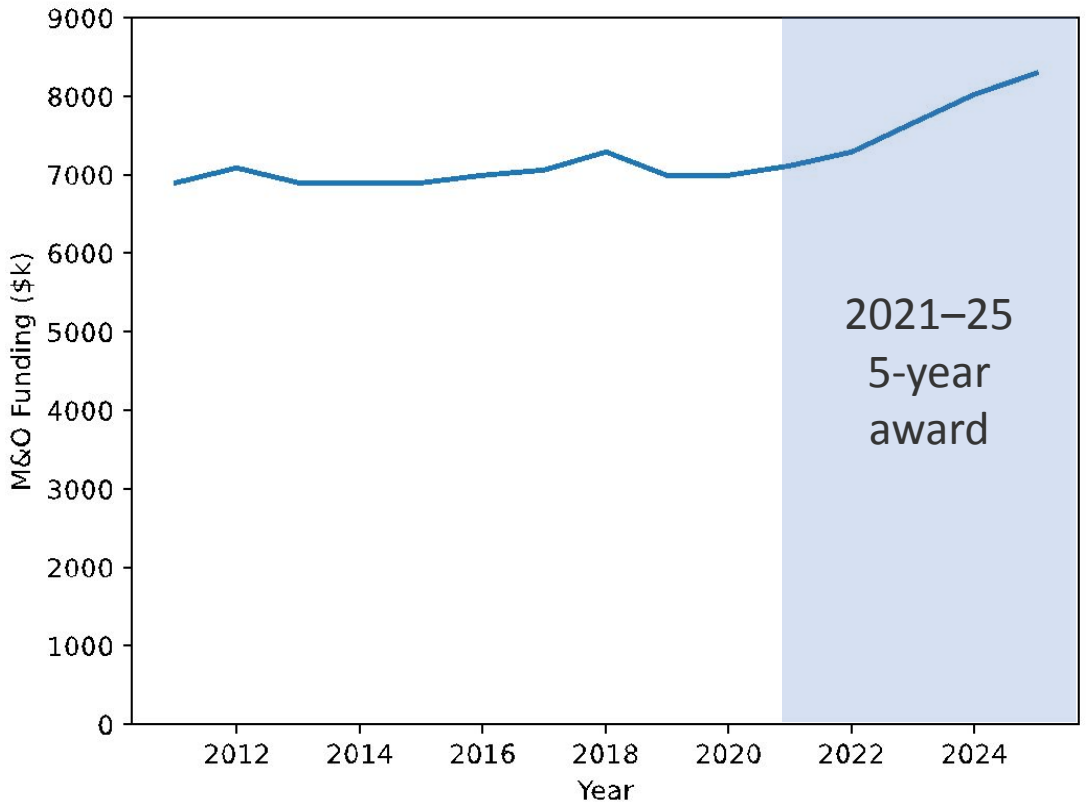


Current M&O Award (2021–25)

Budget summary table

NSF Funds Request	Budget Elements	Total NSF					
		YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	TOTAL
A	Total Senior Personnel	$308,770	$314,944	$343,955	$350,833	$357,850	$1,676,352
B	Other Personnel	$2,344,998	$2,388,752	$2,487,896	$2,583,654	$2,635,327	$12,440,627
A+B	**Total Salaries and Wages**	**$2,653,768**	**$2,703,696**	**$2,831,851**	**$2,934,487**	**$2,993,177**	**$14,116,979**
C	Total Fringe	$891,662	$908,442	$951,498	$985,984	$1,005,708	$4,743,294
A+B+C	**Total Salaries + Fringe**	**$3,545,430**	**$3,612,138**	**$3,783,349**	**$3,920,471**	**$3,998,885**	**$18,860,273**
D	Capital Equipment	$0	$0	$0	$0	$0	$0
E1	Travel Domestic	$132,217	$136,004	$141,702	$146,585	$149,467	$705,975
E2	Travel Foreign	$85,869	$88,766	$92,685	$95,447	$97,315	$460,082
G1	Materials & Supplies	$72,679	$72,921	$73,136	$73,617	$73,975	$366,328
G3	Consultant Services	$0	$0	$0	$0	$106,405	$106,405
G4	Computer Services	$30,000	$75,000	$75,000	$75,000	$75,000	$330,000
G5	Subawards	$1,035,147	$1,097,785	$1,175,968	$1,326,791	$1,292,235	$5,927,926
G	**Total Other Direct Cost**	**$1,137,826**	**$1,245,706**	**$1,324,104**	**$1,475,407**	**$1,547,615**	**$6,730,659**
H (A thr G)	**Total Direct Costs**	**$4,901,342**	**$5,082,614**	**$5,341,840**	**$5,637,910**	**$5,793,282**	**$26,756,989**
I1	Labor Indirect	$1,949,986	$2,004,736	$2,099,762	$2,175,861	$2,219,380	$10,449,725
I2	Travel Indirect	$119,935	$124,752	$130,102	$134,335	$136,959	$646,083
I3	Materials & Supplies Indirect	$39,973	$40,471	$40,591	$40,857	$41,056	$202,949
I4	Overhead Setup	$82,500	$0	$0	$0	$0	$82,500
I5	Consultant Services Indirect	$0	$0	$0	$0	$59,055	$59,055
I6	Computer Services Indirect	$16,500	$41,625	$41,625	$41,625	$41,625	$183,000
I	**Total Indirect Cost**	**$2,208,894**	**$2,211,584**	**$2,312,080**	**$2,392,678**	**$2,498,075**	**$11,623,311**
J=H+I	**Total Direct & Indirect**	**$7,110,237**	**$7,294,199**	**$7,653,920**	**$8,030,589**	**$8,291,357**	**$38,380,301**

Award history



- M&O budget largely flat vs. time
- Most equipment (e.g. computing) not on budget
- Increase in PY3–PY5 assists in Upgrade integration

Subawards

			Dollars					
Institution	**Major Responsibilities**	**Average FTE PY1–PY5**	**PY1**	**PY2**	**PY3**	**PY4**	**PY5**	**Total PY1-PY5**
Lawrence Berkeley National Laboratory	Computing infrastructure, long-term data archival, DOM firmware support	.05 Senior Personnel .14 Other Professional	$ 82,688	$ 91,822	$ 95,571	$ 106,807	$ 110,475	**$ 487,363**
Pennsylvania State	Simulation production, DAQ firmware support	.24 Post-Doctoral Scholars .25 Other Professionals	$ 23,098	$ 39,055	$ 96,850	$ 162,966	$ 106,943	**$ 428,912**
University of Delaware	IceTop calibration, monitoring and maintenance;IceTop simulation production	.65 Senior Personnel .25 Post-Doctoral Scholars	$ 174,104	$ 177,554	$ 181,075	$ 184,663	$ 188,328	**$ 905,724**
University of Maryland at College Park **Original**	Overall software coordination, IceTray software framework, online filter, simulation software and production	.02 Senior Personnel 2.4 Other Professional	$ 635,366	$ 643,918	$ 652,605	$ 718,288	$ 728,089	**$ 3,378,266**
After CR PY3-PY5	same as above	.02 Senior Personnel 2.5 Other Professional	$ 635,366	$ 643,918	$ 762,484	$ 811,590	$ 812,369	**$ 3,665,727**
University of Alabama at Tuscaloosa	Detector calibration, reconstruction and analysis tools	.08 Senior Personnel	$ 30,101	$ 30,703	$ 31,318	$ 31,944	$ 32,584	**$ 156,650**
Michigan State University	Simulation production, Northern Test System (NTS) maintenance	.2 Post-Doctoral Scholars	$ 89,792	$ 114,733	$ 118,549	$ 122,123	$ 125,817	**$ 571,014**

CR in PY3 to increase Univ. of Maryland subaward (same total budget)

Common Fund Contributions

- Both U.S. and non-U.S. full member institutions contribute to IceCube M&O via the common fund
  - $13,650 / Ph.D. author / year
- U.S. Common Fund: NSF award increment divided into appropriate accounts based on current author count
- Non-U.S. Common Fund: WIPAC invoices foreign institutions annually
- Used to support "*core activities that are agreed to be of common necessity for reliable operation of the IceCube detector and computing infrastructure"* including:
  - winterover detector operators
  - data acquisition and filtering hardware and software at the South Pole
  - data transfer and archival hardware and software at the WIPAC data center

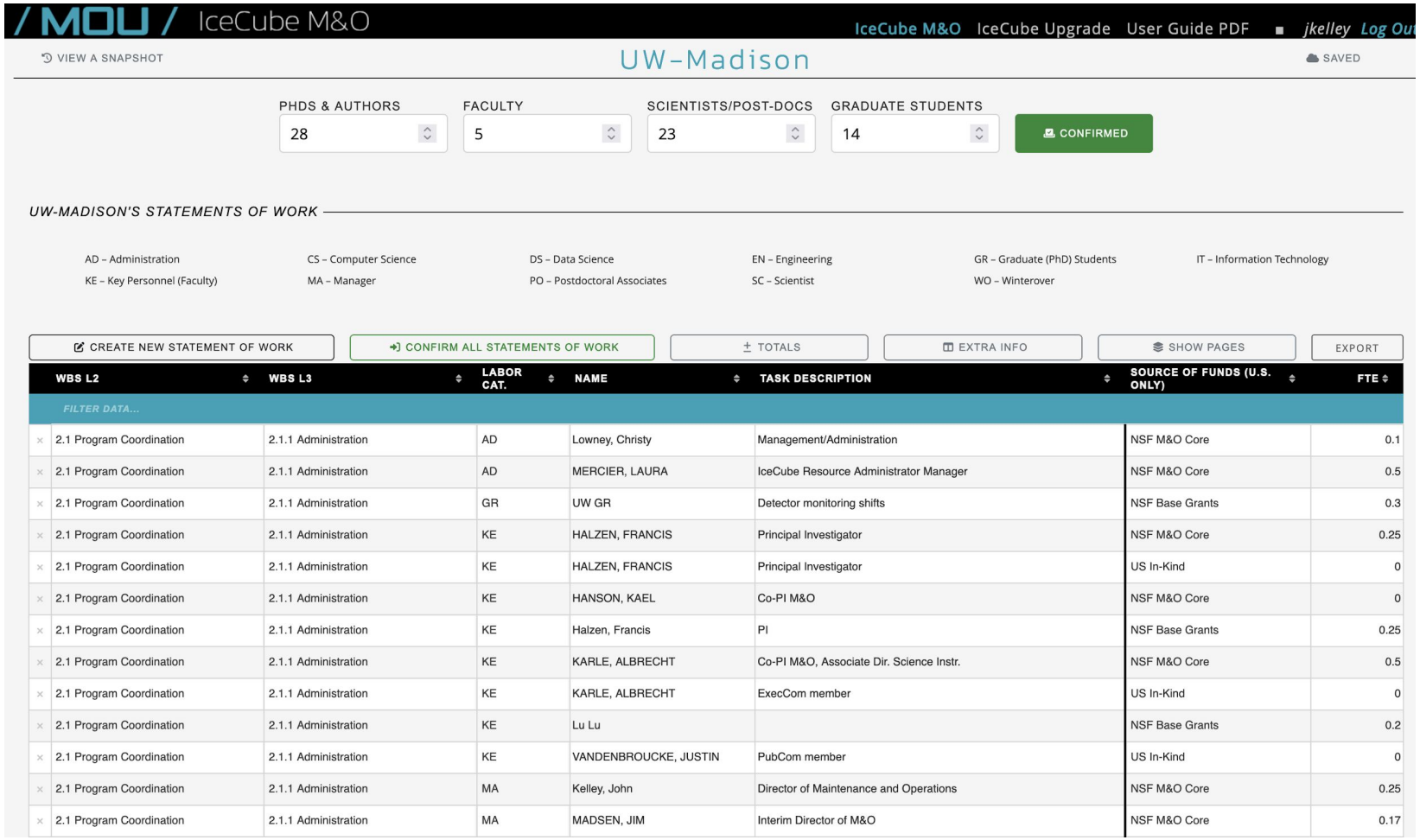
Common Fund PY1–PY3

	PY1		PY2		PY3	
	PhD. Authors	**Planned**	**PhD. Authors**	**Planned**	**PhD. Authors**	**Planned**
Total CF Planned	162	$2,211,300	172	$2,347,800	183.5	$2,504,775
U.S. Contribution	88	$1,201,200	97	$1,324,050	106	$1,446,900
Non-U.S. Contribution	74	$1,010,100	75	$1,023,750	77.5	$1,057,875
		Actual		**Actual**		**Actual**
Total CF Contributions		$2,136,225		$2,327,325		$2,445,145
U.S. Contribution		$1,201,200		$1,324,050		$1,446,900
Non-U.S. Contribution		$935,025		$1,003,275		$998,245
Difference (Actual-Planned)		$(75,075)		$(20,475)		$(59,630)

- small fraction of Non-U.S. CF contributions are in-kind
- contributions are in line with plan (within ~few%)
- author counts continue to increase

In-Kind Labor Contributions

- M&O labor contributions tracked through the MoU Dashboard
  - updates solicited bi-annually by Resource Coordinator
  - Institutional Leads update and confirm SoW
- Regular tasks include detector monitoring shifts by all institutions
  - training, organization by Run Coordinator
- Coordination boards prioritize work, set tasking
  - example: new offline filter development coordinated by ICC and TFT
  - continue work to improve feedback mechanisms here



/ MOU / IceCube M&O

IceCube M&O | IceCube Upgrade | User Guide PDF | jkelley Log Out

VIEW A SNAPSHOT

UW–Madison

SAVED

PHDS & AUTHORS	FACULTY	SCIENTISTS/POST-DOCS	GRADUATE STUDENTS	
28	5	23	14	CONFIRMED

UW-MADISON'S STATEMENTS OF WORK

AD – Administration; CS – Computer Science; DS – Data Science; EN – Engineering; GR – Graduate (PhD) Students; IT – Information Technology

KE – Key Personnel (Faculty); MA – Manager; PO – Postdoctoral Associates; SC – Scientist; WO – Winterover

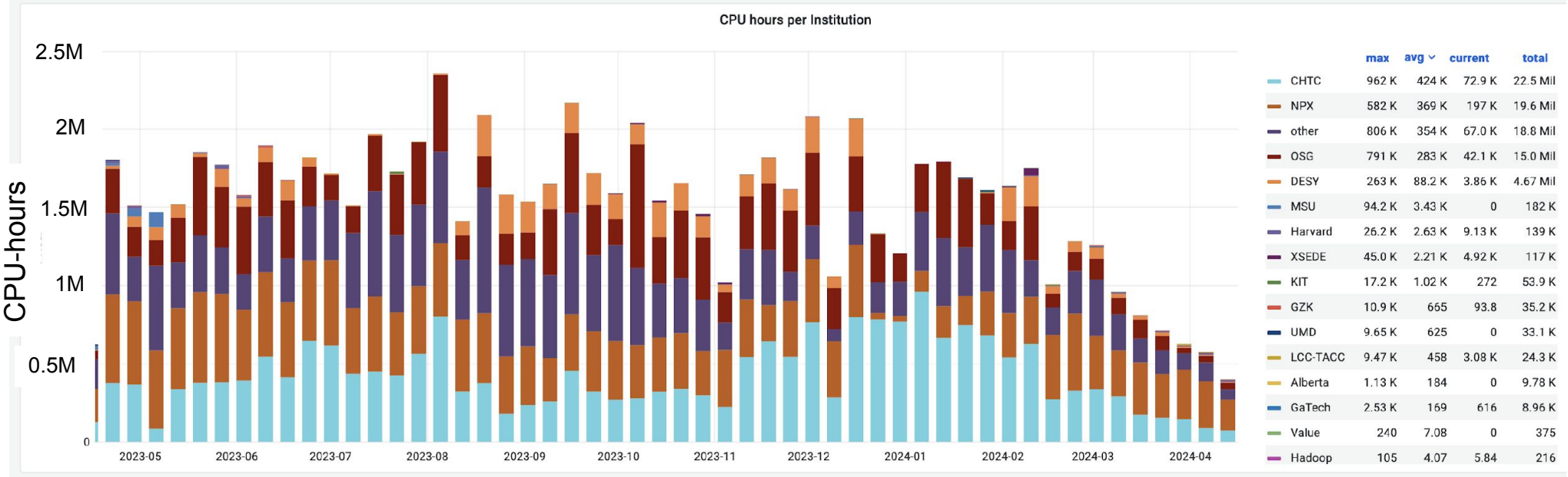
CREATE NEW STATEMENT OF WORK | CONFIRM ALL STATEMENTS OF WORK | TOTALS | EXTRA INFO | SHOW PAGES | EXPORT

WBS L2	WBS L3	LABOR CAT.	NAME	TASK DESCRIPTION	SOURCE OF FUNDS (U.S. ONLY)	FTE
FILTER DATA...						
2.1 Program Coordination	2.1.1 Administration	AD	Lowney, Christy	Management/Administration	NSF M&O Core	0.1
2.1 Program Coordination	2.1.1 Administration	AD	MERCIER, LAURA	IceCube Resource Administrator Manager	NSF M&O Core	0.5
2.1 Program Coordination	2.1.1 Administration	GR	UW GR	Detector monitoring shifts	NSF Base Grants	0.3
2.1 Program Coordination	2.1.1 Administration	KE	HALZEN, FRANCIS	Principal Investigator	NSF M&O Core	0.25
2.1 Program Coordination	2.1.1 Administration	KE	HALZEN, FRANCIS	Principal Investigator	US In-Kind	0
2.1 Program Coordination	2.1.1 Administration	KE	HANSON, KAEL	Co-PI M&O	NSF M&O Core	0
2.1 Program Coordination	2.1.1 Administration	KE	Halzen, Francis	PI	NSF Base Grants	0.25
2.1 Program Coordination	2.1.1 Administration	KE	KARLE, ALBRECHT	Co-PI M&O, Associate Dir. Science Instr.	NSF M&O Core	0.5
2.1 Program Coordination	2.1.1 Administration	KE	KARLE, ALBRECHT	ExecCom member	US In-Kind	0
2.1 Program Coordination	2.1.1 Administration	KE	Lu Lu		NSF Base Grants	0.2
2.1 Program Coordination	2.1.1 Administration	KE	VANDENBROUCKE, JUSTIN	PubCom member	US In-Kind	0
2.1 Program Coordination	2.1.1 Administration	MA	Kelley, John	Director of Maintenance and Operations	NSF M&O Core	0.25
2.1 Program Coordination	2.1.1 Administration	MA	MADSEN, JIM	Interim Director of M&O	NSF M&O Core	0.17

In-Kind Computing and Hardware Contributions

- In-kind computing resources integrated into IceCube grid
  - tracked per site and by resource type (CPU / normalized GPU)
  - DESY, MSU, Harvard, KIT, UMD *et al.* contributions

- Specialized hardware contributions also support M&O
  - example: surface array scintillator panels from KIT



	max	avg	current	total
CHTC	962 K	424 K	72.9 K	22.5 Mil
NPX	582 K	369 K	197 K	19.6 Mil
other	806 K	354 K	67.0 K	18.8 Mil
OSG	791 K	283 K	42.1 K	15.0 Mil
DESY	263 K	88.2 K	3.86 K	4.67 Mil
MSU	94.2 K	3.43 K	0	182 K
Harvard	26.2 K	2.63 K	9.13 K	139 K
XSEDE	45.0 K	2.21 K	4.92 K	117 K
KIT	17.2 K	1.02 K	272	53.9 K
GZK	10.9 K	665	93.8	35.2 K
UMD	9.65 K	625	0	33.1 K
LCC-TACC	9.47 K	458	3.08 K	24.3 K
Alberta	1.13 K	184	0	9.78 K
GaTech	2.53 K	169	616	8.96 K
Value	240	7.08	0	375
Hadoop	105	4.07	5.84	216

Budget and Expenditures Summary

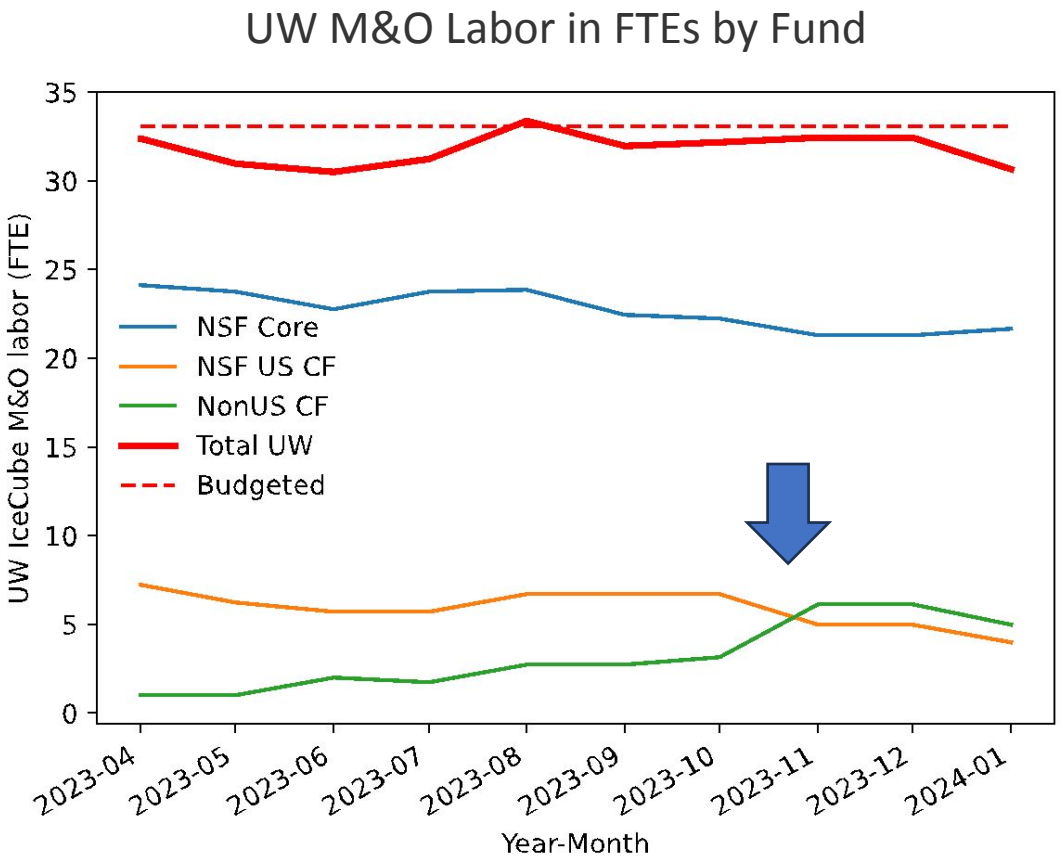
PY1–PY3 actual vs. budget

(a)	(b)	(c)	(d)= a - b - c
PY1–3 Budget (Apr.'21-Mar. '24)	**Actual Cost To Date** through Mar. 2024	**Open Commitments**	**End of YEAR3 Balance**
$22,058K	**$21,470K**	**$658K**	**-$70K**

- PY1-PY3 balance is -$70K (-0.3%)
  - open commitments are subawards yet to invoice us
  - this is basically balanced (but after labor expenses shifted)

- Inflation has increased faster than award escalation
  - e.g. 4% COLA mandated by state of Wisconsin
  - personnel departures + rehiring at market rates

Inflation Mitigation



- M&O labor FTEs under budgeted plan
  - action is still needed due to labor inflation
- Labor rebalanced between U.S. and Non-U.S. Common Funds
  - core hardware and software maintenance
- South Pole server upgrade deferred until after Upgrade installation
  - solid logistical and financial reasons
    - ~$800k deferred
    - focus on Upgrade pole activities
  - minimal technical risk

Non-U.S. Common Fund Expenditures

System	Computing Infrastructure	Detector Infrastructure	Labor	Total
South Pole System + Test System	$4K	$17K	$201K	**$222K**
Data Warehouse + UW Data Center	$533K	—	$21K	**$554K**
PY1 TOTAL	**$537K**	**$17K**	**$222K**	**$776K**
South Pole System + Test System	$231K	$3K	$162K	$396K
Data Warehouse + UW Data Center	$111K	—	$56K	$167K
PY2 TOTAL	**$342K**	**$3K**	**$218K**	**$563K**
South Pole System + Test System	$281K	$40K	$330K	**$651K**
Data Warehouse + UW Data Center	$867K	—	$75K	**$942K**
PY3 TOTAL	**$1,148K**	**$40K**	**$405K**	**$1,593K**

- Caught up with infrastructure upgrades post-COVID

- Shift of labor to Non-U.S. CF will continue for PY4 and PY5
  - will maintain at least $300K/yr budget for hardware upgrades

Summary

- Robust M&O management at all levels
  - WBS organization tracks technical effort
  - maintain active communication with stakeholders
  - continue to work to direct and manage in-kind contributions

- Significant hardware upgrades in PY1–3
  - largely funded by Non-U.S. Common Fund
  - caught up post-COVID

- Labor inflation challenging but under control
  - some maintenance deferred but minimal technical risk
  - will need to be addressed after Upgrade construction completion

Supplemental Slides

Work Breakdown Structure (WBS) to L3