

M&O Finance Management & Common Fund

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IceCube Management and Operations
NSF Site Visit March 16, 2020



Outline

- IceCube M&O Sources of Funds
- NSF M&O Core award financial status
- NSF M&O Subawards
- Memorandum of Understanding and Common Fund

IceCube M&O Sources of Funds

NSF M&O Core	This 5-year NSF award mostly covers Core M&O tasks, travel, M&S and service agreements for UW and eight U.S. sub-awardee institutions and contribution to the M&O Common Fund.
NSF Base Grants	NSF IceCube data analysis grant supports M&O activities done by U.S. graduate students and postdocs.
U.S. Institutional In-Kind	Institutional contribution mostly covers M&O activities done by faculty members, different fellowships and university funded activities.
Europe & Asia Pacific In-Kind	Institutional contribution from non-U.S. collaborators includes labor and travel and contribution to the M&O Common Fund.

IceCube M&O Sources of Funds (cont'd)

Definitions of M&O Task Categories: (2009 NSF Panel Summary Review)

Core M&O Tasks

- Technical tasks required for the continuing efficient operation of the detector and its associated data acquisition, transmission, analysis and archiving systems.
Examples: South Pole overwinter personnel, computer system administration, software engineering to improve the performance of production code, running simulation production.

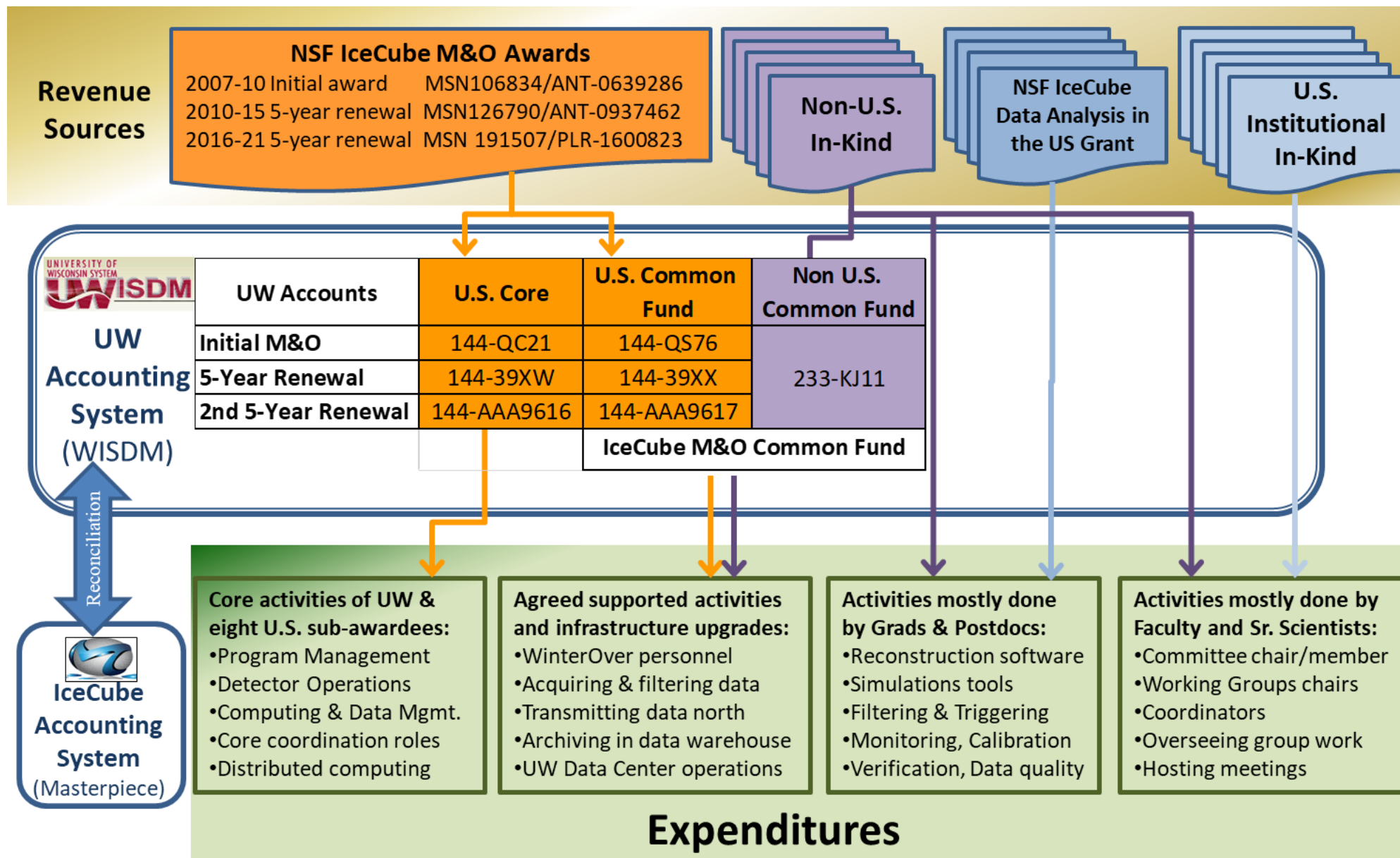
Collaboration Service

- Additional tasks that are essential for the collaboration to achieve its scientific goals.
Examples: service on collaboration committees and subgroups, working on data reduction and filtering, shift-taking, and other tasks that benefit the collaboration as a whole.

NSF Core M&O funding is used for Category 1 tasks.



IceCube M&O Program - Money Flow Diagram



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IceCube Maintenance & Operations Program

NSF M&O Award: Baseline Budget
by Cost Categories and Project Years

UW-Madison and U.S. Sub-Awards	YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	TOTAL
	Apr '16 - Mar '17	Apr '17 - Mar '18	Apr '18 - Mar '19	Apr '19 - Mar '20	Apr '20 - Mar '21	Apr '16 - Mar '21
Labor	\$6,214,583	\$6,259,716	\$6,230,959	\$6,172,008	\$6,163,558	\$31,040,824
Capital Equipment	\$80,950	\$154,947	\$220,579	\$162,777	\$243,431	\$862,684
Materials & Supplies	\$115,090	\$115,159	\$108,161	\$153,582	\$152,691	\$644,683
Travel	\$361,926	\$364,268	\$362,206	\$360,977	\$360,842	\$1,810,219
Service Agreements	\$147,951	\$105,910	\$78,095	\$150,656	\$79,479	\$562,090
Subaward Setup Fee	\$79,500	\$0	\$0	\$0	\$0	\$79,500
NSF M&O Award Total	\$7,000,000	\$7,000,000	\$7,000,000	\$7,000,000	\$7,000,000	\$35,000,000

The NSF IceCube M&O award provides funds for M&O Core activities and for the U.S. portion of the M&O Common Fund.



IceCube NSF M&O Award Budget, Actual Cost and Forecast

(a)	(b)	(c)	(d)= a - b - c	(e)	(f) = d - e
YEARS 1-4 Budget (Apr.'16- Mar.'20)	Actual Cost To Date through Feb. 29, 2020	Open Commitments on Feb. 29, 2020	Current Balance on Feb. 29, 2020	YEAR 4 Remaining Projected Expenses through March 2020	End of YEAR 4 Forecast Balance March 31, 2020
\$28,360K	\$27,466K	\$620K	\$274K	\$528K	-\$254K

This second five-year NSF M&O renewal award started in April 2016 and ends in March 2021.

NSF award of **\$7M** per year: **\$35M total**

NSF Supplemental funding of **\$292K** to develop a multimessenger INCLUDES program and **\$68K** for SDSM&T

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IceCube NSF M&O Sub-Awards

Major Responsibilities and Funds

Institution	Major Responsibilities	Effort and coverage	Total PY1-5
Lawrence Berkeley National Laboratory	Data Acquisition maintenance, computing infrastructure	<i>Institutional PI 5%, Engineer 15%</i>	\$445,626
Pennsylvania State University	Data acquisition firmware support, simulation production	<i>Postdoctoral Researcher 25% Scientist 25%</i>	\$354,313
University of Delaware, Bartol Institute	IceTop calibration, monitoring & maintenance, On-Ice field work	<i>Scientist 70%-80%, Engineer 17%</i>	\$773,285
University of Maryland at College Park	Overall IceCube software coordination, IceTray software framework, simulation software, maintain and test PnF software and online filters	<i>Institutional PI 2%, Scientist 75%, Computer Science 90%, Software Engineer 75%, Admin Support 4%, Capital Equip. for sim. prod. & maintenance of PnF software</i>	\$3,017,448
University of Alabama at Tuscaloosa	Detector calibration, reconstruction and analysis tools	<i>Institutional PI 8%,</i>	\$122,990
Michigan State University	Simulation software, simulation production	<i>Postdoctoral Researcher 25%</i>	\$142,481
South Dakota School of Mines and Technology (added in July 2017)	Simulation production and reconstruction	<i>Graduate Student for 12 months fulltime</i>	\$54,749
Total			\$4,910,892

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Memorandum of Understanding (MoU) and Common Fund (CF) Contribution

The IceCube M&O Common Fund was created in April 2007, the start of formal operations:

- To enable collaborating institutions to contribute to the costs of maintaining the computing hardware and software required to manage experimental data prior to processing for analysis.
- Each institution contributes to the Common Fund based on the total number of the institution's Ph.D. authors as indicated in the Institutional MoU.
- The Collaboration updates the Scope of Work and M&O Responsibilities in the MoUs twice a year at the collaboration meetings.
- As of April 1st 2010, the annual established rate per Ph.D. author is \$13,650.



Memorandum of Understanding (MoU) and Common Fund (CF) Contribution

The M&O activities identified as appropriate for support from the Common Fund are those core activities that are agreed to be of common necessity for reliable operation of the IceCube detector and computing infrastructure. The activities directly support the functions of:

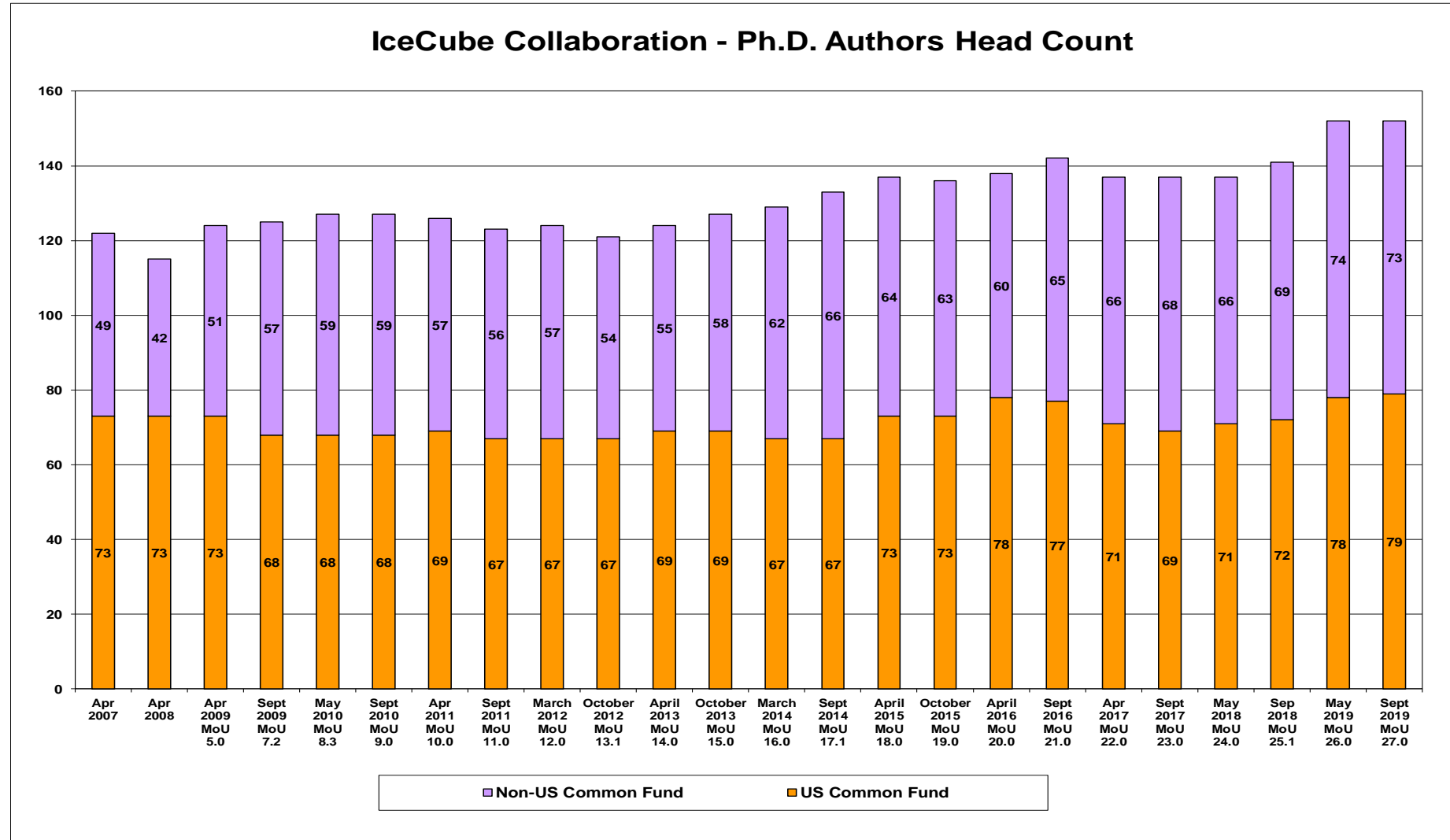
- Winterover technical support and run coordination at the South Pole
- Hardware and software systems for acquiring and filtering data at the South Pole
- Hardware and software systems for transmitting data via satellite and disks to the UW data center
- Systems for archiving the data in the central data warehouse at UW and UW Data Center Operations as listed in the Cooperative Agreement

IceCube M&O MoU's are posted on:

Docushare: <https://docushare.icecube.wisc.edu/dsweb/View/Collection-6627>



Memorandum of Understanding (v27.0 from September 2019)



The total number of Ph.D. authors has increased from 122 in April 2007 to 152 in September 2019.



M&O Common Fund Contributions in 2015-2018

Planned and Actual (US dollars in thousands)

	2015		2016		2017		2018	
	PhD. authors	Planned	PhD. authors	Planned	PhD. authors	Planned	PhD. authors	Planned
Total CF Planned	137	\$1,870	138	\$1,904	137	\$1,843	137	\$1,843
U.S. Contribution	73	\$996	78	\$1,065	71	\$969	71	\$969
Non-U.S. Contribution	64	\$873	60	\$839	66	\$874	66	\$874
		Actual		Actual		Actual		Actual
Total CF Contributions		\$1,848		\$1,931		\$1,839		\$1,807
U.S. Cash Transfer		\$996		\$1,065		\$969		\$969
Non-U.S. Cash Transfer		\$715		\$786		\$692		\$743
Non-U.S. In-Kind		\$137		\$80		\$177		\$96
Difference (Actual-Planned)		\$-22		+\$27		\$-4		-\$35

Actual Common Fund contributions were 22k lower than planned in 2015, \$27k higher than planned in 2016, \$4k lower than planned in 2017 and \$63K lower than planned in 2018. The final non-U.S. 2018 contributions are underway, it is anticipated that most of the planned contributions will be fulfilled.

IceCube M&O Computing Infrastructure Upgrade - 2018/2019, funded by Common Fund

System Upgrade	Computing Infrastructure	Detector Infrastructure	Labor	Total
South Pole System	\$311K	\$81K	\$574K	\$966K
South Pole Test System	\$255K	\$12K		\$267K
Data Warehouse	\$662K			\$662K
UW Data Center	\$318K			\$318K
Total	\$1,546K	\$93K	\$574K	\$2,214K

This summary includes the major purchases for the 2018/2019 upgrades of the South Pole System (SPS), South Pole Test System (SPTS), UW Data Center, UW Data Warehouse and networking equipment that are funded by IceCube M&O Common Fund.

Detailed expenditures information by cost category, vendor, quantity and line item description can be found in the annual Common Fund Status reports on Docushare: <https://docushare.icecube.wisc.edu/dsweb/View/Collection-8986>



Summary

The 5-year NSF M&O award started in April 2016, renewed the previous 5-year program, and is ending in March 2021

The Collaboration updates the Scope of Work and M&O Responsibilities in the MoU's twice a year

The total number of Ph.D. authors has increased from 122 in April 2007 to 152 in September 2019.

Actual Common Fund contributions have been either as planned or balanced out across years, with any negative balances offset by positive balances.

Questions?



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University of Wisconsin – Madison

Wisconsin IceCube Particle Astrophysics Center (WIPAC)

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Thank you!



Supplemental Material

Additional IceCube M&O Program related materials for reference



IceCube Maintenance & Operations Program

NSF M&O Award: Baseline Budget by WBS and Project Years

WBS	YEAR1 \$	YEAR2 \$	YEAR3 \$	YEAR4 \$	YEAR5 \$	TOTAL	%
2.1.1 Management & Administration	\$825k	\$758k	\$769k	\$781k	\$793k	\$3,927k	11.2%
2.1.2 Engineering Support	\$255k	\$259k	\$205k	\$196k	\$187k	\$1,102k	3.1%
2.1.3 Usap Support	\$65k	\$53k	\$54k	\$54k	\$55k	\$282k	0.8%
2.1.4 Education & Outreach	\$262k	\$266k	\$270k	\$251k	\$255k	\$1,303k	3.7%
2.2 Detector Operations & Maintenance	\$2,608k	\$2,591k	\$2,666k	\$2,611k	\$2,569k	\$13,046k	37.3%
2.3 Computing And Data Management	\$2,615k	\$2,699k	\$2,657k	\$2,721k	\$2,751k	\$13,444k	38.4%
2.4 Triggering And Filtering	\$81k	\$82k	\$84k	\$85k	\$86k	\$418k	1.2%
2.5 Data Quality, Reco. & Sim. Tools	\$287k	\$291k	\$296k	\$300k	\$305k	\$1,479k	4.2%
NSF IceCube M&O Proposal Total	\$7,000k	\$7,000k	\$7,000k	\$7,000k	\$7,000k	\$35,000k	100%

The two major WBS areas supported by NSF M&O program are WBS 2.2 Detector Operations and Maintenance (37.3%), and WBS 2.3 Computing and Data Management (38.4%).



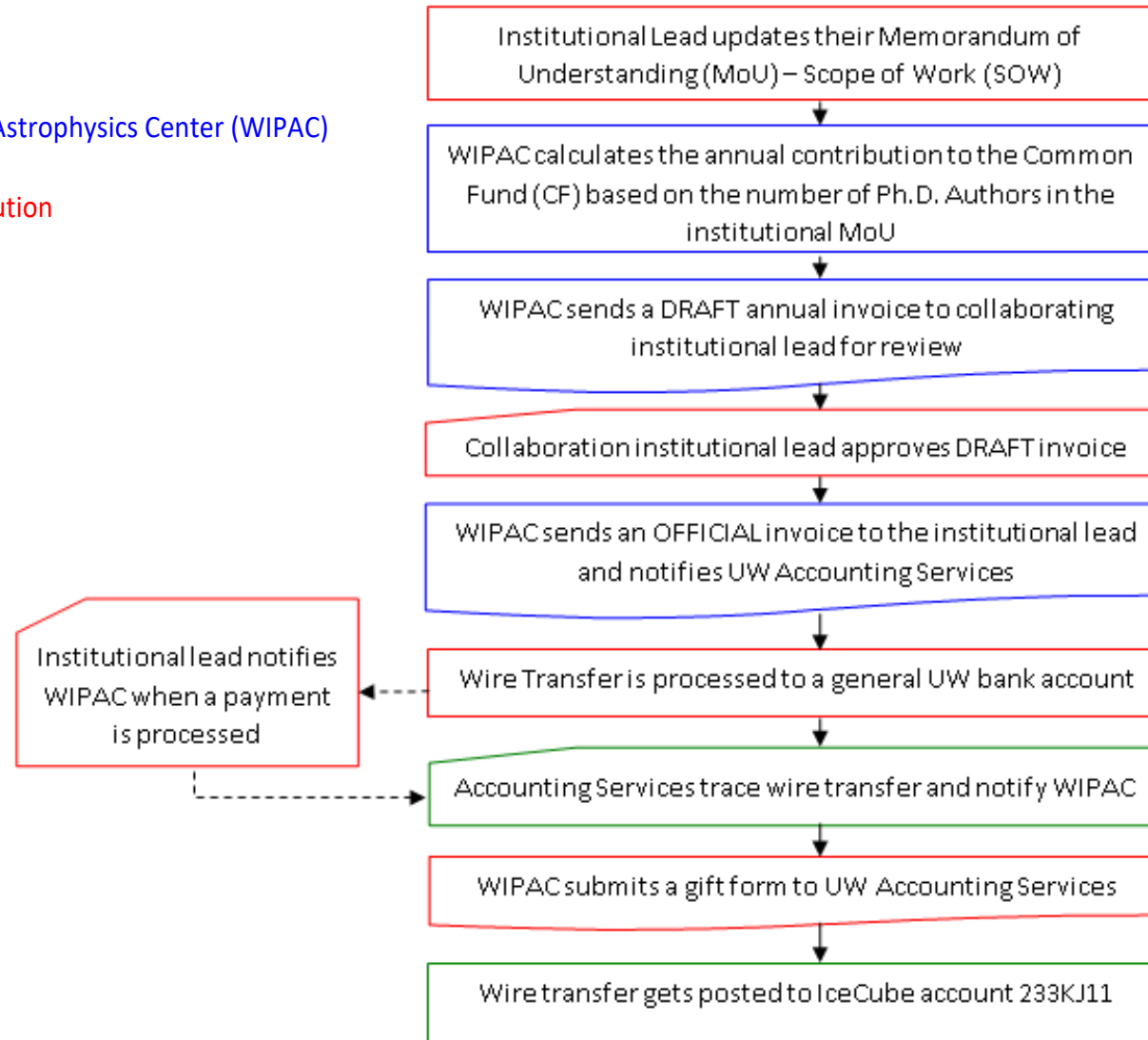
Common Fund Contribution

Wire Transfer from Non-U.S. Institutions

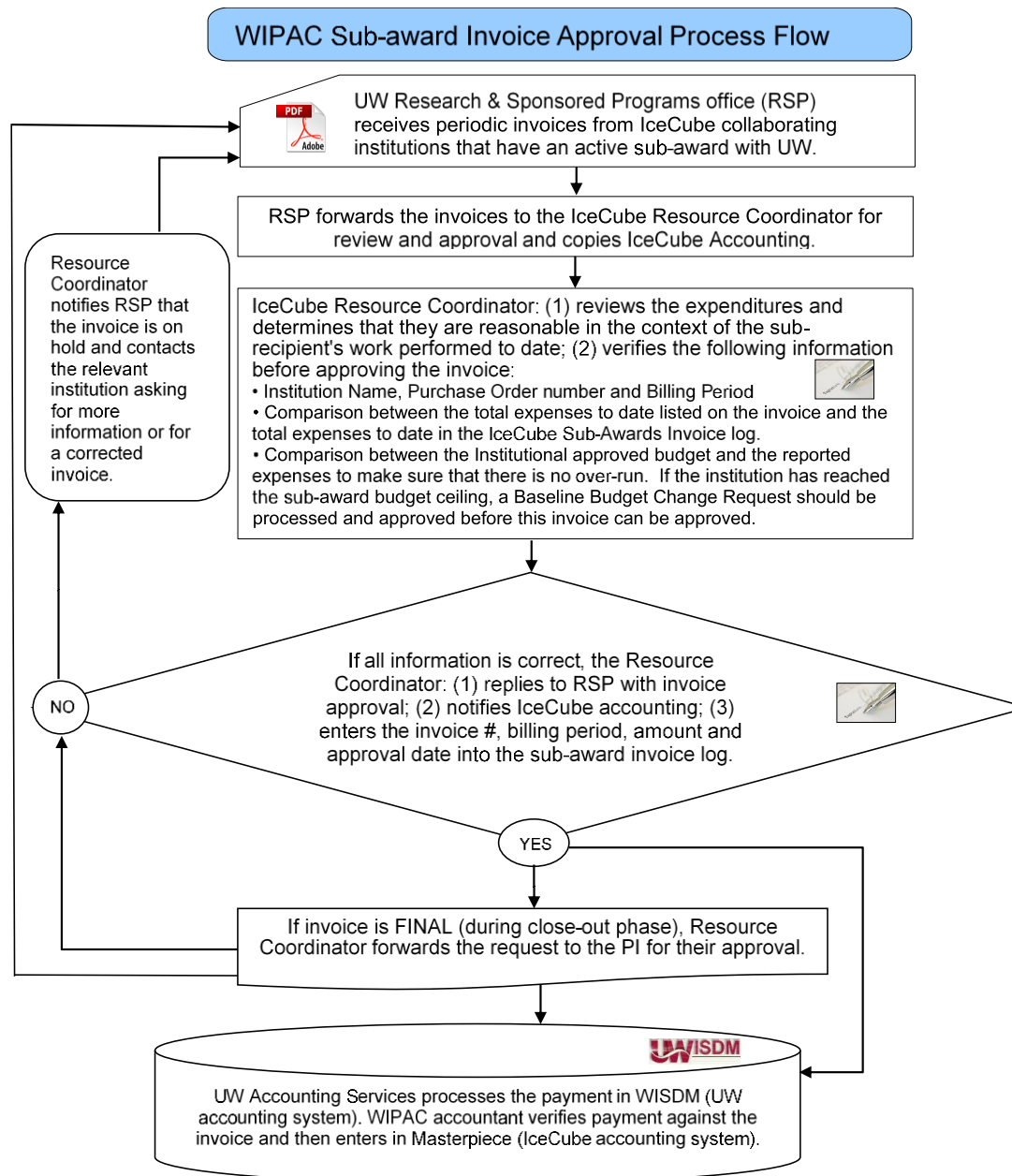
Wisconsin IceCube Particle Astrophysics Center (WIPAC)

IceCube Collaborative Institution

UW Accounting Services



M&O Sub-Award Monitoring Process



Presenter's Background

- 9+ years with IceCube Collaboration (2010-present)
- IceCube Upgrade Project Controls Manager (2018-present)
- IceCube Maintenance and Operations Resource Coordinator (2014-present)
- CMB PolarBear Project Control & Systems Manager (2015-2016)
- 12+ years of financial & project management experience in academia and private industry
- Master of Business Administration (MBA) degree (2008)
- Project Management Professional (PMP), license No. 1820230 (2015)
- Member of Project Management Institute, PMI (2014–present)

