

# FDP Cost Reimbursement Research Subaward Agreement

**Federal Awarding Agency:** National Science Foundation (NSF)

**Pass-Through Entity (PTE):**

Board of Regents of the University of Wisconsin System on Behalf of the University of Wisconsin - Madison

PTE PI: KAEI HANSON

PTE Federal Award No: 1719277 - PHY

**Subrecipient:**

MICHIGAN STATE UNIVERSITY

Sub PI: Tyce DeYoung

Subaward No: 855K805

**Project Title:** IceCube Gen2 Phase 1: an IceCube Extension for Precision Neutrino Physics and Astrophysics

**Subaward Period of Performance (Budget Period):**

Start: 10/01/2018

End: 03/31/2019

Amount Funded This Action (USD): \$ 149,192.00

**Estimated Project Period (if incrementally funded):**

Start: 10/01/2018

End: 03/31/2019

Incrementally Estimated Total (USD): \$ 0

## Terms and Conditions

1. PTE hereby awards a cost reimbursable subaward, as described above, to Subrecipient. The Statement of Work and budget for this Subaward are as shown in Attachment 5. In its performance of Subaward work, Subrecipient shall be an independent entity and not an employee or agent of PTE.
2. Subrecipient shall submit invoices not more often than monthly and not less frequently than quarterly for allowable costs incurred. Upon the receipt of proper invoices, the PTE agrees to process payments in accordance with this Subaward and 2 CFR 200.305. All invoices shall be submitted using Subrecipient's standard invoice, but at a minimum shall include current and cumulative costs (including cost sharing), Subaward number, and certification, as required in 2 CFR 200.415 (a). Invoices that do not reference PTE Subaward number shall be returned to Subrecipient. Invoices and questions concerning invoice receipt or payments shall be directed to the party's Financial Contact, shown in Attachment 3A.
3. A final statement of cumulative costs incurred, including cost sharing, marked "FINAL" must be submitted to PTE's Financial Contact, as shown in Attachment 3A, not later than 60 days after the Project Period end date. The final statement of costs shall constitute Subrecipient's final financial report.
4. All payments shall be considered provisional and are subject to adjustment within the total estimated cost in the event such adjustment is necessary as a result of an adverse audit finding against the Subrecipient.
5. Matters concerning the technical performance of this Subaward shall be directed to the appropriate party's Principal Investigator as shown in Attachments 3A and 3B. Technical reports are required as shown in Attachment 4.
6. Matters concerning the request or negotiation of any changes in the terms, conditions, or amounts cited in this Subaward, and any changes requiring prior approval, shall be directed to each party's Authorized Official Contact, as shown in Attachments 3A and 3B. Any such change made to this Subaward requires the written approval of each party's Authorized Official, as shown in Attachments 3A and 3B.
7. The PTE may issue non-substantive changes to the Period of Performance and budget Unilaterally. Unilateral modification shall be considered valid 14 days after receipt unless otherwise indicated by Subrecipient when sent to Subrecipient's Authorized Official Contact, as shown in Attachment 3B.
8. Each party shall be responsible for its negligent acts or omissions and the negligent acts or omissions of its employees, officers, or directors, to the extent allowed by law.
9. Either party may terminate this Subaward with 30 days written notice to the appropriate party's Authorized Official Contact, as shown in Attachments 3A and 3B. PTE shall pay Subrecipient for termination costs as allowable under Uniform Guidance, 2 CFR 200, or 45 CFR Part 75 Appendix IX, as applicable.
10. By signing this Subaward, including the attachments hereto which are hereby incorporated by reference, Subrecipient certifies that it will perform the Statement of Work in accordance with the terms and conditions of this Subaward and the applicable terms of the Federal Award, including the appropriate Research Terms and Conditions ("RTCs") of the Federal Awarding Agency, as referenced in Attachment 2. The parties further agree that they intend this Subaward to comply with all applicable laws, regulations and requirements.

By an Authorized Official of Pass-through Entity:

*Kurt McMillen*

1/23/2019

Name: Kurt McMillen

Date

Title: Assistant Director

By an Authorized Official of Subrecipient:

*Diane Cox*

22 Jan 2019

Name: Diane Cox

Date

Title: Sponsored Programs Manager

*MC*  
1/22/19

## **Attachment 1**

### **Certifications and Assurances**

Subaward Number:

#### **Certification Regarding Lobbying (2 CFR 200.450)**

By signing this Subaward, the Subrecipient Authorized Official certifies, to the best of his/her knowledge and belief, that no Federal appropriated funds have been paid or will be paid, by or on behalf of the Subrecipient, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement in accordance with 2 CFR 200.450.

If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or intending to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the Subrecipient shall complete and submit Standard Form -LLL, "Disclosure Form to Report Lobbying," to the PTE.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

---

#### **Debarment, Suspension, and Other Responsibility Matters (2 CFR 200.213 and 2 CFR 180)**

By signing this Subaward, the Subrecipient Authorized Official certifies, to the best of his/her knowledge and belief that neither the Subrecipient nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in this transaction by any federal department or agency, in accordance with 2 CFR 200.213 and 2 CFR 180.

---

#### **Audit and Access to Records**

Per 2 CFR 200.501- 200.521, Subrecipient certifies that it will provide notice of any adverse findings which impact this Subaward and will provide access to records as required by parts 2 CFR 200.336, 200.337, and 200.201 as applicable. If Subrecipient is not subject to the Single Audit Act, then Subrecipient will provide notice of the completion of any required audits and provide access to such audits upon request.

---

#### **Program for Enhancement of Contractor Employee Protections (41 U.S.C 4712)**

Subrecipient is hereby notified that they are required to: inform their employees working on any federal award that they are subject to the whistleblower rights and remedies of the pilot program; inform their employees in writing of employee whistleblower protections under 41 U.S.C §4712 in the predominant native language of the workforce; and include such requirements in any agreement made with a subcontractor or subgrantee.

---

The Subrecipient shall require that the language of the certifications above in this Attachment 1 be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

---

#### **Use of Name**

Neither party shall use the other party's name, trademarks, or other logos in any publicity, advertising, or news release without the prior written approval of an authorized representative of that party. The parties agree that each party may use factual information regarding the existence and purpose of the relationship that is the subject of this Subaward for legitimate business purposes, to satisfy any reporting and funding obligations, or as required by applicable law or regulation without written permission from the other party. In any such statement, the relationship of the parties shall be accurately and appropriately described.

## Attachment 2

### Federal Award Terms and Conditions

Subaward Number

#### Required Data Elements

The data elements required by Uniform Guidance are incorporated

Federal Award Issue Date FAIN

CFDA No.

#### This Subaward Is:

CFDA Title

Research & Development

Subject to FFATA

Key Personnel Per NOA

---

#### General Terms and Conditions

By signing this Subaward, Subrecipient agrees to the following:

1. To abide by the conditions on activities and restrictions on expenditure of federal funds in appropriations acts that are applicable to this Subaward to the extent those restrictions are pertinent. This includes any recent legislation noted on the Federal Awarding Agency's website:
2. 2 CFR 200
3. The Federal Awarding Agency's grants policy guidance, including addenda in effect as of the beginning date of the period of performance or as amended found at:
4. Research Terms and Conditions, including any Federal Awarding Agency's Specific Requirements found at:

except for the following :

  - a. No-cost extensions require the written approval of the PTE. Any requests for a no-cost extension shall be directed to the Contact shown in Attachment 3A, not less than 30 days prior to the desired effective date of the requested change.
  - b. Any payment mechanisms and financial reporting requirements described in the applicable Federal Awarding Agency Terms and Conditions and Agency-Specific Requirements are replaced with Terms and Conditions (1) through (4) of this Subaward; and
  - c. Any prior approvals are to be sought from the PTE and not the Federal Awarding Agency.
  - d. Title to equipment as defined in 2 CFR 200.33 that is purchased or fabricated with research funds or Subrecipient cost sharing funds, as direct costs of the project or program, shall vest in the Subrecipient subject to the conditions specified in 2 CFR 200.313.
  - e. Prior approval must be sought for a change in Subrecipient PI or change in Key Personnel (defined as listed on the NOA).
5. Treatment of program income:

---

#### Special Terms and Conditions:

##### **Copyrights:**

to PTE an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any copyrights or copyrighted material (including any computer software and its documentation and/or databases) first developed and delivered under this Subaward solely for the purpose of and only to the extent required to meet PTE's obligations to the Federal Government under its PTE Federal Award.

Subrecipient grants to PTE the right to use any written progress reports and deliverables created under this Subaward solely for the purpose of and only to the extent required to meet PTE's obligations to the Federal Government under its Federal Award.

##### **Data Rights:**

Subrecipient grants to PTE the right to use data created in the performance of this Subaward solely for the purpose of and only to the extent required to meet PTE's obligations to the Federal Government under its PTE Federal Award.

---

##### **Data Sharing and Access** (Check if applicable):

Subrecipient agrees to comply with the Federal Awarding Agency's data sharing and access requirements as reflected in the NOA (or in the special terms below) and the Data Management/Sharing Plan submitted to the Federal Awarding Agency and

---

**Promoting Objectivity in Research (COI):**

Subrecipient must designate herein which entity's Financial Conflicts of Interest policy (COI) will apply:

If applying its own COI policy, by execution of this Subaward, Subrecipient certifies that its policy complies with the requirements of the relevant Federal Awarding Agency as identified herein:

Subrecipient shall report any financial conflict of interest to PTE's Administrative Representative or COI contact, as designated on Attachment 3A. Any financial conflicts of interest identified shall, when applicable, subsequently be reported to Federal Awarding Agency. Such report shall be made before expenditure of funds authorized in this Subaward and within 45 days of any subsequently identified COI.

---

**Work Involving Human or Vertebrate Animals** (Select Applicable Options)

No Human or Vertebrate Animals

---

**Human Subjects Data** (Select One)

---

**Additional Terms**

**Attachment 3A**  
**Pass-Through Entity (PTE) Contacts**

Subaward Number:

---

**PTE Information**

Entity Name:

Legal Address:

Website:

---

**PTE Contacts**

Central Email:

Principal Investigator Name:

Email:

Telephone Number:

Administrative Contact Name:

Email:

Telephone Number:

COI Contact email (if different to above):

Financial Contact Name:

Email:

Telephone Number:

Email invoices?      Yes      No      Invoice email (if different):

Authorized Official Name:

Email:

Telephone Number:

---

**PI Address:**

**Administrative Address:**

**Invoice Address:**

## Attachment 3B

### Subrecipient Contacts

Subaward Number:

#### Subrecipient Information for [FFATA](#) reporting

Entity's DUNS Name:

EIN No.:

Institution Type:

DUNS:

Currently registered in SAM.gov: Yes No

Exempt from reporting executive compensation: Yes No *(if no, complete 3Bpg2)*

Parent DUNS:

*This section for U.S. Entities:* Zip Code [Look-up](#)

Place of Performance Address

Congressional District: Zip Code+4:

---

#### Subrecipient Contacts

Central Email:

Website:

Principal Investigator Name:

Email:

Telephone Number:

Administrative Contact Name:

Email:

Telephone Number:

Financial Contact Name:

Email:

Telephone Number:

Invoice/Payment Email:

Authorized Official Name:

Email:

Telephone Number:

---

**Legal Address:**

**Administrative Address:**

**Payment Address:**

**Attachment 3B-2**  
**Highest Compensated Officers**

Subaward Number:

---

**Subrecipient:**

Institution Name:

PI Name:

---

**Highest Compensated Officers**

The names and total compensation of the five most highly compensated officers of the entity(ies) must be listed if the entity in the preceding fiscal year received 80 percent or more of its annual gross revenues in Federal awards; and \$25,000,000 or more in annual gross revenues from Federal awards; and the public does not have access to this information about the compensation of the senior executives of the entity through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. §§ 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. See FFATA § 2(b)(1) Internal Revenue Code of 1986.

---

Officer 1 Name:

Officer 1 Compensation:

Officer 2 Name:

Officer 2 Compensation:

Officer 3 Name:

Officer 3 Compensation:

Officer 4 Name:

Officer 4 Compensation:

Officer 5 Name:

Officer 5 Compensation:

---

**Attachment 4**  
**Reporting and Prior Approval Terms**

Subaward Number:

Subrecipient agrees to submit the following reports (PTE contacts are identified in Attachment 3A):

---

**Technical Reports:**

Monthly technical/progress reports will be submitted to the PTE's \_\_\_\_\_ within \_\_\_\_\_ days of the end of the month.

Quarterly technical/progress reports will be submitted within 30 days after the end of each project quarter to the PTE's

Annual technical / progress reports will be submitted within \_\_\_\_\_ days prior to the end of each budget period to the PTE's \_\_\_\_\_. Such report shall also include a detailed budget for the next Budget Period, updated other support for key personnel, certification of appropriate education in the conduct of human subject research of any new key personnel, and annual IRB or IACUC approval, if applicable.

A Final technical/progress report will be submitted to the PTE's \_\_\_\_\_ within \_\_\_\_\_ days of the end of the Project Period or after termination of this award, whichever comes first.

Technical/progress reports on the project as may be required by PTE's \_\_\_\_\_ in order for the PTE to satisfy its reporting obligations to the Federal Awarding Agency.

---

**Prior Approvals:**

Carryover:

---

**Other Reports:**

In accordance with 37 CFR 401.14, Subrecipient agrees to notify PTE's \_\_\_\_\_ days after Subrecipient's inventor discloses invention(s) in writing to Subrecipient's personnel responsible for patent matters. The Subrecipient will submit a final invention report using Federal Awarding Agency specific forms to the PTE's \_\_\_\_\_ within 60 days of the end of the Project Period to be included as part of the PTE's final invention report to the Federal Awarding Agency.

A negative report is required:

Property Inventory Report (only when required by Federal Awarding Agency), specific requirements below.

**Other Special Reporting Requirements:**



**Attachment 5**  
**Statement of Work, Cost Sharing, Indirects & Budget**

Subaward Number:

**Statement of Work**

Below Attached, pages  
If award is FFATA eligible and SOW exceeds 4000 characters, include a *Subrecipient Federal Award Project Description*

**Budget Information**

<b>Indirect Information</b> Indirect Cost Rate (IDC) Applied % Rate Type:	<b>Cost Sharing</b> If Yes, include Amount: \$
--	---

**Budget Details** Below Attached, pages

**Budget Totals**

Direct Costs \$  
Indirect Costs \$  
Total Costs \$

*All amounts are in United States Dollars*

# **IceCube Gen2 Phase 1: an IceCube Extension for Precision Neutrino Physics and Astrophysics**

**UW Project#: 144-AAD7628**

**Statement of Work  
1 October 2018 through 31 March 2019**

## **Michigan State University**

The Michigan State University group's major responsibilities and contributions to the IceCube Gen2 Phase 1 project during the first six months include:

- 1) Identification of vendors through request for information (RFI)
- 2) Cable mechanical and electrical specification and procurement planning
- 3) MSU Principal Investigator, Cable L2 cost account manager, IceCube Upgrade communications, power and timing systems. Budget and schedule planning, interface coordination.
- 4) Preparation for project readiness review (PRR).

## **Attachment 6**

### **Notice of Award (NOA) and any additional documents**

The following pages include the NOA and if applicable any additional documentation referenced throughout this Subaward.

Not incorporating the NOA or any additional documentation to this Subaward.

Award title: IceCube Gen2 Phase 1: an IceCube Extension for Precision Neutrino Physics and Astrophysics  
 Award project #: 144-AAD7628  
 Subaward: Michigan State University  
 Period: 1 October 2018 - 31 March 2019

Institution	Budget Element	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Cumulative
<b>TRAVEL</b>														
	DIRECT		\$ 8,000	\$ 8,000	\$ 8,000	\$ 6,163								\$ 30,163
	OVERHEAD	\$ -	\$ 4,400	\$ 4,400	\$ 4,400	\$ 3,389	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 16,589
	<b>TRAVEL Subtotal:</b>	<b>\$ -</b>	<b>\$ 12,400</b>	<b>\$ 12,400</b>	<b>\$ 12,400</b>	<b>\$ 9,552</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 46,752</b>
<b>WAGES</b>														
	DIRECT	\$ 8,333	\$ 8,333	\$ 8,333	\$ 8,333	\$ 8,333	\$ 8,333	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 50,000
	FRINGE	\$ 2,682	\$ 2,682	\$ 2,682	\$ 2,682	\$ 2,682	\$ 2,682	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 16,090
	OVERHEAD	\$ 6,058	\$ 6,058	\$ 6,058	\$ 6,058	\$ 6,058	\$ 6,058	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 36,350
	<b>WAGES Subtotal:</b>	<b>\$ 17,073</b>	<b>\$ 17,073</b>	<b>\$ 17,073</b>	<b>\$ 17,073</b>	<b>\$ 17,073</b>	<b>\$ 17,073</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 102,440</b>
<b>Institution Totals:</b>		<b>\$ 17,073</b>	<b>\$ 29,473</b>	<b>\$ 29,473</b>	<b>\$ 29,473</b>	<b>\$ 26,625</b>	<b>\$ 17,073</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 149,192</b>

## Charlie Giese

---

**From:** kspencer@nsf.gov  
**Sent:** Tuesday, September 18, 2018 11:47 AM  
**To:** RSP - NSF  
**Subject:** Award Id : 1719277, PI: Hanson

NATIONAL SCIENCE FOUNDATION  
4201 Wilson Boulevard  
Arlington, VA 22230  
www.nsf.gov

### AWARD NOTICE

Award Date: September 18, 2018  
Project Title: IceCube Gen2 Phase 1: an IceCube Extension for Precision Neutrino Physics and Astrophysics  
PI: Kael D. Hanson, Dawn Williams, Tyce R. DeYoung, Douglas F. Cowen  
Awardee: The University of Wisconsin-Madison  
Award No. (FAIN): 1719277  
DUNS ID: 161202122

This is to inform you that your proposal for a Cooperative Agreement, 1719277, has been awarded. This award is expected to total \$22,983,529.

Please view the award details at the following web address:

[<https://www.fastlane.nsf.gov/researchadmin/emailLoginHome.do?awardId=1719277&amendmentId=000>]

This award is subject to the Federal Funding Accountability and Transparency Act (FFATA) award term entitled, Reporting Subawards and Executive Compensation, which has been incorporated into the NSF Terms and Conditions referenced above.

If the awardee has any questions related to the pre-populated data associated with this award in the FFATA Subaward Reporting System, such questions should be submitted to: [FFATTAReporting@nsf.gov](mailto:FFATTAReporting@nsf.gov) or by phone to: (800) 673-6188.

The links within the award document include important terms and conditions. Your understanding of these terms and conditions is essential for effective management of the award.

[Award Documents](#) | [MAIN](#) ▶**Organization:** University of Wisconsin-Madison**Award 1719277** as of 2018-9-18 : Amendment 000 (current) [Choose Version](#) ▶Award Document | [Last Notice Sent](#) | [Budget](#)[View Print Friendly Version \(PDF\)](#)[Return to Search Results](#)**NATIONAL SCIENCE FOUNDATION**  
4201 Wilson Boulevard  
Arlington, VA 22230  
[www.nsf.gov](http://www.nsf.gov)**COOPERATIVE AGREEMENT (CA)**

<b>AWARD:</b> PHY-1719277		<b>EFFECTIVE DATE:</b>	October 1, 2018
		<b>EXPIRATION DATE:</b>	September 30, 2023
<b>PROJECTED TOTAL AWARD FUNDING:</b> (Subject to availability of funds) \$22,983,529  <b>CUMULATIVE AMOUNT:</b>  \$4,731,506		<b>SOLICITATION:</b> (Incorporated by reference, as amended)  <a href="#">NSF 16-566</a>  Division of Physics: Investigator-Initiated Research Projects  <b>CFDA NUMBER:</b> 47.049  <b>OTHER AWARDS UNDER THIS PROGRAM:</b>  <a href="#">Show List of Awards</a>	
<b>AWARDEE:</b>		<a href="#">University of Wisconsin-Madison</a>	
<b>PROJECT TITLE:</b>		IceCube Gen2 Phase 1: an IceCube Extension for Precision Neutrino Physics and Astrophysics	
<b>PROJECT ABSTRACT:</b>		<a href="https://www.fastlane.nsf.gov/servlet/showaward?award=1719277">https://www.fastlane.nsf.gov/servlet/showaward?award=1719277</a>	
<u>Principal Investigator (s)</u>		<u>Proposal No.</u>	<u>Institution (s)</u>
<a href="#">Kael D. Hanson</a>		PHY-1719277	University of Wisconsin-Madison
Dawn Williams			
Douglas F. Cowen			
Tyce R. DeYoung			Michigan State University
<b>NSF Contact Information:</b>			

Financial/Administrative questions: e-mail your NSF Grants and Agreements Official, Kristin B. Spencer, at [kspencer@nsf.gov](mailto:kspencer@nsf.gov) or call the Division at 703-292-4585.

Programmatic questions: e-mail your NSF Program Officer, James J. Whitmore, at [jwhitmor@nsf.gov](mailto:jwhitmor@nsf.gov) or call the Program Division at 703-292-8908.

This CA is entered into between the United States of America, represented by the National Science Foundation (NSF), and the above named Awardee pursuant to the authority of the National Science Foundation Act of 1950, as amended (42 USC 1861-1875). This CA is provided electronically to the Awardee. The Awardee is responsible for full compliance with all Programmatic and Financial/Administrative Terms and Conditions as initially stated or as updated over the life of this CA. The Awardee's request to draw down funds under this CA will represent acceptance by the Awardee of all Terms and Conditions of the CA. The Authorized Organizational Representative (AOR) will be electronically notified of any changes to these Terms and Conditions and is encouraged to immediately review these changes and contact the Grants and Agreements Official or Program Officer within thirty days with any questions.

**Financial/Administrative Terms and Conditions (FATC):**

General FATC:  
[http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=NSF99999FATC004](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=NSF99999FATC004)

**Award Specific FATC:**

Part 1. Award Specific Financial and Administrative Terms and Conditions (FATC)

1.1. Terms and Conditions Incorporated by Reference, Deviations and Order of Precedence

a. Terms and Conditions Incorporated by Reference. At time of award, all activities under this CA are subject to NSF's Cooperative Agreement-Financial and Administrative Terms and Conditions (CAFATC), and the Cooperative Agreement Modifications and Supplemental Financial and Administrative Terms and Conditions (CAFATC) for Major Multi-User Research Facility Projects and Federally Funded Research and Development Centers, hereafter referred to as the CAFATC Supplement, available in full text at [https://www.nsf.gov/awards/managing/co-op\\_conditions.jsp](https://www.nsf.gov/awards/managing/co-op_conditions.jsp).

b. Deviations from the CAFATC and CAFATC Supplement. To meet the specific needs and requirements of this CA, any deviations are provided in full text herein. Any subsequent changes shall be incorporated by amendment.

c. Order of Precedence. The award-specific terms and conditions of this CA, Parts 1 and 2, take precedence over the CAFATC Supplement. The CAFATC Supplement takes precedence over the CAFATC.

1.2. Term of Agreement. The term of this CA ends on September 30, 2023 unless otherwise amended.

1.3. Funding. Contingent on the conduct of this award, NSF intends to provide up to \$22,983,324 in funding over the term of this award, of which \$20,127,513 is baseline funding and \$2,855,811 is contingency.

a. Contingency. The total contingency budget of \$2,855,811 is hereby approved. Use of contingency funds shall be in accordance with Article 2.6, paragraph c., 'Configuration Management and Use of Contingency.' The Awardee shall manage allocations from the contingency budget against the cumulative allocated and against the total contingency budget, and report status to NSF in accordance with Article 2.5, 'Reporting Requirements.'

b. Anticipated Funding Profile. NSF will specify approved allocations to the baseline and to budget contingency, with cumulative totals for each, by amendment to this award. Funding provided will be based on award performance and contingency use. The planned schedule of funding is as follows:

FYI	Baseline	Contingency	Total
FY18	\$4,069,959	\$664,979	\$4,734,938
FY19	\$5,130,419	\$575,002	\$5,705,421
FY20	\$3,638,072	\$362,229	\$4,000,301
FY21	\$3,604,047	\$464,748	\$4,068,795
FY22	\$3,985,016	\$788,853	\$4,773,869
Total	\$20,127,513	\$2,855,811	\$22,983,324

c. Funding Awarded to Date (funding only the Project Office activities for 6 months, 10/01/2018 - 03/31/2019)

FY	Baseline	Contingency	Total
FY18	\$1,024,762	\$0	\$1,024,762

d. Of the funding awarded for FY2018, \$1,024,762 is available for expenditure on the effective date of this award. Contingency is not included in this amount and is not authorized during the initial six-month Project Office setup.

- 1) Project Office expenditures will be in accordance with the Project Readiness Plan, which is hereby incorporated as part of the Awardee's proposal.
- 2) Remaining funding will be authorized for expenditure pending satisfactory completion of initial project management office setup. The Awardee may request an increase in the expenditure limit by demonstrating satisfactory progress and the need for additional funding. The request must be sent by email to the cognizant Program Officers and NSF Grants and Agreements Officer. Any increase in the expenditure limit will be implemented by amendment to this agreement.
- e. Approval by the cognizant NSF Program Officer, and implementation by the Awardee of any project or schedule change, shall not constitute a basis for an increase in funding for this Cooperative Agreement, nor be interpreted as an amendment increasing the award term.
- f. Segregation of Funds. Funding provided under this CA shall be used solely for the work identified herein and may not be reprogrammed or reallocated to any other award under any circumstances.

1.4. Property and Equipment. Tangible Property means property of any kind except intangible property and debt instruments. Title to all tangible property and equipment purchased or fabricated with NSF funds under this award shall vest as follows:

a. Title shall vest in the Awardee upon acquisition when the equipment is designated for research and development activities that are conducted by the Awardee and is not intended to be incorporated into, built, or necessary for the operation, maintenance or enhancement of the ice drill. All equipment acquired in accordance with this clause shall be subject to the Article of the CAFATC entitled 'Equipment.'

- b. Title shall vest in the Government upon acquisition when the equipment is intended to be incorporated into, built, or necessary for the operation, maintenance or enhancement of the ice drill. In addition to the CAFATC Supplement article entitled 'NSF-Owned Equipment and Real Property,' all Government equipment acquired under this agreement shall be subject to the requirements set forth below:
- c. Legal title to all tangible property furnished by NSF or acquired from other Government agencies shall remain with the Government, unless otherwise specified in writing by the NSF Property Administrator.
- d. Title to Government property shall not be affected by the incorporation or attachment thereof to any property not owned by the Government, no shall any Government property lose its identity by reason of affixation to any reality.
- e. All contracts and any subawards issued or awarded with respect to performance of this agreement shall include provisions regarding the determination of title to equipment acquired by the contractor or the subrecipient in accordance with this clause.

1.5. Contracts. To the clause, 'Contract Requirements' of the CAFATC Supplement, add the following (internally numbered):

d. Prior to entering into any Time & Materials (T&M) type of contract, agreement or purchase order, the Awardee will submit a detailed cost/performance monitoring plan to the NSF Program Officers and Agreements Officer. The Plan must show that the Awardee has in place the requisite oversight and monitoring of the contractor to ensure planned funding exists and is sufficient to meet forecasted level of effort, required notifications and limitations or stops are included in the contract to prevent overruns and 'at-risk' situations, and that contractor time and effort reporting and deliverables will be verified. The Awardee will include regular updates on the status of any T&M contracts in its reports to the NSF Program Officer.

## Programmatic Terms and Conditions (PTC):

### General PTC:

[http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=NSF16566TPTC000](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=NSF16566TPTC000)

### Award Specific PTC:

#### Part 2. Award Specific Programmatic Terms and Conditions (PTC)

2.1 Project Description. Embedded deep in the ice cap at the South Pole, the IceCube Neutrino Observatory (ICNO) is the world's unique, largest, and most sensitive high energy neutrino telescope. It is a one-billion-ton detector that uses the deep Antarctic ice as a medium to detect high energy atmospheric and astrophysical neutrinos. Most of the neutrinos observed by IceCube exhibit energies in the range expected for atmospheric neutrinos that originate from decays of elementary particles produced in extensive air showers by cosmic rays coming from nearby sectors of the Milky Way Galaxy. While these can be used to measure the fundamental properties of neutrinos, astrophysical neutrinos at higher energies are key probes of the high-energy phenomena in the Universe. Because of their unique properties, neutrinos pass almost freely through even dense volumes of space and are not deflected by galactic or extra-galactic magnetic fields and traverse the photon-filled universe unhindered. Thus, neutrinos provide direct information about the dynamics and interiors of the powerful cosmic objects that may be the origins of high energy cosmic rays: supernovae, black holes, pulsars, active galactic nuclei and other extreme extragalactic phenomena. This award will fund the deployment of seven additional strings of photon sensors in the deep, clear Antarctic ice at the bottom center of IceCube, forming the IceCube Gen2 Phase 1 extension ("Phase 1").

2.2. Scope of the Award. Specifically, the Awardee will work to accomplish the following:

- a. Drill: Full development and operation of the hot water drill system in support of the IceCube Upgrade array installation. Includes resurrection of available Enhanced Hot Water Drill (EHWD) equipment; design, procurement, and construction of new drill subsystems that, together with EHWD equipment, satisfies the project's drilling requirements; integration, verification, and testing of the drill system and its subsystems; and field operation of the drill system to deliver required installation borehole specifications.
- b. Optical modules: Development and production of up to 700 deep-ice optical sensor modules, including refurbished IceCube Digital Optical Modules, dual-phototube large effective area modules, and segmented sensors modules with 24 3" PMTs. These devices all also carry on-board calibration equipment for module and ice characterization.
- c. Cables: This category is responsible for the physical and electronic systems providing the interface between new sensor and calibration instrumentation and ICL/station infrastructure (power, communications for control and readout, global timing). Deliverables include the physical cables and structures to which new instruments are connected, the surface readout electronics, software, and firmware, and the systems for connecting these readout electronics to the station network and power system and the IceCube master clock.
- d. Calibration Devices: This category is responsible for calibrating and characterizing the detector, which consists of both modules and ice. The deliverables are well characterized modules which meet the high level design requirements of the IceCube upgrade for stability and performance, and improved measurements of the modules and the ice relative to our current knowledge of the detector.
- e. Integration with IceCube: This element is responsible for the seamless integration of all new systems from the IceCube upgrade project into the existing IceCube detector maintenance/operations structures. This includes integration with online software systems, databases, offline software components, simulation software packages, and computing infrastructure needed to support this effort.

2.3 Project Governance. The Awardee will ensure that an efficient and effective project governing structure is in place throughout the award period to support all critical or significant project activities.

#### a. Project Management and Staff Reporting

1) Overall Organization. The IceCube Neutrino Observatory (ICNO) is a collaborative effort between the University of Wisconsin (hereafter, the Awardee) and an international IceCube Collaboration (the Collaboration). The National Science Foundation (NSF) provides funding for U.S. activities and overall program oversight.

2) ICNO Upgrade Organization. The Awardee's ICNO Upgrade Organization is responsible for reliable overall management, construction of the IceCube Phase 1 Upgrade to the IceCube detector, data management, and the full exploitation of the IceCube scientific program. The ICNO Upgrade Organization is located within UW's Wisconsin IceCube Particle Astrophysics Center (WIPAC). The WIPAC is the primary interface to the university administrative and support systems and includes people whose salaries are paid by the university, including accounting, purchasing, human resources, and other general administrative support. The Upgrade Organization has six primary elements: Quality Engineer, Safety Engineer, Project Engineer, Project Controls Manager, Production Manager and Logistics. The Upgrade Organization must interact closely and coordinate the upgrade efforts with the overall ICNO management.

3) Engineering configuration control. Configuration Management will be exercised through the existing Engineering Change Control process that applies to all design aspects of the project. Change requests will be reviewed by Systems Engineering, then approved for change pending budgetary review.

4) Budget change control. Budget control will be exercised through the existing Change Control Board (CCB) that reviews and makes recommendations to the Principal Investigator on the disposition of budgetary Change Requests submitted for its consideration. The CCB is chaired by the Project Manager and includes all major account managers.

#### b. International partners

1) DESY-Zeuthen (Germany) - mDOM production, data acquisition electronics, cables



- 2) TU Munich (Germany) - Precision Optical Calibration Module (POCAM)
- 3) Muenster Universitat (Germany) - mDOM mechanical design
- 4) Chiba University (Japan) - Optical sensors, D-EGGs
- 5) Sungkyunkwan University (S. Korea) - Camera system

c. Major Subawards. As proposed by the Awardee and approved by NSF, major subawards at the time of this award are as follows:

- 1) Michigan State University - Communications power timing, detector simulation
- 2) Penn State University - Data acquisition firmware, electronics
- 3) University of Alabama - Calibration coordination; commissioning
- 4) University of Maryland - Data filtering, software, IceCube integration

d. Agency contact. The ICNO/Gen2/Phase1 PI will serve as point-of-contact for the cognizant NSF Program Officers, including providing notification of any critical project management issues.

2.4. Planning Requirements. The Awardee shall provide a detailed Annual Work Plan (AWP) for the coming fiscal year for the approval of the NSF Program Officer within three months following the award. The AWP should include goals/objectives, activity-based budget that traces the budget for the coming year (to extent possible) and schedule for work to be performed to the current project baseline. The AWP should also include a Basis of Estimate for planned expenditures and labor.

## 2.5 Reporting Requirements

a. In addition to the requirement for an annual report, the Awardee will provide ad hoc and regular reports as designated by the NSF cognizant Program Officer. Content, format, and submission timeline will be established by the NSF cognizant Program Officer. The Awardee will submit all required reports via research.gov using the appropriate reporting category; for any type of report not specifically mentioned in research.gov the Awardee will use the 'Interim Reporting' function to submit reports.

b. Monthly financial and technical status reports are to be provided to the NSF Program Officers. Reports shall address the following:

- 1) Schedule status relative to high level milestones with explanation for variances.
- 2) Earned Value Management report at Level 2 of the Work Breakdown Structure (WBS). Present and discuss variances and plans for recovery when they exceed -10%.
- 3) Contingency Management report including contingency usage for the reporting period, update of its graphical presentation as a percentage of costs to go, and forecasts on potential future contingency liens for the project.
- 4) Summary of risk management activities for the reporting period.
- 5) Report all Configuration Management and Change Control Board Actions for the reporting period, including status of the project scope relative to science and design/as-built capability of the system.
- 6) Report on contractor activities and performance status for contracted amounts exceeding \$250K.
- 7) Discussion of any other issues relevant to project performance.
- 8) Environmental Health and Safety report, including training and environmental compliance and site use (e.g. permits, agreements, or other arrangements).

c. Project Readiness Plan Deliverables. The Awardee will provide the deliverables as described in the Project Readiness Plan for the approval of the NSF Program Officers. Approval is required prior to NSF's authorization to draw additional funding, unless NSF determines that sufficient progress has been made to allow a portion of that funding to be released for use by the Awardee for activities under this award.

## 2.6 Project Oversight

a. Commitment and Cooperation. The Awardee will ensure full commitment and cooperation among the governing structure components, and all project staff during all ongoing NSF project management and oversight activities.

b. Annual Review. The project progress will be reviewed annually during the corresponding panel reviews of the related award for ICNO Operations & Management.

c. Configuration Management and Use of Contingency. Prior approval of the cognizant NSF Program Officer is required for:

- 1) Configuration changes increasing the overall program baselines for cost by more than \$250,000 or revising a Level 1 schedule milestone by more than 1 month. Level 1 schedule milestones are to be established by concurrence of the NSF Program Officer with submittal of the Annual Work Plan.
- 2) Requests for use of cost contingency exceeding \$150,000. Note: In the event of an emergency that threatens imminent harm to life or property, NSF authorizes the Awardee to use contingency exceeding \$100,000. NSF must be informed with a detailed rationale as soon as practicable and no later than 24 hours of the emergency.

2.7 Key Personnel. In addition to the requirements regarding change in PI under the PAPPG Chapter VII.B and the CAFATC incorporated herein, the position(s) specified below are considered essential to the work being performed hereunder. Any proposed change or substitution must be submitted, in advance, and with all necessary documentation, to the NSF Program Officer for review and approval. No changes may be implemented without prior formal written approval by the NSF Grants & Agreements Officer:

Principal Investigator  
Co-Principal Investigators  
Project Manager

Download [Adobe Acrobat Reader](#) for viewing PDF files

National Science Foundation  
2415 Eisenhower Avenue, Alexandria, Virginia 22314, USA  
Tel: 703-292-5111, FIRS: 800-877-8339 | TDD: 703-292-5090

[Privacy and Security](#)

# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>University of Wisconsin-Madison</b>				FOR NSF USE ONLY		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Kael Hanson</b>				PROPOSAL NO.		DURATION (months)
				Proposed		Granted
AWARD NO.				Funds Requested By proposer		Funds granted by NSF (if different)
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		
				CAL	ACAD	SUMR
1. <b>Kael Hanson - PI</b>				2.00	0.00	0.00
2.						
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				2.00	0.00	0.00
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00
2. ( 8 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				32.04	0.00	0.00
3. ( 0 ) GRADUATE STUDENTS						0
4. ( 0 ) UNDERGRADUATE STUDENTS						0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6. ( 0 ) OTHER						0
TOTAL SALARIES AND WAGES (A + B)						320,398
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						102,453
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						422,851
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.) <b>Cap.Equipment (see budget justification) \$ 2,666,220</b>						
TOTAL EQUIPMENT						2,666,220
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)						20,196
2. INTERNATIONAL						26,928
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 0						
2. TRAVEL 0						
3. SUBSISTENCE 0						
4. OTHER 0						
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS						0
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						37,500
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						3,298
5. SUBAWARDS						569,256
6. OTHER						664,979
TOTAL OTHER DIRECT COSTS						1,275,033
H. TOTAL DIRECT COSTS (A THROUGH G)						4,411,228
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Computer Services Indirect (Rate: 53.0000, Base: 3298) (Cont. on Comments Page)</b>						
TOTAL INDIRECT COSTS (F&A)						323,710
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						4,734,938
K. SMALL BUSINESS FEE						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						4,734,938
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME <b>Kael Hanson</b>				FOR NSF USE ONLY		
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION		
				Date Checked	Date Of Rate Sheet	Initials - ORG

1 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

---

### **\*\* I- Indirect Costs**

**Labor Indirect (Rate: 53.0000, Base 422851)**

**Materials & Supplies Indirect (Rate: 53.0000, Base 37500)**

**Subaward Setup (Rate: 53.0000, Base 100000)**

**Travel Indirect (Rate: 53.0000, Base 47124)**

---

# SUMMARY PROPOSAL BUDGET

YEAR **2**

ORGANIZATION <b>University of Wisconsin-Madison</b>				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Kael Hanson</b>				PROPOSAL NO.		DURATION (months)	
						Proposed	Granted
				AWARD NO.			
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Kael Hanson - PI</b>				2.00	0.00	0.00	<b>35,668</b>
2.							
3.							
4.							
5.							
6. ( <b>0</b> ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	<b>0</b>
7. ( <b>1</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				2.00	0.00	0.00	<b>35,668</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	<b>0</b>
2. ( <b>10</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				34.44	0.00	0.00	<b>316,428</b>
3. ( <b>0</b> ) GRADUATE STUDENTS							<b>0</b>
4. ( <b>0</b> ) UNDERGRADUATE STUDENTS							<b>0</b>
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>0</b>
6. ( <b>0</b> ) OTHER							<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>352,096</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>108,600</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>460,696</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.) <b>Cap.Equipment (see budget justification)</b>				<b>\$ 3,430,301</b>			
TOTAL EQUIPMENT							<b>3,430,301</b>
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							<b>9,156</b>
2. INTERNATIONAL							<b>60,759</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <b>0</b>							
2. TRAVEL <b>0</b>							
3. SUBSISTENCE <b>0</b>							
4. OTHER <b>0</b>							
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS							<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>36,500</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>0</b>
3. CONSULTANT SERVICES							<b>0</b>
4. COMPUTER SERVICES							<b>6,595</b>
5. SUBAWARDS							<b>822,348</b>
6. OTHER							<b>575,002</b>
TOTAL OTHER DIRECT COSTS							<b>1,440,445</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>5,401,357</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Computer Services Indirect (Rate: 53.0000, Base: 6595) (Cont. on Comments Page)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>304,064</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>5,705,421</b>
K. SMALL BUSINESS FEE							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							<b>5,705,421</b>
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Kael Hanson</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

2 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 2

---

**\*\* I- Indirect Costs**

**Labor Indirect (Rate: 53.0000, Base 460696)**

**Materials & Supplies Indirect (Rate: 53.0000, Base 36500)**

**Travel Indirect (Rate: 53.0000, Base 69915)**

---

# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION <b>University of Wisconsin-Madison</b>				FOR NSF USE ONLY		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Kael Hanson</b>				PROPOSAL NO.		DURATION (months)
				Proposed		Granted
AWARD NO.				Funds Requested By proposer		Funds granted by NSF (if different)
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		
				CAL	ACAD	SUMR
1. <b>Kael Hanson - PI</b>				2.00	0.00	0.00
2.						
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				2.00	0.00	0.00
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00
2. ( 11 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				38.64	0.00	0.00
3. ( 0 ) GRADUATE STUDENTS						
4. ( 0 ) UNDERGRADUATE STUDENTS						
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						
6. ( 0 ) OTHER						
TOTAL SALARIES AND WAGES (A + B)						36,382
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						0
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						36,382
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.) <b>Cap.Equipment (see budget justification)</b>						36,382
TOTAL EQUIPMENT						2,158,520
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)						14,008
2. INTERNATIONAL						3,820
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 0						
2. TRAVEL 0						
3. SUBSISTENCE 0						
4. OTHER 0						
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS						0
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						29,500
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						9,893
5. SUBAWARDS						573,570
6. OTHER						362,229
TOTAL OTHER DIRECT COSTS						975,192
H. TOTAL DIRECT COSTS (A THROUGH G)						3,686,464
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Computer Services Indirect (Rate: 53.0000, Base: 9893) (Cont. on Comments Page)</b>						
TOTAL INDIRECT COSTS (F&A)						313,837
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						4,000,301
K. SMALL BUSINESS FEE						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						4,000,301
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME <b>Kael Hanson</b>				FOR NSF USE ONLY		
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION		
		Date Checked		Date Of Rate Sheet		Initials - ORG

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 3

---

**\*\* I- Indirect Costs**

**Labor Indirect (Rate: 53.0000, Base 534924)**

**Materials & Supplies Indirect (Rate: 53.0000, Base 29500)**

**Travel Indirect (Rate: 53.0000, Base 17828)**

---

# SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION <b>University of Wisconsin-Madison</b>				FOR NSF USE ONLY		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Kael Hanson</b>				PROPOSAL NO.		DURATION (months)
						Proposed
				AWARD NO.		
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
	CAL	ACAD	SUMR			Funds granted by NSF (if different)
1. <b>Kael Hanson - PI</b>	2.00	0.00	0.00	<b>37,109</b>		
2.						
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	<b>0</b>		
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)	2.00	0.00	0.00	<b>37,109</b>		
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	<b>0</b>		
2. ( 11 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	38.64	0.00	0.00	<b>361,682</b>		
3. ( 0 ) GRADUATE STUDENTS				<b>0</b>		
4. ( 0 ) UNDERGRADUATE STUDENTS				<b>0</b>		
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				<b>0</b>		
6. ( 0 ) OTHER				<b>0</b>		
TOTAL SALARIES AND WAGES (A + B)				<b>398,791</b>		
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				<b>128,299</b>		
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				<b>527,090</b>		
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.) <b>Cap.Equipment (see budget justification)</b>				<b>\$ 2,023,600</b>		
TOTAL EQUIPMENT				<b>2,023,600</b>		
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)				<b>2,381</b>		
2. INTERNATIONAL				<b>13,855</b>		
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$	<b>0</b>					
2. TRAVEL	<b>0</b>					
3. SUBSISTENCE	<b>0</b>					
4. OTHER	<b>0</b>					
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS				<b>0</b>		
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES				<b>33,500</b>		
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				<b>0</b>		
3. CONSULTANT SERVICES				<b>0</b>		
4. COMPUTER SERVICES				<b>23,084</b>		
5. SUBAWARDS				<b>662,584</b>		
6. OTHER				<b>464,748</b>		
TOTAL OTHER DIRECT COSTS				<b>1,183,916</b>		
H. TOTAL DIRECT COSTS (A THROUGH G)				<b>3,750,842</b>		
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Computer Services Indirect (Rate: 53.0000, Base: 23084) (Cont. on Comments Page)</b>						
TOTAL INDIRECT COSTS (F&A)				<b>317,953</b>		
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				<b>4,068,795</b>		
K. SMALL BUSINESS FEE				<b>0</b>		
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				<b>4,068,795</b>		
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME <b>Kael Hanson</b>				FOR NSF USE ONLY		
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION		
		Date Checked	Date Of Rate Sheet	Initials - ORG		



## SUMMARY PROPOSAL BUDGET COMMENTS - Year 4

---

**\*\* I- Indirect Costs**

**Labor Indirect (Rate: 53.0000, Base 527090)**

**Materials & Supplies Indirect (Rate: 53.0000, Base 33500)**

**Travel Indirect (Rate: 53.0000, Base 16236)**

---

# SUMMARY PROPOSAL BUDGET

YEAR 5

ORGANIZATION <b>University of Wisconsin-Madison</b>				FOR NSF USE ONLY		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Kael Hanson</b>				PROPOSAL NO.		DURATION (months)
				AWARD NO.		Proposed
						Granted
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
				CAL	ACAD	SUMR
1. <b>Kael Hanson - PI</b>				2.00	0.00	0.00
2.						
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				2.00	0.00	0.00
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00
2. ( 9 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				36.84	0.00	0.00
3. ( 0 ) GRADUATE STUDENTS						
4. ( 0 ) UNDERGRADUATE STUDENTS						
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						
6. ( 0 ) OTHER						
TOTAL SALARIES AND WAGES (A + B)						37,851
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						0
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						37,851
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.) <b>Cap.Equipment (see budget justification)</b>						37,851
TOTAL EQUIPMENT						2,233,200
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)						17,003
2. INTERNATIONAL						6,624
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 0						
2. TRAVEL 0						
3. SUBSISTENCE 0						
4. OTHER 0						
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS						0
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						33,500
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						6,595
5. SUBAWARDS						575,687
6. OTHER						788,853
TOTAL OTHER DIRECT COSTS						1,404,635
H. TOTAL DIRECT COSTS (A THROUGH G)						4,170,374
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Computer Services Indirect (Rate: 53.0000, Base: 6595) (Cont. on Comments Page)</b>						
TOTAL INDIRECT COSTS (F&A)						303,495
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						4,473,869
K. SMALL BUSINESS FEE						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						4,473,869
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME <b>Kael Hanson</b>				FOR NSF USE ONLY		
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION		
				Date Checked	Date Of Rate Sheet	Initials - ORG

5 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 5

---

**\*\* I- Indirect Costs**

**Labor Indirect (Rate: 53.0000, Base 508912)**

**Materials & Supplies Indirect (Rate: 53.0000, Base 33500)**

**Travel Indirect (Rate: 53.0000, Base 23627)**

---

# SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION <b>University of Wisconsin-Madison</b>				FOR NSF USE ONLY		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Kael Hanson</b>				PROPOSAL NO.		DURATION (months)
				Proposed		Granted
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Kael Hanson</b>				AWARD NO.		
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
				CAL	ACAD	SUMR
1. <b>Kael Hanson - PI</b>				10.00	0.00	0.00
2.						
3.						
4.						
5.						
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00
7. ( <b>1</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				10.00	0.00	0.00
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00
2. ( <b>49</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				180.60	0.00	0.00
3. ( <b>0</b> ) GRADUATE STUDENTS						0
4. ( <b>0</b> ) UNDERGRADUATE STUDENTS						0
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						0
6. ( <b>0</b> ) OTHER						0
TOTAL SALARIES AND WAGES (A + B)						1,867,592
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						586,881
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						2,454,473
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
<b>\$ 12,511,841</b>						
TOTAL EQUIPMENT						12,511,841
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)						62,744
2. INTERNATIONAL						111,986
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ <b>0</b>						
2. TRAVEL <b>0</b>						
3. SUBSISTENCE <b>0</b>						
4. OTHER <b>0</b>						
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS						0
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						170,500
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						49,465
5. SUBAWARDS						3,203,445
6. OTHER						2,855,811
TOTAL OTHER DIRECT COSTS						6,279,221
H. TOTAL DIRECT COSTS (A THROUGH G)						21,420,265
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)						
TOTAL INDIRECT COSTS (F&A)						1,563,059
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						22,983,324
K. SMALL BUSINESS FEE						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						22,983,324
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME <b>Kael Hanson</b>				FOR NSF USE ONLY		
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION		
				Date Checked	Date Of Rate Sheet	Initials - ORG

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

**Budget Justification**  
**1 October 2018 – 30 September 2023**  
**IceCube Gen2 Phase 1: An IceCube Extension for Precision Neutrino Physics and**  
**Astrophysics**  
**University of Wisconsin - Madison**

This NSF IceCube Gen2 Phase 1 proposal covers the five-year period from October 1, 2018 through September 30, 2023, with a total funding request of **\$22,983,326**. The detailed budget was developed based on the actual experience during the past ten years of IceCube M&O and the ten years of the IceCube MREFC project.

<b>(A) Senior Personnel</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
Kael Hanson, Principal Investigator # of months per year: Calendar 2.0	\$34,969	\$35,668	\$36,382	\$37,109	\$37,851	\$181,979
<b>(1) Total Senior Personnel</b>	<b>\$34,969</b>	<b>\$35,668</b>	<b>\$36,382</b>	<b>\$37,109</b>	<b>\$37,851</b>	<b>\$181,979</b>

The University of Wisconsin – Madison (UW) is responsible for overall project management, including project monitoring and reporting, system engineering, logistics support, integration into IceCube operations, and the development and delivery of the hot water drill by the UW Physical Sciences Laboratory (PSL). All aspects of the project, including oversight of foreign partners' deliverables, will be coordinated from the project office located within the Wisconsin IceCube Particle Astrophysics Center (WIPAC) which reports to the UW Vice Chancellor for Research.

The Principal Investigator, IceCube Director of Operations, Prof. Kael Hanson, is responsible for the overall success of the IceCube Gen2 Phase 1 and meeting its science objectives.

<b>(B) Other Personnel</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
Other Professionals	\$285,429	\$316,428	\$378,145	\$361,682	\$343,929	<b>\$1,685,613</b>
Total # of calendar months per year	32.04	34.44	38.64	38.64	36.84	<b>180.60</b>

This labor budget covers the effort of (a) the Project Manager to lead the overall technical project execution; (b) other project office personnel whose activities are related to the management, administration, systems engineering, quality assurance and safety, reliability, document control, cost/schedule management and control systems, subcontract management, and NSF reporting; (c) engineering labor to develop and produce PDOMs; (d) engineering labor for cable system communications and timing development; (e) software integration support; (f) calibration management; and, (g) computing infrastructure support.

**(C) Fringe Benefit:** The fringe rates are calculated annually and disclosed and audited as required for all federal contracts and grants. Beginning from July 1, 2018, the fringe rates are: faculty, managers, engineers, computer science, software engineer: 33.3%.

	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
<b>(A+B) Total Salaries and Wages</b>	\$320,398	\$352,096	\$414,527	\$398,791	\$381,780	<b>\$1,867,592</b>
<b>(C) Fringe Benefits</b>	\$102,453	\$108,600	\$120,397	\$128,299	\$127,132	<b>\$586,881</b>
<b>(A+B+C) Total Salaries, Wages &amp; Fringe</b>	<b>\$422,851</b>	<b>\$460,696</b>	<b>\$534,924</b>	<b>\$527,090</b>	<b>\$508,912</b>	<b>\$2,454,473</b>

An escalation rate of 2.0% per year was applied based on prior years' actual salaries. The wages are paid in compliance with UW institutional policies.

**(D) Capital Equipment:** This capital equipment budget supports (A) The hot water drill upgrade and modifications including field refurbishment. Actual capital equipment purchases [not capitalized labor described in (B)] of \$3.12 million and include the following major cost drivers: (a) Microturbine generators and sled: \$1.44 million; (b) New drill hose: \$1.1 million; (c) Water filtration system: \$250K. (B) Capitalized labor for drill development and field work, including drill system refurbishment and deep ice drilling; (C) Optical sensors - PDOMs; (D) Surface data acquisition infrastructure.

This drill modification budget was prepared by the same personnel involved in the design and construction of the very successful IceCube Enhanced Hot Water Drill and the Firm drill at the UW Physical Science Lab (PSL). The table below shows the cost of the major categories of the UW capital equipment budget:

<b>(D) Capital Equipment</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
PSL Equipment and Capitalized Labor	\$2,666,220	\$3,104,520	\$2,158,520	\$2,023,600	\$2,233,200	<b>12,186,060</b>
Field hubs	-	\$136,406	-	-	-	<b>\$136,406</b>
PDOMs	-	\$189,375	-	-	-	<b>\$189,375</b>
<b>Total Capital Equipment</b>	<b>\$2,666,220</b>	<b>\$3,430,301</b>	<b>\$2,158,520</b>	<b>\$2,023,600</b>	<b>\$2,233,200</b>	<b>\$12,511,841</b>

<b>(E) Travel</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
<b>Domestic Travel</b>	\$20,196	\$9,156	\$14,008	\$2,381	\$17,003	<b>\$62,744</b>
<b>Foreign Travel</b>	\$26,928	\$60,759	\$3,820	\$13,855	\$6,624	<b>\$111,987</b>

The travel budget is calculated based on the number of planned domestic and foreign trips for each labor category. The domestic and foreign direct rates take into consideration airfare, transportation, lodging and per diem. Travel expenses include travel to domestic and foreign IceCube workshops, reviews and meetings, travel expenses in Christchurch on the way to/from Antarctica during the construction seasons (only per diem and lodging expenses in Christchurch, NZ) - see Figure 1. The domestic rate (\$2200/trip), foreign rate (\$4,000/trip) and stay in Christchurch, NZ (\$1,200/trip) plus an applied escalation rate of 2.0% per year are based on prior years' actual cost.

<b>PY</b>	<b>Activity</b>	<b>Domestic</b>		<b>International</b>		<b>CHC</b>	
PY1	Cable / D-Egg / mDOM PDR reviews; NSF Review	9	\$20,196	6	\$24,480	2	\$2,448
PY2	Cable FDR, D-egg FDR, mDOM FDR, DESY PRR	4	\$9,156	14	\$58,262	2	\$2,497
PY3	pDOM FDR; NSF Review	6	\$14,008	0	\$0	3	\$3,820
PY4	Instrumentation Shipping review	1	\$2,381	2	\$8,659	4	\$5,196
PY5	Deployment Readiness review; Transition to Ops; NSF Review	7	\$17,003	0	\$0	5	\$6,624
	<b>Total:</b>	<b>27</b>	<b>\$62,744</b>	<b>22</b>	<b>\$91,402</b>	<b>16</b>	<b>\$20,585</b>

*Figure 1: IceCube Gen2 Phase 1 Domestic and Foreign Travel Plan*

<b>(G1) Materials &amp; Supplies</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
Direct Cost	\$37,500	\$36,500	\$29,500	\$33,500	\$33,500	<b>\$170,500</b>

This budget includes costs for materials, tools and supplies, shipping and packing materials necessary to support the project activities.

<b>(G4) Other</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
Computer Services	\$3,298	\$6,595	\$9,893	\$23,084	\$6,595	<b>\$49,465</b>

**Services and Service Agreements:** Assembly of cable breakouts, physical qualification examinations for deploying to the South Pole.

<b>(G5) Subawards</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
Direct Cost	\$569,256	\$822,348	\$573,570	\$662,584	\$575,687	<b>\$3,203,446</b>

<b>Institution</b>	<b>Major Deliverables</b>	<b>Effort and coverage</b>	<b>Years 1-5</b>
Michigan State University	Cables; detector simulation	<i>Institutional PI 4% in Y1-5 Engineer 100% in Y1-4, 50% in Y5</i>	<b>\$1,522,010</b>
Pennsylvania State University	Data acquisition firmware, electronics	<i>Institutional PI 4% in Y1-5 Scientist 75% in Y1-5</i>	<b>\$828,805</b>
University of Maryland at College Park	Data filtering, software, IceCube integration	<i>Institutional PI 4%, Scientist 5%, Computer Science 5% in Y1-5, Postdoctoral Researcher 30% in Y3-5</i>	<b>\$497,977</b>
University of Alabama at Tuscaloosa	Calibration coordination	<i>Institutional PI 4% in Y1-5 Postdoctoral Researcher 100% in Y4-5</i>	<b>\$354,654</b>
<b>Total</b>			<b>\$3,203,446</b>

**Figure 2: IceCube Gen2 Phase 1 Subawards - Major Responsibilities and Funds**

<b>(G6) Other</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
Contingency	\$664,979	\$575,002	\$362,229	\$464,748	\$788,853	<b>\$2,855,810</b>

Contingency was calculated by the combination of project risks and cost uncertainty and estimated using the methods borrowed from the successful IceCube MREFC.

	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
<b>(H=A through G) Total Direct Cost</b>	<b>\$4,411,228</b>	<b>\$5,401,357</b>	<b>\$3,686,464</b>	<b>\$3,750,843</b>	<b>\$4,170,375</b>	<b>\$21,420,267</b>
Labor Indirect 53%	\$224,111	\$244,169	\$283,509	\$279,358	\$269,723	<b>\$1,300,870</b>
Travel Indirect 53%	\$24,976	\$37,055	\$9,449	\$8,605	\$12,522	<b>\$92,607</b>
Materials & Supplies Indirect 53%	\$19,875	\$19,345	\$15,635	\$17,755	\$17,755	<b>\$90,365</b>
Overhead on first \$25k of subawards 53%	\$53,000	\$0	\$0	\$0	\$0	<b>\$53,000</b>
Services and Service Agreements Indirect 53%	\$1,748	\$3,496	\$5,243	\$12,234	\$3,496	<b>\$26,217</b>
<b>(I) Total Indirect Cost</b>	<b>\$323,709</b>	<b>\$304,064</b>	<b>\$313,836</b>	<b>\$317,953</b>	<b>\$303,496</b>	<b>\$1,563,059</b>

The fixed indirect rate for this five-year award is 53%. This is the federally negotiated rate at the original proposal submission and is based on MTDC. No indirect was applied to capital equipment.

<b>(J=H+I) Total Direct and Indirect Cost</b>	<b>Year1</b>	<b>Year2</b>	<b>Year3</b>	<b>Year4</b>	<b>Year5</b>	<b>Total</b>
<b>Total Direct and Indirect Cost</b>	<b>\$4,734,937</b>	<b>\$5,705,421</b>	<b>\$4,000,301</b>	<b>\$4,068,796</b>	<b>\$4,473,871</b>	<b>\$22,983,326</b>

<b>Total UW–Madison proposal request</b>	<b>Years 1-5</b>	<b>\$22,983,326</b>
--	------------------	---------------------

**Project Development:** The budget for the first six months of PY01 is \$1,024,762, out of \$4,734,937 budgeted for the entire PY01, is requested to establish the IceCube Gen 2 Phase 1 Project Office and the activities necessary to prepare project readiness deliverables as described in the IceCube Upgrade Project Readiness Plan submitted to NSF on September 5, 2018.

**In-kind contributions from Non-US groups:** IceCube Gen 2 Phase 1 is an international collaboration that includes DESY-Zeuthen, TU Munich, and Muenster Universitat (Germany), Chiba University in Japan, and Sungkyunkwan University (SKKU) in S. Korea. A significant fraction of instrumentation will be developed and optical sensors entirely produced outside the USA by these collaborators.

<b>Institution</b>	<b>YEAR1</b>	<b>YEAR2</b>	<b>YEAR3</b>	<b>YEAR4</b>	<b>YEAR5</b>	<b>TOTAL</b>
UW	\$4,165,681	\$4,883,073	\$3,426,730	\$3,406,211	\$3,898,184	<b>\$19,779,880</b>
UMD	\$79,261	\$70,118	\$112,862	\$113,189	\$122,547	<b>\$497,977</b>
PSU	\$176,045	\$172,249	\$158,743	\$157,432	\$164,335	<b>\$828,805</b>
UA	\$37,134	\$37,169	\$32,130	\$120,157	\$128,064	<b>\$354,654</b>
MSU	\$276,816	\$542,812	\$269,835	\$271,806	\$160,741	<b>\$1,522,010</b>
<b>U.S. Subtotal</b>	<b>\$4,734,937</b>	<b>\$5,705,421</b>	<b>\$4,000,301</b>	<b>\$4,068,796</b>	<b>\$4,473,871</b>	<b>\$22,983,326</b>
SOUTH KOREA	\$92,265	\$244,109	\$245,992	\$97,912	\$99,871	<b>\$780,149</b>
JAPAN	\$288,951	\$1,203,840	\$1,424,757	\$42,620	\$43,472	<b>\$3,003,640</b>
GERMAN UNIVERSITIES	\$264,747	\$270,039	\$227,701	\$183,557	\$187,229	<b>\$1,133,273</b>
DESY	\$403,361	\$2,110,721	\$2,392,252	\$607,857	\$548,893	<b>\$6,063,084</b>
MSU	\$2,749,299	\$134,270	\$138,298	\$77,048	\$79,359	<b>\$3,178,274</b>
<b>U.S and Non-U.S. In-Kind Subtotal</b>	<b>\$3,798,623</b>	<b>\$3,962,979</b>	<b>\$4,429,000</b>	<b>\$1,008,994</b>	<b>\$958,824</b>	<b>\$14,158,420</b>
<b>Total U.S. &amp; Non U.S.</b>	<b>\$8,533,560</b>	<b>\$9,668,400</b>	<b>\$8,429,301</b>	<b>\$5,077,790</b>	<b>\$5,432,695</b>	<b>\$37,141,746</b>

<b>NSF Funds</b>	<b>Grand Total</b>						
	<b>YEAR1</b>	<b>YEAR2</b>	<b>YEAR3</b>	<b>YEAR4</b>	<b>YEAR5</b>	<b>TOTAL</b>	
<b>NSF FUNDS REQUEST</b>	<b>\$4,734,937</b>	<b>\$5,705,421</b>	<b>\$4,000,301</b>	<b>\$4,068,796</b>	<b>\$4,473,871</b>	<b>\$22,983,326</b>	<b>62%</b>
<b>IN KIND</b>	<b>\$3,798,623</b>	<b>\$3,962,979</b>	<b>\$4,429,000</b>	<b>\$1,008,994</b>	<b>\$958,824</b>	<b>\$14,158,420</b>	<b>38%</b>
<b>TOTAL PROJECT COST</b>	<b>\$8,533,560</b>	<b>\$9,668,400</b>	<b>\$8,429,301</b>	<b>\$5,077,790</b>	<b>\$5,432,695</b>	<b>\$37,141,746</b>	<b>100%</b>

Gen-2 Phase I NSF Funds Request - Revision 2 vs Revision 1 Differences

Revision 2 - September 5, 2018

NSF Funds Request	Budget Elements	Total NSF					TOTAL
		YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	
A	Total Senior Personnel	\$34,969	\$35,668	\$36,382	\$37,109	\$37,851	\$181,979
B	Other Personnel	\$285,429	\$316,428	\$378,145	\$361,682	\$343,929	\$1,685,613
A+B	Total Salaries and Wages	\$320,398	\$352,096	\$414,527	\$398,791	\$381,780	\$1,867,592
C	Total Fringe	\$102,453	\$108,600	\$120,397	\$128,299	\$127,132	\$586,881
A+B+C	Total Salaries + Fringe	\$422,851	\$460,696	\$534,924	\$527,090	\$508,912	\$2,454,473
D	Capital Equipment	\$2,666,220	\$3,430,301	\$2,158,520	\$2,023,600	\$2,233,200	\$12,511,841
E1	Travel Domestic	\$20,196	\$9,156	\$14,008	\$2,381	\$17,003	\$62,744
E2	Travel Foreign	\$26,928	\$60,759	\$3,820	\$13,855	\$6,624	\$111,987
G1	Materials & Supplies	\$37,500	\$36,500	\$29,500	\$33,500	\$33,500	\$170,500
G4	Computer Services	\$3,298	\$6,595	\$9,893	\$23,084	\$6,595	\$49,465
G5	Subawards	\$569,256	\$822,348	\$573,570	\$662,584	\$575,687	\$3,203,446
G6	Other (Contingency)	\$664,979	\$575,002	\$362,229	\$464,748	\$788,853	\$2,855,810
G	Total Other Direct Cost	\$1,275,033	\$1,440,445	\$975,192	\$1,183,916	\$1,404,635	\$6,279,222
H (A thr G	Total Direct Costs	\$4,411,228	\$5,401,357	\$3,686,464	\$3,750,843	\$4,170,375	\$21,420,267
I1	Labor Indirect	\$224,111	\$244,169	\$283,509	\$279,358	\$269,723	\$1,300,870
I2	Travel Indirect	\$24,976	\$37,055	\$9,449	\$8,605	\$12,522	\$92,607
I3	Materials & Supplies Indirect	\$19,875	\$19,345	\$15,635	\$17,755	\$17,755	\$90,365
I4	Subaward Setup	\$53,000	\$0	\$0	\$0	\$0	\$53,000
I5	Services Indirect	\$1,748	\$3,496	\$5,243	\$12,234	\$3,496	\$26,217
I	Total Indirect Cost	\$323,709	\$304,064	\$313,836	\$317,953	\$303,496	\$1,563,059
J=H+I	Total Direct & Indirect	\$4,734,937	\$5,705,421	\$4,000,301	\$4,068,796	\$4,473,871	\$22,983,326

Revision 1 - May 10, 2018

Budget Elements	Total NSF					TOTAL
	YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	
Total Senior Personnel	\$34,283	\$34,969	\$35,668	\$36,382	\$37,109	\$178,411
Other Personnel	\$347,491	\$323,038	\$323,486	\$357,883	\$358,784	\$1,710,682
Total Salaries and Wages	\$381,774	\$358,007	\$359,154	\$394,265	\$395,893	\$1,889,093
Total Fringe	\$133,621	\$125,301	\$125,702	\$137,992	\$138,564	\$661,180
Total Salaries + Fringe	\$515,395	\$483,308	\$484,856	\$532,257	\$534,457	\$2,550,273
Capital Equipment	\$2,801,000	\$4,510,406	\$2,273,000	\$2,266,000	\$2,124,000	\$13,974,406
Travel Domestic	\$9,180	\$9,364	\$15,281	\$1,948	\$9,937	\$45,710
Travel Foreign	\$12,138	\$25,906	\$35,444	\$45,354	\$15,788	\$134,631
Materials & Supplies	\$90,000	\$90,000	\$120,000	\$180,000	\$60,000	\$540,000
Computer Services	\$13,298	\$76,595	\$9,893	\$23,084	\$6,595	\$129,465
Subawards	\$898,289	\$1,069,470	\$587,773	\$647,378	\$551,095	\$3,754,005
Other	\$0	\$0	\$0	\$0	\$0	\$0
Total Other Direct Cost	\$1,001,586	\$1,236,066	\$717,666	\$850,461	\$617,691	\$4,423,471
Total Direct Costs	\$4,339,299	\$6,265,049	\$3,526,248	\$3,696,021	\$3,301,873	\$21,128,490
Labor Indirect	\$273,159	\$256,154	\$256,974	\$282,097	\$283,262	\$1,351,646
Travel Indirect	\$11,299	\$18,693	\$26,885	\$25,070	\$13,634	\$95,581
Materials & Supplies Indirect	\$47,700	\$47,700	\$63,600	\$95,400	\$31,800	\$286,200
Subaward Setup	\$53,000	\$0	\$0	\$0	\$0	\$53,000
Services Indirect	\$7,048	\$40,596	\$5,243	\$12,234	\$3,496	\$68,617
Total Indirect Cost	\$392,205	\$363,142	\$352,702	\$414,802	\$332,192	\$1,855,043
Total Direct & Indirect	\$4,731,505	\$6,628,192	\$3,878,950	\$4,110,822	\$3,634,065	\$22,983,533

Differences (Rev 2 - Rev 1)

Budget Elements	Total NSF					TOTAL
	YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	
Total Senior Personnel	\$686	\$699	\$714	\$727	\$742	\$3,568
Other Personnel	-\$62,062	-\$6,610	\$54,659	\$3,799	-\$14,855	-\$25,069
Total Salaries and Wages	-\$61,376	-\$5,911	\$55,373	\$4,526	-\$14,113	-\$21,501
Total Fringe	-\$31,168	-\$16,701	-\$5,305	-\$9,693	-\$11,432	-\$74,299
Total Salaries + Fringe	-\$92,544	-\$22,612	\$50,068	-\$5,167	-\$25,545	-\$95,800
Capital Equipment	-\$134,780	-\$1,080,105	-\$114,480	-\$242,400	\$109,200	-\$1,462,565
Travel Domestic	\$11,016	-\$208	-\$1,273	\$433	\$7,066	\$17,034
Travel Foreign	\$14,790	\$34,853	-\$31,624	-\$31,499	-\$9,164	-\$22,643
Materials & Supplies	-\$52,500	-\$53,500	-\$90,500	-\$146,500	-\$26,500	-\$369,500
Computer Services	-\$10,000	-\$70,000	\$0	\$0	\$0	-\$80,000
Subawards	-\$329,033	-\$247,122	-\$14,203	\$15,207	\$24,592	-\$550,559
Other (Contingency)	\$664,979	\$575,002	\$362,229	\$464,748	\$788,853	\$2,855,810
Total Other Direct Cost	\$273,446	\$204,380	\$257,526	\$333,455	\$786,945	\$1,855,751
Total Direct Costs	\$71,928	-\$863,692	\$160,216	\$54,822	\$868,502	\$291,777
Labor Indirect	-\$49,048	-\$11,985	\$26,535	-\$2,739	-\$13,539	-\$50,776
Travel Indirect	\$13,677	\$18,362	-\$17,436	-\$16,465	-\$1,112	-\$2,973
Materials & Supplies Indirect	-\$27,825	-\$28,355	-\$47,965	-\$77,645	-\$14,045	-\$195,835
Subaward Setup	\$0	\$0	\$0	\$0	\$0	\$0
Services Indirect	-\$5,300	-\$37,100	\$0	\$0	\$0	-\$42,400
Total Indirect Cost	-\$68,496	-\$59,078	-\$38,866	-\$96,849	-\$28,696	-\$291,984
Total Direct & Indirect	\$3,433	-\$922,770	\$121,350	-\$42,027	\$839,806	-\$208



# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>Michigan State University</b>				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Tyce DeYoung</b>				PROPOSAL NO.	DURATION (months)		
				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Tyce DeYoung - Professor</b>				0.00	0.00	0.50	6,483
2.							
3.							
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.50	6,483
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. ( 2 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				12.00	0.00	0.00	100,000
3. ( 0 ) GRADUATE STUDENTS							0
4. ( 0 ) UNDERGRADUATE STUDENTS							0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							106,483
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							33,056
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							139,539
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							6,732
2. INTERNATIONAL							16,320
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____				0			
2. TRAVEL _____				0			
3. SUBSISTENCE _____				0			
4. OTHER _____				0			
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							16,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							16,000
H. TOTAL DIRECT COSTS (A THROUGH G)							178,591
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Indirect (Rate: 55.0000, Base: 178591)</b>							
TOTAL INDIRECT COSTS (F&A)							98,225
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							276,816
K. SMALL BUSINESS FEE							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							276,816
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Tyce DeYoung</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

1 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

# SUMMARY PROPOSAL BUDGET

YEAR **2**

ORGANIZATION <b>Michigan State University</b>				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Tyce DeYoung</b>				PROPOSAL NO.		DURATION (months)	
						Proposed	Granted
				AWARD NO.			
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Tyce DeYoung - Professor</b>				0.00	0.00	0.50	<b>6,677</b>
2.							
3.							
4.							
5.							
6. ( <b>0</b> ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	<b>0</b>
7. ( <b>1</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.50	<b>6,677</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	<b>0</b>
2. ( <b>2</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				12.00	0.00	0.00	<b>103,000</b>
3. ( <b>0</b> ) GRADUATE STUDENTS							<b>0</b>
4. ( <b>0</b> ) UNDERGRADUATE STUDENTS							<b>0</b>
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>0</b>
6. ( <b>0</b> ) OTHER							<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>109,677</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>34,459</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>144,136</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
<b>Cables</b> <span style="float: right;"><b>\$ 255,000</b></span>							
TOTAL EQUIPMENT							<b>255,000</b>
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							<b>4,578</b>
2. INTERNATIONAL							<b>24,970</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <b>0</b>							
2. TRAVEL <b>0</b>							
3. SUBSISTENCE <b>0</b>							
4. OTHER <b>0</b>							
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS							<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>12,000</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>0</b>
3. CONSULTANT SERVICES							<b>0</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>0</b>
6. OTHER							<b>0</b>
TOTAL OTHER DIRECT COSTS							<b>12,000</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>440,684</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Indirect (Rate: 55.0000, Base: 185685)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>102,127</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>542,811</b>
K. SMALL BUSINESS FEE							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							<b>542,811</b>
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Tyce DeYoung</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

2 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

# SUMMARY PROPOSAL BUDGET

YEAR 3

ORGANIZATION <b>Michigan State University</b>				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Tyce DeYoung</b>				PROPOSAL NO.	DURATION (months)		
				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Tyce DeYoung - Professor</b>				0.00	0.00	0.50	6,877
2.							
3.							
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.50	6,877
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. ( 2 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				12.00	0.00	0.00	106,090
3. ( 0 ) GRADUATE STUDENTS							0
4. ( 0 ) UNDERGRADUATE STUDENTS							0
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							112,967
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							35,928
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							148,895
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							11,673
2. INTERNATIONAL							5,518
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ 0							
2. TRAVEL 0							
3. SUBSISTENCE 0							
4. OTHER 0							
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS							0
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							8,000
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							0
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							0
TOTAL OTHER DIRECT COSTS							8,000
H. TOTAL DIRECT COSTS (A THROUGH G)							174,086
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) <b>Indirect (Rate: 55.0000, Base: 174088)</b>							
TOTAL INDIRECT COSTS (F&A)							95,748
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							269,834
K. SMALL BUSINESS FEE							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							269,834
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Tyce DeYoung</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

# SUMMARY PROPOSAL BUDGET

YEAR 4

ORGANIZATION <b>Michigan State University</b>				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Tyce DeYoung</b>				PROPOSAL NO.	DURATION (months)		
				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Tyce DeYoung - Professor</b>				0.00	0.00	0.50	<b>7,083</b>
2.							
3.							
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	<b>0</b>
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.50	<b>7,083</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	<b>0</b>
2. ( 2 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				12.00	0.00	0.00	<b>109,272</b>
3. ( 0 ) GRADUATE STUDENTS							<b>0</b>
4. ( 0 ) UNDERGRADUATE STUDENTS							<b>0</b>
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>0</b>
6. ( 0 ) OTHER							<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>116,355</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>37,466</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>153,821</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
<b>Equipment Item</b>				\$		<b>0</b>	
TOTAL EQUIPMENT							<b>0</b>
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							<b>11,907</b>
2. INTERNATIONAL							<b>5,629</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____				<b>0</b>			
2. TRAVEL _____				<b>0</b>			
3. SUBSISTENCE _____				<b>0</b>			
4. OTHER _____				<b>0</b>			
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS							<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>4,000</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>0</b>
3. CONSULTANT SERVICES							<b>0</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>0</b>
6. OTHER							<b>0</b>
TOTAL OTHER DIRECT COSTS							<b>4,000</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>175,357</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>Indirect (Rate: 55.0000, Base: 175359) (Cont. on Comments Page)</b>							
TOTAL INDIRECT COSTS (F&A)							<b>96,447</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>271,804</b>
K. SMALL BUSINESS FEE							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							<b>271,804</b>
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Tyce DeYoung</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

## SUMMARY PROPOSAL BUDGET COMMENTS - Year 4

---

**\*\* I- Indirect Costs**

**New Indirect Item goes here (Rate: 0.0000, Base 0)**

# SUMMARY PROPOSAL BUDGET

YEAR 5

ORGANIZATION				FOR NSF USE ONLY		
Michigan State University				PROPOSAL NO.		DURATION (months)
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR				AWARD NO.		
Tyce DeYoung						
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer
				CAL	ACAD	SUMR
1. Tyce DeYoung - Professor				0.00	0.00	0.50
2.						
3.						
4.						
5.						
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.50
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)						
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00
2. ( 2 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				12.00	0.00	0.00
3. ( 0 ) GRADUATE STUDENTS						
4. ( 0 ) UNDERGRADUATE STUDENTS						
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)						
6. ( 0 ) OTHER						
TOTAL SALARIES AND WAGES (A + B)						7,295
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)						0
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)						7,295
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)						
TOTAL EQUIPMENT						0
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)						14,574
2. INTERNATIONAL						5,741
F. PARTICIPANT SUPPORT COSTS						
1. STIPENDS \$ 0						
2. TRAVEL 0						
3. SUBSISTENCE 0						
4. OTHER 0						
TOTAL NUMBER OF PARTICIPANTS ( 0 ) TOTAL PARTICIPANT COSTS						0
G. OTHER DIRECT COSTS						
1. MATERIALS AND SUPPLIES						0
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION						0
3. CONSULTANT SERVICES						0
4. COMPUTER SERVICES						0
5. SUBAWARDS						0
6. OTHER						0
TOTAL OTHER DIRECT COSTS						0
H. TOTAL DIRECT COSTS (A THROUGH G)						103,700
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)						
Indirect (Rate: 55.0000, Base: 103704)						
TOTAL INDIRECT COSTS (F&A)						57,037
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)						160,737
K. SMALL BUSINESS FEE						0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)						160,737
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$		
PI/PD NAME				FOR NSF USE ONLY		
Tyce DeYoung				INDIRECT COST RATE VERIFICATION		
ORG. REP. NAME*				Date Checked	Date Of Rate Sheet	Initials - ORG
David Schuster						

5 \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

# SUMMARY PROPOSAL BUDGET

Cumulative

ORGANIZATION <b>Michigan State University</b>				FOR NSF USE ONLY			
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Tyce DeYoung</b>				PROPOSAL NO.	DURATION (months)		
				AWARD NO.	Proposed	Granted	
A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)				NSF Funded Person-months		Funds Requested By proposer	Funds granted by NSF (if different)
				CAL	ACAD	SUMR	
1. <b>Tyce DeYoung - Professor</b>				0.00	0.00	2.50	<b>34,415</b>
2.							
3.							
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	<b>0</b>
7. ( <b>1</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	2.50	<b>34,415</b>
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	<b>0</b>
2. ( <b>10</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				60.00	0.00	0.00	<b>474,637</b>
3. ( <b>0</b> ) GRADUATE STUDENTS							<b>0</b>
4. ( <b>0</b> ) UNDERGRADUATE STUDENTS							<b>0</b>
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							<b>0</b>
6. ( <b>0</b> ) OTHER							<b>0</b>
TOTAL SALARIES AND WAGES (A + B)							<b>509,052</b>
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							<b>160,724</b>
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							<b>669,776</b>
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
<b>\$ 255,000</b>							
TOTAL EQUIPMENT							<b>255,000</b>
E. TRAVEL 1. DOMESTIC (INCL. U.S. POSSESSIONS)							<b>49,464</b>
2. INTERNATIONAL							<b>58,178</b>
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ <b>0</b>							
2. TRAVEL <b>0</b>							
3. SUBSISTENCE <b>0</b>							
4. OTHER <b>0</b>							
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> ) TOTAL PARTICIPANT COSTS							<b>0</b>
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							<b>40,000</b>
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							<b>0</b>
3. CONSULTANT SERVICES							<b>0</b>
4. COMPUTER SERVICES							<b>0</b>
5. SUBAWARDS							<b>0</b>
6. OTHER							<b>0</b>
TOTAL OTHER DIRECT COSTS							<b>40,000</b>
H. TOTAL DIRECT COSTS (A THROUGH G)							<b>1,072,418</b>
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							<b>449,584</b>
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							<b>1,522,002</b>
K. SMALL BUSINESS FEE							<b>0</b>
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							<b>1,522,002</b>
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PD NAME <b>Tyce DeYoung</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>David Schuster</b>				INDIRECT COST RATE VERIFICATION			
				Date Checked	Date Of Rate Sheet	Initials - ORG	

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET