**Directorate for Geosciences**

 **Division of Polar Programs**

**Directorate for Mathematical & Physical Sciences**

 **Division of Physics**

November 7, 2018

**Panel Charge**

**IceCube Neutrino Observatory**

**Maintenance & Operation (M&O)**

**Mid-Term Panel Review**

**January 8-9, 2019**

**TO: Panel Members**

The IceCube Neutrino Observatory (ICNO) is a major scientific facility sponsored by the NSF and operated by the University of Wisconsin in Madison under a Cooperative Agreement with NSF. The current award for the maintenance and operation (M&O) of this facility is OPP-1600823. The ICNO enables research in ground-based neutrino astrophysics by the U.S. and international scientific communities.

The IceCube Collaboration is an international collaboration of scientists (currently involving 49 institutions from 12 countries) who conduct scientific analyses of data collected by ICNO. In addition to conducting scientific analyses of ICNO data, members of the Collaboration contribute to the overall enterprise by performing service work needed to operate the Observatory or preparing data for scientific analysis. Some collaborating institutions provide computing and database infrastructure and services to facilitate the work of the Collaboration. This approach creates a mechanism for collaborating scientists and institutions to support the work needed to make ICNO data useful scientifically, as well as to provide students and postdocs realistic experience in operation of a major astrophysics facility.

This mid-term external review of the ICNO Maintenance and Operation (M&O) award is recommended by the Cooperative Agreement to cover, at a minimum, the program management, cost and performance objectives, and scientific and technical performance after the second and fourth project years to inform the NSF's decision on potential pathways for the support of ICNO/M&O activities beyond 2021. NSF expects to invite IOFG members to participate in this review.

**The Charge**

The ICNO Mid-Term Review Panel should examine the existing balance of activities to support the ICNO maintenance and operation. The primary goal of this review, and of any resulting adjustments of the M&O activities, is to ensure that investments in the IceCube-related science and respective facility's support are properly aligned, both now and in the future, within the project's goals and objectives and research priorities of the U.S. and international particle astrophysics community.

The review will assess the budget and management activities encompassing the ICNO's maintenance and operation from April 2016 to the beginning of 2019 and consider the costs of continuing the ICNO observing capabilities funded by the M&O Cooperative Agreement through 2021. The Panel may also assess the currently needed and future developments of the ICNO capabilities.

As identified in the attached copy of the ICNO/M&O Cooperative Agreement, the following elements should be considered in the Panel’s recommendation:

* 1. ICNO Scientific and Technical Management:
	2. Technical progress (hardware data collection systems at South Pole and UW)
	3. Systems architecture (IceCube and IceTop triggering and filtering)
	4. Field support & logistics, hardware upgrades, R&D effort for IceTop
	5. Data management (preprocessing, local & remote computing requirements, data transfer)
	6. Data quality, simulation and reconstruction tools
	7. Analysis coordination and publications

2. ICNO Program Management and Business Systems:

* 1. University and WIPAC administrative structure:
		1. Oversight, reporting
		2. Advisory mechanisms.
	2. Program Organizational Structure:
		1. WBS and reporting structures of the U.S. and in-kind contributions
		2. Change & interface controls, technical board role, program integration activities, etc.
		3. Compliance monitoring of work conditions and requirements
		4. Resource loading planning
		5. Cost and schedule control
		6. Coordination with NSF and Antarctic Support Contractor.

The Panel should consider the effects of its recommendations on the future landscape of the U.S. and international particle astrophysics communities. The recommended M&O support and its potential changes should be viable and lead to a vigorous and sustainable scientific research program. The Panel is asked to examine how the recommended M&O activities may support and develop a workforce with the requisite abilities and diversity to exploit the recommended research and education investments.

Finally, the elements of recommended support for ICNO should be prioritized in sufficient detail to enable NSF to make subsequent appropriate adjustments in response to variations in the available Federal and non-Federal funding.

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