



Panel Charge
IceCube Neutrino Observatory
Maintenance & Operation (M&O)
Mid-Term Panel Review (V242133)
April 29-30, 2024

April 4, 2024

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 the Cooperative Agreement with NSF. The current award for the maintenance and operations (M&O) of this facility is OPP-2042807 to cover a period of 60 month from April 1, 2021 to March 31, 2026. The ICNO enables research in ground-based neutrino astrophysics by the U.S. and international scientific communities.

The IceCube Collaboration is an international effort of over 350 scientists (currently involving 59 institutions from 14 countries; <https://icecube.wisc.edu/collaboration/>) conducting scientific analyses of data collected by ICNO. In addition, members of the Collaboration contribute to the overall M&O enterprise by performing service work needed to operate the Observatory and preparing data for scientific analyses. Some institutions provide “in-kind” 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 graded as scientifically valid, as well as providing to students and postdocs unique realistic experience in operating a major research astrophysical facility.

This mid-term external review of the ICNO/M&O award is recommended by the Cooperative Agreement to cover, at a minimum, project management, cost and performance objectives, and scientific and technical performance to inform NSF's decision on potential pathways for the support of the ICNO/M&O activities through 2026 and beyond.

The Charge

The ICNO Mid-Term Review Panel should examine the existing balance of activities to support the ICNO maintenance and operations. The primary goal of this review, and of any resulting adjustments to the M&O activities, is to ensure that investments in the IceCube-related science and respective facility's support are properly aligned, both as now and in the future, within the project's goals and objectives as well as with 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 operations from April 2021 through March 2024 and consider the costs of continuing the ICNO observing capabilities funded through March 2026. The Panel may also assess the current needs and future developments of the ICNO capabilities.

As identified in the attached copy of the ICNO/M&O Cooperative Agreement, the following elements are considered for the Panel's review and recommendations:

ICNO Scientific and Technical Management:

- a) ICNO Science Overview, Collaboration, Education & Outreach
- b) ICNO Systems Architecture (IceCube and IceTop, triggering and filtering)
- c) Data management (preprocessing, local & remote computing requirements, data transfer from the South Pole to U. Wisconsin)
- d) Data quality, simulation and reconstruction tools



- e) Data analysis coordination and publications
- f) Technical progress (hardware data collection systems at the South Pole and U. Wisconsin)
- g) Field support & logistics, hardware upgrades, and R&D effort for the IceTop replacements
- h) Expected integration (during the 2025–2026 field season) of the IceCube Upgrade’s 7 new strings into the ICNO main data collection system.

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.

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.

NSF Cognizant Program Officers:

Dr. Vladimir Papitashvili
 Program Director
 Antarctic Astrophysics & Geospace Sciences
 GEO/Office of Polar Program
 Phone: (703) 282-6700
 E-mail: vpapita@nsf.gov

Dr. William Wester
 Program Director
 Particle Astrophysics
 MPS/Division of Physics
 Phone: (630) 917-7604
 E-mail: wwester@nsf.gov

CA Cognizant Officer:

Ms. Taina MMunoz-Mulero
 Grant & Agreement Specialist
 NSF/DACS
 Phone: 703-292-5013
 E-mail: kspencer@nsf.gov

RIO Liaison:

Dr. Kevin Porter
 Research Infrastructure
 Advisor, NSF/BFA/RIO
 Phone: 703-292-5484
 E-mail: kporter@nsf.gov

Panel Support Contact:

Ms. Desiree Marshall
 Program Specialist
 NSF/Office of Polar Programs
 Phone: 703-292-7433
 E-mail: demarsha@nsf.gov

ICNO/M&O Mid-Term Review Panel

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**Prof. Donald L. Hartill
 Emeritus (Chair)**
 Department of Physics,
 Cornell University
 E-mail: dlh13@cornell.edu
 Phone: 607-255-8787
[https://physics.cornell.edu/
 donald-hartill](https://physics.cornell.edu/donald-hartill)
 NSF ID: WW0117731

**Dr. James Annis
 (ICNO Science and
 Technology)**
 Fermi National Laboratory
 E-mail: annis@fnal.gov
 Phone: 630-840-5181
[https://computing.fnal.gov/
 james-annis/](https://computing.fnal.gov/james-annis/)
 NSF ID: ZY0872290

**Mr. Richard S.
 Armstrong, PE, LLC
 (ICNO Infrastructure
 and Management)**
 E-mail:
darmstrong@rsa-ak.com
 Phone: 907-229-0331
 NSF ID: ZG0854223