Budget Justification

As described in the proposal, we are requesting funds to perform engineering and technical R&D to enable submission of a full proposal for the Braidwood Neutrino Experiment. Much of the R&D needed to optimize details of the detector design will be supported by base grants of the collaborators. Here, we request funds for specific engineering and R&D tasks that are beyond the existing resources of the groups. Our present request also includes funds to support undergraduate participation in this exciting planning phase of the experiment.

The budget request has four components.

1. *Civil Engineering.* Civil construction will be the single largest expense in the experiment, and will set the schedule for the start of data collection. A relatively complete civil construction plan is needed to establish a reliable cost and schedule for the experiment. We have requested \$525K to develop a "design and build" plan that would be suitable for construction bids by contractors. Most of this design work will employ capabilities not available inside the collaboration, and will be contracted with outside firms.

2. *Detector Engineering.* The request includes \$408K to develop detailed engineering plans for the detectors, including the liquid scintillator based detector, calibration systems, and shielding system. As with civil engineering, the goal is to develop a full technical design allowing a reliable cost and schedule estimate.

3. *Liquid Scintillator R&D.* This experiment relies on availability of Gd-loaded scintillator with good optical clarity and stability. The Brookhaven group has produced small samples of scintillator with significantly better properties than that used in previous experiments. They will continue to refine their procedures and perform additional tests during the coming year. Additional tests of different aspects of the scintillator performance will be performed at several institutions in the Collaboration. This proposal includes \$28K to purchase chemicals to produce 200 L of Gd-loaded scintillator to be used for these studies.

4. *Outreach and Education.* A total of sixteen undergraduates, *i.e.* two per U.S.-based university, will participate in the Braidwood Undergraduate Program described in the proposal. We request funding for the four U.S. universities that do not have REU programs in experimental particle physics. For each student, we will provide a summer salary of \$3650 which includes travel allowance for expenses between the student's home and the host institution, but does not include housing; the total salary request is $8 \times \$3650 = \$29{,}200$). We also request an \$1800 housing allowance for these eight for students. The four universities with existing REU programs in particle physics will support two students each through existing programs. All eight groups require funding to allow these students to attend the summer school in Chicago. We request \$350/student (for all 16 students) to cover cost of attending the summer school at the University of Chicago. The \$20,000 travel request in the budget is the sum of the housing allowance for 8 students (\$14,400) and the support for travel to the Chicago summer school for all 16 students (\$5,600).