

A U.S. DEEP UNDERGROUND SCIENCE AND ENGINEERING LABORATORY SCIENTIFIC OPPORTUNITIES AND TECHNICAL REQUIREMENTS

The Deep Underground Science and Engineering Laboratory (DUSEL) will offer an exciting opportunity to illuminate the dark side of Earth, life, and the cosmos. It will allow us to answer fundamental physics questions as to the nature of dark matter, the properties of the neutrinos and the stability of matter. It will provide a unique observatory to explore the microbial processes and evolution under our planet's surface and the complex connection between tectonics, rock properties and multifaceted reaction and transport phenomena. It will enable a dramatic improvement underground construction, resource extraction and environmental remediation industries. DUSEL will also provide unique opportunities for cross-disciplinary education and outreach and for involvement of minority-serving institutions and local communities.

This community-wide and multidisciplinary proposal is in answer to the NSF request for a site-independent study of such laboratory, its scientific potential and the infrastructure required. This proposal has been developed at a widely attended multidisciplinary workshop in Berkeley. It is supported by all the eight sites that are currently planning to submit site-specific proposals.

The proposed study will sketch roadmaps describing the optimal development of each of scientific fields involved. It will identify the important experiments along this path and analyze their generic technical requirements. The experiments sharing the same needs will be grouped into cross-disciplinary modules. The study will define the common infrastructure necessary to carry the scientific and engineering programs at one or several sites and outline generic features of the needed management structure. It will put an American DUSEL in the international context, estimating the likely evolution of the demand and identifying the unique characteristics and strategic advantage that such a facility would bring. The goal is to generate broadly accepted benchmarks against which the proposals for individual sites will be judged, and provide data on the basis of which NSF will be able to make the appropriate decisions. The conclusions will be summarized in a 40–50 pages report written for nonspecialists, program officers at various federal funding agencies and staffers in Congress, the Office of Management and Budget, and the Office of Science and Technology Policy (OSTP). The supporting technical reports will be available on a website.

The study will be lead by six co-PIs who have widely recognized science credentials and community consensus-building experience: Bernard Sadoulet, Hamish Robertson, Eugene Beier, Charles Fairhurst, Tullis Onstott and James Tiedje. They represent, respectively: astrophysics, nuclear and particle physics, geology/engineering, geomicrobiology and microbial biology. The bulk of the work will be done in fourteen working groups. Three planned workshops will gather the community to synthesize the conclusions of individual working groups.

In order to address the challenge of a truly site-independent study, a number of mechanisms have been put in place. Although the PIs benefit from the trust of the sites, they are independent and ultimately responsible for the scientific basis of the conclusions. A site consultation group and a initiative coordination group have been set up to allow the voices of the sites and the major institutional stakeholders, such as national laboratories, to be heard, but they cannot direct the study. An NRC-style review is planned before the report is released.

The proposed study will have much broader impact than simply defining the sciences at DUSEL, or the corresponding infrastructure requirements. It will bring together the physics, earth sciences, biology and engineering communities to explore new scientific interfaces. It will prototype the involvement of private industry and other sectors. And the education planning process by scientists, engineers and education specialists from many fields will deepen the community understanding of how best to improve our education system and increase diversity of the scientific and engineering workforce.