

# Educational and Research Opportunities for Young Scientists at the National Underground Science Laboratory

Howard Baer, Florida State University  
David Benfield, South Dakota State University  
Florencia Canelli, University of Rochester  
Al Cooper, National Center for Atmospheric Research  
Royce Engstrom, University of South Dakota  
Dan Farrington, Black Hills State University  
Sherry Farwell, South Dakota School of Mines and Technology  
Joseph Formaggio, University of Washington  
Christopher Hays, Duke University  
David Hilderbrand, South Dakota State University  
Bill Hiscock, Montana State University  
John Krane, Iowa State University  
Gail Schmidt, Raytheon ITSS  
Gordon Watts, University of Washington

November 14, 2001

## Contents

|          |                                   |          |
|----------|-----------------------------------|----------|
| <b>1</b> | <b>Introduction</b>               | <b>2</b> |
| <b>2</b> | <b>EPSCoR Program at the NUSL</b> | <b>3</b> |
| <b>3</b> | <b>Intellectual Activity</b>      | <b>4</b> |

|   |          |
|---|----------|
| <b>4 Graduate Students</b>                        | <b>5</b> |
| <b>5 Post-Graduate and Young Faculty Programs</b> | <b>7</b> |
| <b>6 Recommendations</b>                          | <b>8</b> |
| <b>7 Conclusion</b>                               | <b>9</b> |

## **1 Introduction**

The National Underground Science Laboratory (NUSL) establishes a multi-purpose, world-class science center. A variety of different science disciplines will be hosted at the site, including neutrino physics, geology, nuclear astrophysics and cosmology, material science, engineering, and microbiology. As the new center draws scientists from the United States and abroad, its challenge will be to maintain an atmosphere of intellectual growth, a broadness of scientific scope, and a commitment to educating the general public. In addition, the laboratory will naturally be a center of intellectual activity for the state of South Dakota and the surrounding region. It is important that NUSL be able to implement a variety of programs that take full advantage of the educational outreach of the laboratory. Our particular focus has been on the educational and outreach opportunities for young scientists; including graduate students, postdoctoral fellows, scientific staff, and young tenured and non-tenured faculty. Throughout this report, we have tried to answer three key questions:

- Do we have a healthy environment in which young scientists can thrive?
- How can scientists take full advantage of the synergism of the different scientific disciplines present at the laboratory?
- How can scientists best integrate with other scientific programs available at the local, regional, and national levels?

The following discussion will focus on a number of key aspects related to educational and outreach opportunities available to young scientists at the NUSL. In particular, this discussion will address how to best integrate with the existing regional educational structure. Specific recommendations can be found within various sections of this document, as well as in Section 6.

## 2 EPSCoR Program at the NUSL

South Dakota is an EPSCoR (Experimental Program to Stimulate Competitive Research) state, and thus has participated for over a decade in programs sponsored by the National Science Foundation and other federal agencies designed to build research infrastructure and productivity. Some twenty of the states are in the EPSCoR program, including most of the states surrounding South Dakota (NE, ND, MT, WY). Within the EPSCoR states, the scientists and administrations have designed research foci around which to build, and EPSCoR resources are invested in a wide range of infrastructure building activities in the context of those research foci. The EPSCoR community should be able to both benefit from and contribute to NUSL activities in a number of ways:

1. The NUSL provides an opportunity to build scientific strength within the EPSCoR community in areas such as particle physics, geology, low-level measurement science, and life in extreme environments. As with the scientific community in general, NUSL represents a facility that will allow the development of new areas of scientific strength for EPSCoR states, and given its location central to the EPSCoR community, NUSL should be a driver for considerable new development. It will be imperative that the leadership of NUSL takes measures to inform the EPSCoR community about the opportunities that the lab represents. It is expected that some of the EPSCoR states would be in a position to participate immediately in NUSL science, while others may develop strength in relevant areas over time.
2. EPSCoR also can play a strong role in the outreach activities indicated in this report. For many years, the EPSCoR states have implemented programs specifically aimed at human resource development at all levels. Thus, examination of the EPSCoR programs in the participating states reveals energetic undergraduate research programs, graduate fellowship programs, post-doctoral training, visiting professorship, and sabbatical programs. Furthermore, the EPSCoR infrastructure should prove highly valuable in administering such programs.
3. The EPSCoR program would provide special opportunities for development of large-scale cooperative proposals. Now that the EPSCoR program has been successful in increasing the competitiveness of individual

investigators and groups of investigators, the EPSCoR community is turning its attention to large-scale efforts such as the development of Centers. NUSL represents a facility and an intellectual rallying point for EPSCoR states to interact on a large scale with other EPSCoR states as well as with other non-EPSCoR states.

In order to capitalize on the special opportunity afforded by EPSCoR, it will be necessary for the leadership of NUSL to pay particular attention to welcoming the EPSCoR states to the lab and providing vigorous outreach to the EPSCoR states. This will best be accomplished by establishing a position with the function of being liaison to the EPSCoR states, participating in national and regional EPSCoR events and ensuring that EPSCoR scientists are aware of the potential opportunities of the lab.

### **3 Intellectual Activity**

As part of the outreach program to young scientists, NUSL should create academic programs to attract scientists to the laboratory. Such programs include fellowships for graduate students and post-doctorates, special tribal scholarships, and women and minority programs. The exact number of such programs will depend on the laboratory budgets and special requirements. However, there are two programs we list in this publication that are limited in cost and can commence at the beginning of the laboratory's operation.

One such program is for NUSL to establish a state-of-the-art lecture/video conference center. Such a system would perform a variety of services. First, it would provide a forum for lectures at the laboratory. Such lectures can be at a number of levels: for scientists, for graduate students, for non-science staff, and for the local public. Second, such a facility can also serve as a video classroom for graduate students. Similar programs have been implemented at Columbia University, University of Rochester, Florida State University, and Fermilab. Classes available through video will allow students to take classes at their home institution (or elsewhere) while stationed at the laboratory. Finally, such a facility need not be exclusively used by scientists at the laboratory. The state of South Dakota enjoys a remarkable Internet system in their universities and K-12 classrooms. The lecture facility can easily be broadcast to classrooms across the state, further adding to the outreach capabilities of the laboratory. A video conference center would be relatively easy

to implement, needing only limited space and appropriate video equipment, and computers for Web cast capabilities. Such equipment is commercially available and would cost \$10-30K for a state-of-art facility. The expendability and outreach potential of such a system makes it a worthy investment for the laboratory.

The laboratory should also continue to encourage a variety of scientists from different disciplines to participate in the laboratory. In order to promote such participation at NUSL, we suggest that the laboratory establish an Exploratory Grant. The purpose of the Exploratory Grant would be to allow a visiting scientist to perform a unique, short duration experiment at the NUSL site. Such a grant would be awarded on the basis of merit and need not be limited to the experiments currently present at the laboratory. The infrastructure for the program can be similar to that employed for visiting scientists (see next section). Such a program would encourage scientists from a variety of fields to be affiliated with the laboratory.

## 4 Graduate Students

Graduate students will be a vital part of the National Underground Science Laboratory. It is estimated that 20-30 students will work as either part of their home institution program or as employees of the laboratory <sup>1</sup>. Part of the outreach program involves meeting the needs of graduate students. Such efforts will ensure that students effectively participate in the NUSL science program.

There are a number of simple measures that the laboratory can administer in order to help students adjust to the laboratory. One such measure would be to ensure that proper student representation is present on site. Such graduate student organizations provide a wealth of benefits to the students, such as student-oriented lectures and seminars, mailing lists, representation in laboratory committees, and social and recreational activities. Such organizations are often self-run and operate with small budgets. It is recommended that NUSL welcome such an organization at the laboratory.

Other issues of quality of life need also to be addressed by the laboratory. Issues such as housing, transportation, educational and social activities will have a significant impact on students working at the Underground Laboratory. Information should always be made available to students as they

---

<sup>1</sup>Based on an estimate of 8-10 experiments running with  $\approx 3$  students per experiment.

Table 1: Results of Fermilab GSA survey

| Do you have health insurance? |     |
|-------------------------------|-----|
| NO                            | 2%  |
| YES, at the University        | 65% |
| YES, Local to Fermilab        | 17% |
| No Response                   | 16% |

arrive at the laboratory. A healthy response of the laboratory on such issues will foster intellectual growth on site and encourage regional and national programs to further participate in the laboratory's scientific program.

One of the more pressing issues facing graduate students at national facilities, however, is health care. In 1999, a survey conducted at the Fermi National Accelerator Laboratory by the Graduate Student Association asked 114 graduate students questions regarding health care insurance. Results are shown in Table 1

Of the respondents who answered that they have insurance at Fermilab, about 29% live at Fermilab for more than 6 months out of the year. Of those which live at the laboratory, 79% would prefer to have health insurance local to Fermilab. More importantly, 65% of the respondents have also indicated that they have refrained from getting treatment because their insurance is non-local. Furthermore, the survey noted cases in which universities did not provide any health benefits for off-campus students, as well as occasions when students needed to pay out-of-pocket for less adequate and more expensive health care.

Ensuring that graduate students working at the laboratory have adequate health care is a primary responsibility of both the students' universities *and* the laboratory. However, often a given university does not have a plan available for off-campus health visits. One possible solution is for the laboratory to place such students under the laboratory health plan; or to offset the difference in cost between the laboratory and university health plans. The laboratory needs to adopt a policy that is beneficial to students working on a part-time or full-time basis at the laboratory. For these reasons, we recommend that NUSL institute an office of human resources, where one of the main priorities would be to ensure the health care of students working at the laboratory. Though the health care problem at national laboratories is a serious issue, it is clear that a comprehensive system at the onset of the

laboratory will prevent problems for students in the long run.

## 5 Post-Graduate and Young Faculty Programs

Finally, the laboratory's outreach program should incorporate the participation of young tenured and un-tenured scientists on a local, regional, and national level. A number of programs can be instituted to attract post-graduates and young faculty to the laboratory. One suggested program is the Visiting Scientist Program. Given the breadth of the types of science projects undertaken at the laboratory, NUSL would provide a rich environment for visiting scientists in a variety of fields. Though the Visiting Scientist Program is not restricted to geographical location, the program has a special advantage to regional institutions, as their scientists have close proximity to the laboratory.

Visiting scientists would come to the lab either via their own institution (to join a specific program at the laboratory), or from special invitation by the laboratory itself. Such positions should be of finite duration (i.e. six months), and it is recommended that a specific requirement be imposed upon completion of the program (i.e., journal submission). Stipends for the visiting scientist would be covered either by the scientist's home institution or the laboratory, depending on which institution originally invited the scientist. As often the visiting scientist will be sponsored by his or her own institution, the laboratory will not be obligated to provide health or child care services. However, the laboratory should provide as much information as possible of various facilities in the neighboring community. Visiting scientists from foreign countries need special considerations in regards to visa status. The visiting scientists program should coordinate with the human resource office to ensure the visitor can work at the laboratory without administrative hindrance. Special care should also be given for ITAR (International Traffic in Arms Regulations) and export control issues.

The Visiting Scientist Program is one example of a simple program that will add to the educational outreach program of the laboratory, as well as enhance the intellectual atmosphere of the lab. Other programs, such as specific fellowships and appointments, can also be considered by the laboratory as part of the educational outreach program.

## 6 Recommendations

Based on various discussions conducted during the October 4<sup>th</sup>-7<sup>th</sup> NUSL meeting, the Educational and Research Opportunities for Young Scientists subgroup has formulated a number of key recommendations to the lab directorate:

- A position for Outreach Director should be instituted at the National Underground Science Laboratory. He or she will have the responsibility of coordinating various aspects of the lab's outreach program, including tourism, K-12 education, and undergraduate, graduate, and post-graduate opportunities. Such a position would indicate the laboratory's strong commitment to a comprehensive outreach program.
- The NUSL should establish a position whose main responsibility is to act as a liaison and coordinator with various EPSCoR state programs. The EPSCoR program provides a significant opportunity for the laboratory to outreach on a regional level, and the establishment of such a position will help ensure the laboratory is fully involved in all available EPSCoR programs.
- The NUSL will need the establishment of a human resource office. Among the principal responsibilities of the office will be to ensure that employees working for or with the lab—especially graduate students—receive proper medical coverage while at the laboratory. As this is one of the most important issues affecting graduate students at a national laboratory, adequate medical coverage should be dealt with at the very onset of the laboratory.
- Currently, there is no explicit outreach commitment for the NUSL 2-year interim period. It is our recommendation that certain aspects of the outreach program (in particular, integration with various EPSCoR projects) are not constrained to NUSL being fully operational and thus should be started in the interim period.

In addition to the recommendations listed above, a number of other suggestions have been made throughout this document. We believe that these programs will contribute to the NUSL's commitment to outreach and to the intellectual health of the laboratory itself.



## 7 Conclusion

The National Underground Science Laboratory promises to be a world-class facility with the potential to address a variety of issues regarding outreach and quality of intellectual life. We hope that the recommendations in this document will help in the structure and formation of the newly-proposed laboratory.

We would like to thank the organizers of the NUSL workshop on outreach for allowing us to participate in this discussion.