Department of Energy and National Science Foundation
Status Review of QuarkNet
March 2004

A joint Department of Energy (DOE) and National Science Foundation (NSF) status review of the QuarkNet project was held on March 22, 2004 at the National Science Foundation in Arlington, Virginia. The review committee was co-chaired by James Whitmore (NSF) and Kathleen Turner (DOE). There were also three DOE, two NSF and four independent review committee members. A complete list of the attendees is attached.

The charge for the review (see attached) was to assess the current status of the project as well as the progress made since the February 2003 review. In particular, the committee was asked to review the project scope in terms of management, costs, schedule and development of the QuarkNet centers, assess the project's goals, progress towards these goals, and evaluation tools. In addition, they were asked to review the materials and services provided by the project and the project's planned funding profile.

Introduction

The QuarkNet project began in 1999 as a joint NSF/DOE research-based high-energy physics teacher education project. Marjorie Bardeen (Fermilab) serves as the spokesperson and is one of four managers shown in the attached organization chart. Staff members are an integral part of running the QuarkNet project. QuarkNet is a partnership of high school teachers and mentor physicists working in the field of high-energy physics at universities and laboratories across the country. It provides long-term professional development for local high school physics teachers through research experiences and workshops as well as sustained support over many years. Through these activities, the teachers enhance their knowledge and understanding of science and technology research. They transfer this experience to their classrooms, engaging their students in both the substance and processes of contemporary research as appropriate for the high school classroom.

The project, starting its sixth year of activity, is jointly supported by the Department of Energy (Office of High Energy Physics) and the National Science Foundation (Directorate for Elementary, Secondary and Informal Education [ESIE] and the Directorate for Mathematical and Physical Sciences [MPS] through the Office of Multidisciplinary Activities [OMA] and Elementary Particle Physics [PHY/EPP]). The QuarkNet project was originally based on university and laboratory "centers" with physicist mentors that are participating in the Large Hadron Collider (LHC) experimental collaborations (ATLAS and CMS) at CERN in Geneva, Switzerland and the Tevatron experimental collaborations (DZero and CDF) at Fermilab. It has since expanded to also include centers with participation in eleven experiments at seven DOE laboratories as well as foreign laboratories that are broadly representative of the field of high-energy physics. It is planned to continue through the life of the LHC program.

Development and Status of the Centers

In order to become a QuarkNet center, at least two experimental physicists must make a long-term commitment to participate for the duration of the project. The teachers who are recruited by the physicist mentors to participate in the centers also make a long-term commitment. The physicist mentors provide the initial research experiences in the summer and also maintain frequent contact with the teachers during the academic year. There has been some turnover in teachers, but relatively little in mentors.

A center has two stages of development, termed Center I and II, before getting to its steady-state level termed Center III or Center IV. The roles of types of centers are described below.

Center I

In the first year of a center's participation, the physicist mentors go through an orientation process and also recruit two "lead" teachers for the project. The teachers attend a one-week high-energy physics orientation workshop (institute) arranged by the QuarkNet staff and usually held at Fermilab. The teachers then participate in a seven-week research project with the physicist mentor, either at the center or at a laboratory where the experiment is conducted.

Center II

In the second year of a center's participation, the physicists and the lead teachers recruit up to ten "associate" teachers. The full complement of teachers attends a three-week research-based institute at their local center, developed by the physicist mentor and lead teachers and focusing on teacher professional development. The new teachers learn about high-energy physics, research methods and inquiry-based teaching and learning, tailored to their needs.

Center III

In the third and subsequent years of a center's participation, QuarkNet provides support for teachers to spend the equivalent of one-week in follow-on activities. Starting in 2004, a Center IIIa will also include a one-week refresher institute for two associate teachers.

Center IV

In addition to the above stages, NSF has funded a stage, termed Center IV, with four high school student-researchers supervised by one of the teachers. This stage started in FY 2004 and will apply to those centers that have reached the Center III level. For the length of the grant, approximately six new centers will become Center IV's each year, growing to include 30 centers over the next few years.

During each year of the ramp-up, the QuarkNet staff recruits up to twelve new Center I's, and the previous ones move to the next stage. The original plans called for QuarkNet to reach a steady-state of participants within five years involving 60 centers, 120 physicists, 720 high school teachers, and potentially reaching 100,000 students.

In September through December of each year, new Center I's are recruited. In January through May of the next year, the project gets ready for the summer program. The main QuarkNet sessions for the year are held in the summer.

The numbers of centers of each type are shown in the table below as a function of year. The number of centers recruited to start in summer 2004 is listed along with the planned development of centers in future years.

The project reported that it does not have a large number of centers applying that are turned down. The original plan was to have a full complement of 60 centers in 2003, though currently there are only 52 on board at this point. This is due principally to funding, but also to the rate of applications. They would rather have strong centers than getting to 60 in a certain time.

They actually have 208 physicist mentors working on the project, almost double the required amount. There were several centers where mentor interest was waning due to their other commitments. The QuarkNet project visited these centers and helped them get back on track.

Number of QuarkNet Centers in Each Project Year

Project Year	# Center I	# Center II	# Center III	# Center IIIa	# Center IV	Total # centers
1999	11					11
2000	13	11				24
2001	8	13	11			32
2002	7	8	24			39
2003	9	7	32			48
2004	4	9	27	6	6	52
2005		4	24	12	12	52
2006			19	15	18	52
2007			16	12	24	52
2008			14	12	26	52

Note: Values for 2005 and beyond are based on support for 52 centers.

The committee found that the current status of the center development is satisfactory and felt that the "new implementation of type IV centers has set QuarkNet as a new benchmark for all outreach groups to aspire".

The consensus of the committee indicated that center quality becomes more important than growing the program and that there was no real need to push for the 60 centers originally planned. They agreed with the QuarkNet management that it is better to ramp up to a steady state of a minimum of about 50 centers and have more emphasis on quality.

Though the committee heard several anecdotal presentations, they felt that more timely and detailed reporting from each center would allow more focus on center quality. An annual report from each center detailing its history, current activities and future plans, how many teachers and students are involved, what they accomplished, what types of teachers are involved and what types of schools they are associated with would be helpful. Although it was reported by the project that paperwork is often detrimental to center efforts, it was not felt that this would be a significant burden for the center. A report by a QuarkNet staff member of the one-week institutions held each summer by Fermilab for Center I's would also be useful.

About the physicist mentors, there was some concern by the committee about maintaining their commitments over the long term. It was also felt that a weak link may be the physicist mentors' ability in running an education project and that the project may be well-served by additional training for the mentors, having a lead mentor in each region and/or having special sessions at an American Physical Society, Division of Particles and Fields meeting.

The various institutes and workshops provide a way for teachers to associate with faculty at local institutions. The institutes have been very highly rated by the teachers, and have improved in quality over time. An important outcome of these sessions has been the ability of local physics teachers to connect with other teachers of similar interests and backgrounds.

Committee members expressed concern that the center sessions start out strong in the first few years and then tail off to one week after a few years. It was questioned whether one week of training for associate teachers was enough and half-day or more workshops throughout the year were suggested. It was noted that a similar lead teacher institute held each summer at Fermilab would perhaps benefit the teachers overall much more than having them evolve to teaching something different each year. The committee would also like more information on how the lead and associate teachers are selected. There was concern that once a teacher was in the program for several years, limited resources are actually spent helping them improve their instructional ability and it was suggested that the funds might be better spent by cycling out the veterans and cycling in new teachers.

The recent addition of high school students to the project, funded by NSF, was commended by the committee. It was commented that this demonstrates the multiplier effect for reaching students and should ensure that QuarkNet meets its goal to exhibit a more positive attitude towards science. One committee member noted that it might be better to select one student per center to ensure broad representation.

<u>Conclusions</u>
Overall, the committee felt that maintaining quality rather than quantity of centers was important. An annual progress report should be required from each center, including information about their teachers and associated schools. The committee felt that the plan for future years of the project regarding institutes and workshops should be revisited.

<u>Project Materials and Services</u>
The QuarkNet staff members provide services to the centers and teachers as well as guidelines for center performance. They have weekly meetings via telecon and a face-to-face meeting every other month. To maintain quality control and support for the centers, they visit each center yearly as well as some of the high schools associated with the center. When new centers are being recruited, a staff member visits to ensure that roles and responsibilities are understood and can be met.

Some of the other services provided include:

- Maintaining the QuarkNet website and collecting data for the independent evaluations.
- Developing and implementing a teacher orientation institute and physicist mentor orientation session each summer.
- Developing an online database with example classroom activities, workshop ideas and other resources for teachers.
- Developing program materials to assist mentors and teachers as they develop local programs.
- Building cosmic ray detectors for teachers to use in the classroom.
- Providing community-building activities for the teachers locally and across the country.

- Enabling teacher meetings and presentations at the American Association of Physics Teachers (AAPT) meeting and other conferences.

Members of the committee commented that classroom cosmic ray detectors seem to be a “hit” and that this will be an exciting project to watch as it is developed. These detectors are quite impressive, allowing students to receive a hands-on experience building and using sophisticated physics apparatus. The project is to be commended for developing very simple yet elegant devices for the classroom. Efforts should be made to get these into as many schools as possible and document their usage. It would be worth exploring ways to partner with industry to use computer interfaces already common in many physics classrooms.

The committee felt that the cosmic ray detectors are an excellent means for students to begin an inquiry-based program. It is more difficult to sense the demand for web-based activities to analyze the cosmic ray data and the software aspect lags behind in its utility. As evidenced by the web-based software currently being developed by QuarkNet, including high school students in data analysis can be challenging. The QuarkNet project provides a number of additional web-based activities including activities for analyzing Fermilab data to measure particle lifetimes and to search for evidence of a Higgs particle. These tools are an interesting and effective way of bringing particle physics into the high school classroom. One committee member commented that they found the web page organization somewhat confusing and disjointed. For instance, it was difficult to determine the sequence of events one should follow to begin analyzing the data. The QuarkNet staff should take the lead in developing a concise set of software tools for allowing students to examine and analyze the cosmic ray and other data, taking care not to get too fancy.

Though not as important to the students as learning to think critically and analyze data, learning to present their results would be a good skill for students to develop. QuarkNet may consider requiring students to complete their research and studies by writing a paper. This is standard for research scientists and would be an invaluable activity for them not only to have something to submit for science fair projects (and potential scholarships), but also an experience that will help them in their college studies. QuarkNet may also consider placing all student and teacher abstracts and results on the web since it is a very powerful concept both for both data collection and data sharing and for the promotion of the QuarkNet program. A “show and tell” site for students would be a great place to show off their work.

Also being developed by QuarkNet is the use of Grid computing for high school student research. This will be important in the future for students to be able to analyze data from the LHC experiments. At this time, it is difficult to determine if the amount of effort invested into this project will return the anticipated results.

With the addition of student-researchers in Center IV’s, the committee felt that the project shows promise in making a direct impact in the life of a physics student. The summer research experience has been valuable for maintaining the interest of the faculty members as each center transitions from Center I to IV status. One concern with this program is how the mentors will be able to include high school students in cutting-edge research as the LHC experiments move from construction to analysis.

The teacher online databases that are provided and demonstrated appeared to the committee to be a potentially valuable tool, but underdeveloped and underused. Teachers should be encouraged, or even required (in order to receive a mini-grant, perhaps) to submit ideas and suggestions to the lesson database. For teachers wishing to incorporate particle physics into their classroom curriculum, these lessons are a great resource. A workshop ideas section and a talks section are good ideas. It was also suggested that talks by experts in the training sessions be posted to the web-site. A short, exit-survey that asks a few simple questions about the use of the lessons on the QuarkNet site could provide feedback from teachers.

The conference opportunities, reunions, and regional meetings organized by the QuarkNet staff are wonderful opportunities for teachers to apply what they have learned with their research and to get support for any further needs they may have. The most recent regional meeting appears to be the most successful, and the committee felt that more should be planned for centers in other parts of the country.

As part of the services provided by the QuarkNet project, staff members visit each of the centers once a year. This corresponds to approximately one trip a month. The committee felt that perhaps the project could determine a better way to maintain the quality of the program through either more regional meetings or video/phone conferences. This would allow the staff to devote more of their time to developing needed materials and services for the project, while also reducing the funds required to support this service.

Conclusions

Overall the committee felt that the project should continue to concentrate on physics and experimental techniques in general, through the use of particle physics. They recommended that the project continue to enhance the online database, web-based activities and teacher meeting opportunities. The cosmic ray detector construction and analysis tool work should continue, with the scope of this work laid out in more detail and made more widely available. Members of the committee felt that the project staff should decrease their time spent traveling to monitor the centers in order to concentrate more on the service activities.

Teacher Professional Development Goals and Evaluations

The QuarkNet project has four measurable goals that relate to teacher development:

1) To increase teachers' knowledge of scientific process, particle physics and relationships to curriculum.
2) To increase teachers' knowledge of and ability to implement inquiry based teaching methods.
3) To increase teachers' contributions to quality and practice of colleagues within the field of science education.
4) To support teachers as they facilitate student understanding of and ability to solve science related problems.

The outcomes of the QuarkNet project are to improve high school students'

- abilities to understand and appreciate measurements
- abilities to engage in scientific investigations
- knowledge of basic physics concepts
- positive attitudes towards science and science literacy.

QuarkNet offers programs designed and conducted according to "best practices" reported in the National Science Education Standards prepared by a National Research Council (NRC) committee and published by the National Academy Press in 1995.

The committee felt that evidence and testimonials presented at the review about the level of satisfaction teachers received from their involvement with this project demonstrated that it is serving the teaching community well. QuarkNet is achieving its goal of supporting teachers as they facilitate student understanding and ability to solve related problems as far as anecdotal evidence shows. The pairing of teachers and research scientists in this endeavor is critical, and QuarkNet should be commended for the success their program has achieved with their programs thus far.

Evidence regarding goal 2, to increase teachers' knowledge of and ability to implement inquiry based teaching methods, appeared to the committee to be weak, although that is a greater problem that should not be attributed to any lack on the part of the QuarkNet program. However, they should still work towards this goal since it is a standard that many teachers are held to. Providing inquiry-based learning workshops in the summer as well as lesson-plans on the website will continue to be a benefit to teachers who wish to implement this in the classroom.

To obtain more measurable outcomes, the project has hired an outside evaluator. This evaluator has implemented a number of methods for determining the impact of QuarkNet on the teachers' scientific understanding and teaching methods. There was much concern by the committee about finding a good way to evaluate and enumerate the benefits of the program. Baseline studies seem critical to fully understand the impact of the program. It was also suggested that a mechanism be put in place to evaluate the physicist mentors.

Perhaps the most useful method of evaluation was felt by the committee to be pre- and post-institute surveys. These surveys seem to indicate that teachers' knowledge of the scientific process and particle physics has increased. Although lead teachers give the institute training high ratings it is difficult to tell how well this is being done at each center. For example, the evaluation states that lead teachers report in pre/post surveys that there is no significant difference in the use of best practices. Perhaps the professional development needs to be reviewed and modified. It is more difficult to sense the professional development of the associate teachers.

A few teachers have been paid to maintain logs of their activities, but the number of teachers is small, decreasing the significance of the data. It was not stated how much of the data collected was derived from the lead teachers, who are presumably exemplary in many ways. It is difficult to accurately assess achievement of goals with a small, self-selecting group of teachers who are paid for the data they provide. Mailing surveys to teachers with self-addressed, stamped envelopes on a regular basis or providing web-based forms would be preferable to the current instrumentation. Care should be taken to developing a cost-effective way of measuring the highest priority goals.

According to the outside evaluator's report, the online activities are seldom utilized. This portion of her evaluation may be misleading due to the limited number of participants. Placing counters on these pages would be one way to monitor how many teachers and students are accessing these activities.

A question by the committee is whether there is a way to assess what impact QuarkNet is having on the students. Pre- and post-testing is essential to determine how well student's problem solving abilities improve. However, simply testing QuarkNet classrooms will not measure the impact that QuarkNet teachers have in the classroom. Unless an unbiased group is included, the data will be difficult to interpret. Determining the impact of QuarkNet on students, should be a high priority for the project.

Conclusions

Overall, the committee felt that it is very important to evaluate the project in terms of its goals for professional development, student impact, and participant satisfaction. The project should prioritize their development goals and tailor their evaluations to these goals, due to limited resources and time constraints of teachers. It is important to have a control group of people not involved in QuarkNet to accurately assess the results of the project. The committee recommended that the project develop a way to more accurately, and with a larger sample of participants, assess teacher and student development. In addition, a way to evaluate the mentors and centers should be investigated.

Cost and Schedule

QuarkNet is a build-to-cost project. The cost per year to run each type of center, mostly for teacher stipends, travel and mini-grants, is shown in the table below. The planned schedule of reaching the full complement centers in the program and of moving them to the steady state, Center III or IIIa (for DOE) and Center IV (for NSF), is shown in the table in the "Development and Status" section above. Starting in FY04, costs for Center IIIa's are also included.

The high school student research component is planned to last through 2008. The costs for the research teams of up to 4 students and a research teacher include student and teacher stipends and support for the teacher to attend a lead teacher institute.

***QuarkNet Center Costs ($k)**

	Center I	**Center II**	**Center III**	**Center IIIa**	**Center IV**
Cost per Year FY03-06	19.7	13.8	6.6	9.6	18.2
FY07-08	na	na	7.5	10.8	20.2

* DOE G&A costs are not included.

Other costs include support for the staff members, the outside evaluators and the advisory group. It is assumed that DOE will fund the staff members at LBNL and Fermilab and that NSF will fund those at Hampton University and Notre Dame. The evaluators and advisory group are funded by NSF. Support for the QuarkNet management team, the physicist mentors, and resources at the laboratories and universities are not part of the project costs, and are contributed separately.

The breakdown of costs each year is shown in the table below, including full G&A costs. The costs in FY09 and beyond are considered flat except for increases due to inflation, since the project will be in a steady state operation. These costs are based on a full complement of teachers at each center.

QuarkNet Project Costs per FY ($k) - includes full G&A

	FY03	**FY04**	**FY05**	**FY06**	**FY07**	**FY08**
Staff[1]	711.5	740.3	767.8	796.0	843.5	861.2
Center I (#centers)	119.4 (9)	85.2 (4)	--	--	--	--
Research Teachers	--	--	10.2 (2)	76.6 (15)	40.6 (7)	23.2 (8)
Center II	70.4 (7)	128.1 (9)	59.6(4)	--	--	--
Center III	127.2 (32)	187.7 (27)	171.1 (24)	137.1 (19)	136.9 (16)	121.9 (14)
Center IIIa[2]	--	66.8 (6)	133.7 (12)	167.1 (15)	149.7 (12)	149.7 (12)
Center IV	--	109.2 (6)	218.4 (12)	327.6 (18)	483.6 (24)	523.9 (26)
Misc[3]	68.9	102.1	95.5	95.5	111.5	111.5
Classroom Equip[4]	--	130.0	25.0	45.0	--	--
TOTAL	**1,097.0**	**1,549.5**	**1,481.4**	**1,644.9**	**1,765.8**	**1,791.4**

1. Staff costs consist of salaries for the staff teachers and secretary, fringe, overhead, travel, and G&A.
2. Beginning in FY04, this includes the additional one-week Fermilab institute as described above.
3. Miscellaneous expenses include funds for outside evaluators, advisory group and M&S.
4. Classroom cosmic ray detectors

Management

The QuarkNet management team organizes the project, works to secure funding, provides reports to the funding agencies, responds to requests for information and represents the project at reviews. The project management is lead by four PI's with a very active and competent staff. They have included an advisory panel to help prioritize their goals and provide further direction.

The committee noted that the team has responded to criticisms from previous reviews, offering new programs to help maintain the enthusiasm of participants and encourage student involvement. The management has done a very good job of directing the program and responding to recommendations, while also managing its resources in terms of costs and schedules. The QuarkNet project management is to be commended for developing a very successful program that mixes teacher development, student research and University outreach.

Funding

After the December 2001 review, NSF approved a planned funding profile for FY 2002 through FY 2006 that matched the planned costs. The NSF funding will be provided by the Directorate for Elementary, Secondary and Informal Education (ESIE) and the Directorate for Mathematical and Physical Sciences (MPS) through the Office of Multidisciplinary Activities (OMA) and Elementary Particle Physics (PHY/EPP). DOE approved a planned funding profile from FY 2003 to FY 2006 that was shown at the review. The funding for FY 2006 and beyond is planned to remain flat at $750k. The DOE funding is provided by the Office of High Energy Physics. The planned funding levels from each agency are shown in the table below.

Planned Funding Profile ($K)

(FY 1998 – FY 2003 are actual funding amounts)

Fiscal year	NSF-ESIE†	NSF-MPS‡	DOE-HEP*	TOTAL
1998	--	188.8	--	**188.8**
1999	317.4	250.0	152.8	**720.2**
2000	353.2	275.0	261.0	**889.2**
2001	324.8	361.0	316.0	**1,001.8**
2002	290.5	530.9	375.0	**1,196.4**
2003	169.0	682.0	475.0	**1,326.0**
2004	--	756.0	575.0	**1,331.0**
2005	--	801.0	675.0	**1,476.0**
2006	--	889.0	750.0	**1,639.0**

† Award goes to Fermilab; QuarkNet's FY runs from June through May

‡ Funds are from the PHY/EPP Division and OMA at NSF. The award goes to Notre Dame. The NSF-ESIE funds are included in this column, starting in FY 2004.

* DOE funding in FY 2006 and beyond is planned to remain flat at $750K.

When the planned funding is less than the costs for a particular year, the QuarkNet management works to secure funds elsewhere as needed and/or changes the scope of work.

Summary

The committee felt that QuarkNet is an excellent project which should be continued and supported. The strength of QuarkNet was felt to be the cooperation of the physics research community and every effort should be made to continue this strong participation. The emphasis on helping to make teachers and students into scientists by conducting actual research is a wonderful emphasis that should continue to be a cornerstone of the goals of the project.

While it is difficult to measure the outcome of the project goals quantitatively, the presentations at the review show progress towards these goals. The committee wants to encourage the QuarkNet project to follow through with their initiatives, including the web-based activities, cosmic ray detectors, and grid computing, and focus on ways to make these great resources more widely available and useful for teachers and students. The method for evaluating whether the project is meeting its goals needs more development. A number of detailed recommendations by members of the committee are given in the sections above.

Conclusions

Overall, the committee commented that QuarkNet continues to set new standards for science education outreach programs and is making a positive impact on the physics teaching and learning community in high schools around the nation.

QuarkNet Organization Chart

<u>QuarkNet Management Team (P.I.'s)</u>

Marge Bardeen – Fermilab (Spokesperson)

Keith Baker – Hampton University
Michael Barnett – LBNL
Randy Ruchti – University of Notre Dame

↓

<u>QuarkNet Staff</u>

Tom Jordan - Coordinator
Beth Marchant (was Beiersdorf)
Ken Cecire
Andria Erzberger
Pat Mooney

Melissa Clayton – Secretary

↓

<u>QuarkNet Center</u>
(currently ~50 at labs and universities)

Mentor-Physicists (two or more per center)
Lead Teachers (two per center)
Associate Teachers (up to 10 per center, starting in Year 2)

To: QuarkNet Review Committee

Date: 9 March 2004

Re: Request to Conduct a Status Review of the QuarkNet Project

The National Science Foundation (NSF) Elementary Particle Physics (EPP) Program and the Department of Energy (DOE) Office of High Energy Physics (HEP) requests that a joint status review of the QuarkNet Project be conducted on March 22, 2004 at the National Science Foundation in Arlington, Virginia.

Begun in 1999, QuarkNet is a joint NSF/DOE research-based physics education project. Marjorie Bardeen (Fermilab) serves as the spokesperson. QuarkNet, a partnership of high school teachers and physicists, provides long-term professional development and sustained support for teachers. Local physics faculty members at universities and labs around the country partner with teachers, providing opportunities for the teachers to participate in frontier high-energy physics research. Through these research experiences, teachers enhance their knowledge and understanding of science and technology research. They transfer this experience to their classrooms engaging their students in both the substance and processes of contemporary research as appropriate for the high school classroom.

This review follows the joint DOE/NSF independent peer review of the QuarkNet project held in December, 2001, in which the committee was impressed by the project's development and operations of the QuarkNet centers as well as overall progress. A DOE/NSF status review was held by the agencies in January, 2003, and QuarkNet was seen as progressing well.

Several recommendations were made concerning evaluation and goal measurement at the reviews. The charge for the current review is to:

- Review the current status of the project, including the scope of the project in terms of management, costs, schedule, and development of the QuarkNet centers.

- Review the teacher professional development goals that have been developed for the project. Review the evaluation tools developed to measure progress towards their goals. Assess the impact that QuarkNet has made towards their goals.

- Review and assess the status of current and planned future materials and services to be provided by the QuarkNet project.

- Review the planned funding profile over the life of the project.

We appreciate your assistance in this matter. As you know, these reviews are an important element of the DOE/NSF joint oversight of the QuarkNet Project. Please provide a report summarizing the findings of the review by May 15, 2004.

/s/

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/s/

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Department of Energy and National Science Foundation
Status Review of the QuarkNet Project

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