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U.S. DEPARTMENT OF ENERGY
HIGH SCHOOL STUDENT
SUPERCOMPUTING HONORS PROGRAM:
A FOLLOW-UP ASSESSMENT

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U.S. DEPARTMENT OF ENERGY
HIGH SCHOOL STUDENT SUPERCOMPUTING HONORS PROGRAM:
A FOLLOW-UP ASSESSMENT

HIGHLIGHTS

The U.S. Department of Energy (DOE) High School Student Supercomputing Honors Program was designed to recognize high school students with superior skills in mathematics and computer science and to provide them with formal training and experience with advanced computer equipment. This document reports on the participants who attended the first such program, which was held at the National Magnetic Fusion Energy Computer Center at the Lawrence Livermore National Laboratory (LLNL) during August 1985. Some of the major findings are summarized below.

- The 42 male and 10 female program participants came from families with above average incomes and well-educated parents. The median family income was about \$50,000 per year; in about 42 percent of the families both parents held graduate degrees.
- The program proved to be very selective. For participants who took the SAT college entrance test the average scores were 645 on the verbal component and 733 on the mathematics component. The national averages were 426 and 471, respectively. Of the participants taking the National Merit Test, nearly two-thirds were finalists.
- The students continued to show interest in mathematics, science, and engineering in the year following the program. More than 90 percent completed at least one mathematics and/or one science course. Nearly all participants planned a college major in a science or engineering discipline.
- Prior to participating in the program, about one-half of the participants indicated that they were unaware of the fact that the Department of Energy is a major sponsor of science and engineering research and development. One year later, about 90 percent said that they would seriously consider the possibility of working in a national laboratory.
- The participants responded that one major benefit of the program was that it broadened their perspective of the career opportunities available in science. More than 40 percent would like a career in research.
- Of the 52 participants, 18 returned to LLNL during the summer of 1986 to work on various research projects.

The results of this assessment indicate that the DOE High School Supercomputing Honors Program makes a valuable contribution to the national effort to improve science, mathematics, and engineering education. Students participating in the program gain practical computing experience not available in any other way. More importantly, they leave with a heightened interest in science and engineering research that is likely to have a lasting influence on their educational and career development.

U.S. DEPARTMENT OF ENERGY
HIGH SCHOOL STUDENT SUPERCOMPUTING HONORS PROGRAM:
A FOLLOW-UP ASSESSMENT

INTRODUCTION

The U.S. Department of Energy High School Student Supercomputing Honors Program (SHP) was sponsored by the U.S. Department of Energy (DOE), Office of Energy Research, Division of University and Industry Programs, as a program to recognize outstanding high school students and to help develop scientific and technical talent in energy-related areas. Fifty-two high school students representing each state, the District of Columbia, and Puerto Rico attended SHP at the Lawrence Livermore National Laboratory (LLNL), National Magnetic Fusion Energy Computer Center in Livermore, California, August 11-24, 1985. SHP was part of DOE's contribution to President Reagan's National Partnership in Education Program.

SHP was designed to identify, recognize the accomplishments of, and honor high school students with superior skills in mathematics and computer science and to provide them with formal training and experience with advanced computer equipment. The program was intended to motivate and encourage participants to continue postsecondary study in mathematics, computer science, and other science and engineering disciplines supportive of DOE's overall research mission and to raise awareness of DOE's research programs and laboratory capabilities.

The first part of this report discusses general information about SHP. Included is background material about national educational issues that helped form the basis for DOE sponsorship of the program as well as a brief description of the implementation of the program. The second part of this report deals with the assessment procedure and findings that emerged from it.

GENERAL INFORMATION ABOUT THE PROGRAM

Background

There is national concern for the widespread decline in the quality of education in the United States over the past twenty years. The National Commission on Excellence in Education's report, A Nation at Risk: The Imperative for Education Reform, helped bring the problems facing education to the public's attention. A central theme of the report is the need to "redress the decline in mathematics and science education and to prepare students to use emerging new technologies, such as the computer, so they may compete effectively in today's society" (NCES 1985).

The precollege experience in science and mathematics is significant in the preparation of students for careers in scientific and engineering (S/E) areas. The results of studies conducted by several nationwide commissions indicate that there exist serious problems in precollege science and mathematics education that threaten the nation's economic future and national security as well as the ability of all citizens to function in a high-technology society. Reductions in the number of high school mathematics and science courses required and taken and declines in the scores on various standardized tests help document these problems (NSB Science Indicators: The 1985 Report 1985). The precollege experience influences other trends and flows within the S/E pipeline. Shortages in some quantitative and technological career fields, especially in the areas of computer science, are predicted for the future. There also exists "a concern that science and engineering may not be attracting as many highly able students as are other professions" (NSB Science Indicators 1982 1983).

The problems facing the U.S. educational system have not gone unnoticed by government officials. Many local, state, and national officials and agencies have worked on improving the conditions of the American educational system. Some of the improvements that have been made in several states include upgrading course requirements, offerings, and content; enhancing teacher certification requirements; and providing programs for students and teachers that further develop their interests and knowledge in various areas, especially the sciences. Results are already being seen; in recent years scores on standardized tests have shown slight gains, and enrollments in many mathematics and science courses have increased.

Steps have also been taken on the national level to improve education. President Reagan has stressed the importance of strengthening and improving precollege education (American Education 1984). To assist in the Presidential commitment to education and to help meet the nation's educational needs in technological areas, DOE has provided increased support for programs and activities involving secondary school science and mathematics teachers and students. These programs are aimed at improving teacher preparation and at encouraging young people to pursue education in scientific areas (DOE 1986).

When John S. Herrington became the Secretary of Energy in 1985, one of his top priorities was the development of a program to recognize some of the nation's outstanding high school students and to provide them with scientific experiences that could not be obtained in a regular classroom setting. A program emphasizing supercomputing was implemented (Trivelpiece 1985). The purpose of the program was to provide the students with first-hand knowledge and experience with supercomputers, "an essential tool for future advances in all fields of science and engineering" (DOE 1986). The Lawrence Livermore National Laboratory, National Magnetic Fusion Energy Computer Center, was selected as the site for the program because of its advanced technological facilities, including the Cray-2, one of the supercomputers now being used in scientific research.

Implementation

At the invitation of Secretary Herrington, governors of each state and Puerto Rico and the mayor of Washington, D.C., selected one high school student and one alternate to represent their region at SHP. They were instructed to select a high school junior or senior on the basis of scholastic aptitude and competence in science and mathematics. Knowledge of computers and an interest in their scientific applications were also to be criteria for selection of program participants.

In his letter, Herrington explained that President Reagan has stressed the importance of maintaining the nation's scientific and technological competitiveness and that one purpose of SHP was to demonstrate DOE's "national commitment to continued progress in science."

Major responsibilities for program organization were undertaken by personnel at LLNL with Fran J. Turner, Office Manager for Computation Directorate, serving as LLNL's program coordinator. Also assisting in the planning and organizing of SHP were personnel at Oak Ridge Associated Universities (ORAU), a prime contractor of DOE. ORAU's main responsibilities were providing logistical support to the participants and conducting the follow-up assessment.

Original plans were for students to be housed in local hotels. Instead, the host family concept was developed. Families of 36 LLNL employees took a student (or students) into their homes for the duration of the two-week stay in the Livermore area to "provide an area of common interest for both the student and the lab employee" (LLNL Weekly Bulletin 1985). Besides providing lodging, host families' responsibilities also included providing local transportation and some meals for their guests.

Activities

For work on the supercomputers, the students were divided into two groups. While the first group used personal computers tied into the Cray supercomputer system for hands-on computer experience and training, the other group toured the facilities, carried out individual research, studied, and was involved in other program-related activities. The two groups would then change places, allowing everyone the opportunity to participate in all the activities. Each student worked on programming projects that demonstrated the capacities of the supercomputers. This hands-on experience provided an opportunity to solve problems in such areas as mathematics, physics, and computer graphics. An advisor, a computer scientist or programmer from the National Magnetic Fusion Energy Computer Center, was assigned to each student to help on the computer projects. Participants also learned about special hardware and performance features of supercomputers, their applications, and future directions of supercomputer usage.

Other activities involved all the participants simultaneously. Guest lecturers from LLNL, other national laboratories, and the private sector addressed the participants on possible career options in technical and scientific fields in energy-related areas. Experts in a variety of disciplines, including aerodynamics, fusion energy, physics, engineering,

graphics, and modeling shared their computing and scientific experiences with the students. Discussions following the presentations allowed the participants to explore their individual interests in computers. As part of the career awareness emphasis of the program, a Career Faire was held at the end of the SHP session. At this time the participants had the opportunity to apply for 1986 summer employment at LLNL.

Not all of the two-week session was work. A full range of social activities was included in the program's agenda to make the students' visit to LLNL a memorable one. These activities included picnics, a tour of the San Francisco area, and such sporting activities as swimming and volleyball.

SHP concluded with an awards program honoring the participants for their achievements. Dr. Alvin Trivelpiece, Director, Office of Energy Research, DOE, was the keynote speaker. In his address he explained that one goal of the program was to show participants that DOE is involved in a wide range of research areas. Trivelpiece read a letter from President Reagan, addressed to the participants as a group and presented to LLNL, which urged the participants to become part of the nation's tradition of scientific excellence. Subsequently, Trivelpiece read a second letter from the President addressed to each individual participant. In this letter, Reagan stated that "America's future success in science and technology rests with students like you who have the talent, curiosity, and desire to learn mathematics, physics, chemistry, biology, and engineering." The letter, accompanied by a plaque recognizing program participation, was presented to each student by Trivelpiece.

PROGRAM FOLLOW-UP ASSESSMENT

The purpose of this report is to gather and analyze data that document the extent to which the objectives of SHP were met. Information was collected on carefully selected variables so that relevant comparisons could be made to other groups of students. Indications of program effects, especially on the educational development and career plans of participants, could then be examined. (However, determining program effects is complex and requires the identification of potential outcomes, both short- and long-term, that may have emerged from participation in the program.)

The information used for this assessment was obtained from participants in March 1986. This time was selected so that information based on the academic year immediately following participation in the program could be determined. Some participants were contacted by telephone to gather additional information or to validate information gathered previously. Responses were received from 51 of the participants for a response rate of 98.1 percent.

Information on a wide range of variables, including information about the participants and their parents, as well as attitudes about the operation and effects of the program, was obtained from the participants. The form used to guide the collection of this information is appended to this report. Many parts of the form were developed so comparisons could be made to published information for similar groups of individuals who have not participated in the program to determine how patterns observed among program participants differ from national norms. This information, together with information about participants gathered prior to the program at LLNL, provided the core around which this programmatic assessment was conducted. (In reporting results, numbers have been rounded to the nearest tenth.)

Demographics

The 52 program participants represented each state, the District of Columbia, and Puerto Rico. (However, there were five non-U.S. citizens among the participants.) They ranged in age from 15.6 to 19.1 years old, with the average age of 17.6 years.

National surveys indicate that about 60.0 percent of the college undergraduate population in 1984 was composed of females (Chronicle of Higher Education 1986) and about 51.8 percent of the 1985 freshman class was female (Astin 1985). Comparable figures for the SHP participants show a much smaller percentage of females. The ten female participants accounted for 19.2 percent of the total SHP participants (Table 1). This figure does compare favorably to the 1982 national figures, which indicate that women comprised about 13 percent of the total work force in the areas of science and engineering (NSF Women and Minorities 1984).

The racial/ethnic composition of college students was also investigated in the previously mentioned national surveys. The undergraduate population was

composed of about 80.7 percent Caucasians, 5.0 percent Blacks, 3.5 percent Asians or Pacific Islanders, 9.2 percent of Hispanic descent, and the rest of other backgrounds. The corresponding figures for freshman are 86.2 percent, 9.1 percent, 2.0 percent, and 1.8 percent, respectively. In comparison, 80.8 percent of the SHP participants were Caucasians (Table 1). For the female participants, 40 percent were from racial/ethnic minorities; 14.3 percent of the male participants were non-Caucasians.

TABLE 1: SEX AND RACIAL/ETHNIC BACKGROUND OF SHP PARTICIPANTS

<u>Racial/Ethnic Background</u>	<u>Sex</u>		<u>Total Participants</u>	<u>% of Total Participants</u>
	<u>Female</u>	<u>Male</u>		
Caucasian	6.0	36.0	42.0	80.8
Asian or Pacific Islander	3.0	4.5 ^a	7.5	14.4
Hispanic origin	<u>1.0</u>	<u>1.5^a</u>	<u>2.5</u>	<u>4.8</u>
Total	10.0	42.0	52.0	100.0%

^aOne participant indicated his background was American Asian/Hispanic

The largest racial/ethnic minority represented among the participants was Asian or Pacific Islanders, who comprised 14.4 percent of the total. This is a much larger percentage than this racial/ethnic group represents in the national work force of employed scientists and engineers, which was about 4.5 percent in 1982 (NSF Women and Minorities 1984). However, this high representation of Asian-background students could be indicative of the fact that, on the average, Asians taking national standardized tests consistently score higher than Caucasians on the mathematics components of such tests (NSB Science Indicators 1982 1983). In addition to those with Asian backgrounds, 4.8 percent of the participants indicated they were of Hispanic descent. Other racial minorities, including Blacks, were not represented among SHP participants.

Participants' Parents

According to a recent national survey, about 62.3 percent of the fathers of college undergraduates do not have a college degree, 25.6 percent have a bachelor's degree, and 12.0 percent have attained an advanced degree (master's or doctoral degree). Similarly, the national averages for mothers of college undergraduates are 74.5 percent, 20.8 percent, and 4.7 percent, respectively (Chronicle of Higher Education 1986). By comparison, the highest educational level of the parents of program participants (known for 48 sets of parents) is well above these national averages (Table 2). Only 8.3 percent of the participants' fathers do not have a college degree, whereas 16.7 percent have a bachelor's degree, and 75.0 percent have advanced degrees (including 41.7 percent with a doctoral degree). These figures for mothers of participants are 29.2 percent, 27.1 percent, and 43.7 percent (8.3 percent), respectively.

TABLE 2: EDUCATIONAL LEVEL OF SHP PARTICIPANTS' PARENTS,
HIGHEST LEVEL OF EDUCATION OBTAINED

Highest Level of Education Obtained and Degree Received	Number of Participants'		% of Participants' Parents		% of College Undergraduates Parents ^b	
	Mothers ^a	Fathers ^a	Mothers	Fathers	Mothers	Fathers
High school graduate	5	2				
Postsecondary school other than college	3	1				
Some college	6	1				
No college degree	14	4	29.2	8.3	74.5	62.3
Bachelor's degree only	8	8				
Some graduate school	5	0				
Bachelor's degree	13	8	27.1	16.7	20.8	25.6
Master's degree	17	16				
Doctoral degree	4	20				
Advanced degree	21	36	43.7	75.0	4.7	12.0
Total	48	48	100.0%	100.0%	100.0%	99.9% ^c

^aOut of 48 participants

^bChronicle of Higher Education 1986

^cDoes not total 100% due to rounding error

Of the 48 responses, there are only four sets of parents, or 8.3 percent, neither of whom has a college degree (Table 3). Thirty-four participants, or 70.1 percent, indicated both parents have college degrees. This latter figure includes twenty sets of parents (41.7 percent), both of whom have attained advanced degrees, including four families with both parents having doctoral degrees. Clearly, SHP participants come from families in which the parents are more highly educated than the parents of most other college students.

TABLE 3: EDUCATIONAL LEVEL OF SHP PARTICIPANTS' PARENTS,
COLLEGE DEGREES RECEIVED PER FAMILY

<u>Level of Education Obtained</u>	<u>Number of Responses</u>	<u>% of Total Responses</u>
Neither parent has college degree	4	8.3
One parent has bachelor's degree One parent has no college degree	3	6.3
Both parents have bachelor's degree	4	8.3
One parent has advanced degree One parent has no college degree	7	14.6
One parent has advanced degree One parent has bachelor's degree	10	20.8
Both parents have advanced degrees	<u>20</u>	<u>41.7</u>
Total	48	100.0%

With most participants' parents having achieved higher educational levels than most Americans, as one would expect, their income level is also well above the national average (Table 4). Based on various national surveys, the median income of all U.S. families in 1983 was approximately \$24,600 (12.6 percent of all families having incomes over \$50,000) (DOC 1986), parents of college undergraduates have a median income of close to \$30,000 (Chronicle of Higher Education 1986), and for parents of college freshman it is about \$34,000 (Astin 1985). In comparison the median parental income for SHP participants was \$50,000. Six families (12.5 percent) had incomes over \$100,000. In five of these families, both parents have advanced degrees. However, in the other family neither parent has a college education.

TABLE 4: 1985 INCOME OF SHP PARTICIPANTS' PARENTS

<u>Income</u>	<u>Number of Responses</u>	<u>% of Total Responses</u>
Less than \$10,000	1	2.1
\$10,000 - \$19,999	0	0.0
\$20,000 - \$29,999	5	10.4
\$30,000 - \$39,999	8	16.7
\$40,000 - \$49,999	10	20.8
\$50,000 - \$74,999	15	31.3
\$75,000 - \$99,999	3	6.3
Over \$100,000	<u>6</u>	<u>12.5</u>
Total	48	100.1% ^a

^aDoes not total 100% due to rounding error

On the average SHP participants come from families with higher educational levels and higher incomes than the average American family. Both of these factors are likely to have a great effect on the educational performance and aspirations of the participants.

College Entrance Tests

Table 5 shows the comparison of average SAT test scores (College Board's Scholastic Aptitude Test, scored on a basis of 200 to 800) as reported by 40 of the SHP participants to the national average for the academic year ending in 1984. Program participants scored an average of 219 points more on the verbal component and 262 more on the mathematics component than the national averages. Similar to national trends, the male participants scored higher than the females on both parts.

TABLE 5: AVERAGE SAT SCORES OF SHP PARTICIPANTS
COMPARED TO NATIONAL AVERAGES OF SAT SCORES

	<u>Participants' Average^a</u>			<u>National Average^b</u>			<u>National Average^c For S/E Fields</u>
	<u>Female</u>	<u>Male</u>	<u>Total</u>	<u>Female</u>	<u>Male</u>	<u>Total</u>	
Verbal	616	651	645	420	433	426	451
Mathematics	724	735	733	449	495	471	505

^a40 participants (seven females and 33 males) took the test

^bFor academic year ending in 1984 (DOC 1986)

^cFor academic year ending in 1984 (NSB Science Indicators: The 1985 Report 1985)

Nationally 7.3 percent of those taking the SAT test scored 600 or above on the verbal component and 16.7 percent scored 600 or above on the mathematics component (DOC 1986). In comparison, out of the 40 SHP participants who gave test scores, 75.0 percent scored 600 or above on the verbal portion and 97.5 percent scored 600 or above on the mathematics portion. In fact, 30.0 percent scored 700 or above on the verbal section and 77.5 percent scored above 700 in mathematics, including 52.5 percent who scored in the 750 to 800 range in mathematics. Nationally only 3.0 percent of SAT scores were 700 or above on the mathematics component in 1984 (NSB Science Indicators: The 1985 Report 1985). One SHP participant had a perfect (800) verbal score and four had perfect mathematics scores.

Even compared to the top high school graduates, SHP participants highly excelled. The national SAT average score for students ranking in the top 10 percent of their graduating class was 543 (DOC 1986), while SHP participants' average score was 146 points higher than this figure at 689.

Comparisons can also be made to similar students, who like SHP participants, plan to major in science or engineering at the undergraduate level. SAT scores for these students declined during 1975 to 1984, approximately paralleling the declines for the total SAT population. Students planning to go into S/E fields generally have higher SAT scores than other college-bound seniors; however, the gap narrowed slightly from 1975 to 1984. In 1984, students going into S/E fields scored an average of 451 on the

verbal part (national average that year was 426) and 505 on the mathematics part (the national average that year was 471) (NSB Science Indicators: The 1985 Report 1985). Program participants' averages were considerably higher than their peers interested in S/E, as their averages were 645 and 733, respectively.

When only figures for those intending to major in computer science, mathematics, physical sciences, or engineering are considered, the SHP participants also score higher. In 1983, the national average SAT mathematics scores for these groups were 483, 580, 544, and 565, respectively (NSF Science and Engineering Personnel 1985). In comparison, the SAT average mathematics score for SHP participants was 733.

Only twenty SHP participants gave scores for the ACT test (American College Testing Programs ACT Assessment Test, scored on a basis of 1 to 36). Their average scores also surpassed the national average scores as shown in Table 6. On all but the English component of the test, the participants scored on the average over ten points above the national average. Unlike scores for the SAT test, except for the natural science part of the ACT test, female SHP participants had higher averages than the males did.

TABLE 6: AVERAGE ACT SCORES OF SHP PARTICIPANTS
COMPARED TO NATIONAL AVERAGES OF ACT SCORES

	<u>Participants Average^a</u>			<u>National Average^b</u>		
	<u>Female</u>	<u>Male</u>	<u>Total</u>	<u>Female</u>	<u>Male</u>	<u>Total</u>
English	27.2	24.7	25.5	18.6	17.5	18.1
Mathematics	34.3	30.3	31.7	16.1	18.6	17.3
Natural sciences	31.2	31.3	31.3	19.9	22.4	21.0
Composite	31.0	28.5	29.3	17.9	19.3	18.5

^a20 participants (6 females and 14 males) took the test

^bFor academic year ending in 1984 (DOC 1986)

Nationally 13 percent of those taking the ACT test had a composite score of 26 or above (DOC 1986), while 80 percent of SHP participants had a composite score in this range; 65 percent scored 30 or above. Eight participants had a perfect (36) mathematics score.

For both the SAT and ACT tests, these comparisons to various categories of national students are indicative of the exceptional quality of SHP participants.

Education-Related Activities

SHP participants have exceptional high school records. Most of them (82.4 percent) ranked in the top 5 percent of their high school classes and 61.2 percent ranked in the top 1 percent. All participants had an average grade in high school of a B or better with 86.3 percent having an average of A- to A+. Nationwide, less than one-fourth of the college freshmen (22.7 percent) indicated having an average of A- or better in high school (Astin 1985).

There are other education-related achievements of the participants. Of the 34 who took the National Merit Test, 25 were finalists (64.7 percent) and three others were semifinalists. More than three-fourths of the participants (78.4 percent) had been offered college scholarships. Eight participants had scholarship offers of more than \$10,000.

Forty-eight of the SHP respondents were enrolled in school during the 1985-86 academic year. Of these, two were high school juniors, 13 were high school seniors, 26 were college freshmen, and seven were college sophomores. Three of the high school seniors were also enrolled in college concurrently; others had also done this while still in high school. Advanced placement tests for college credit also contributed to the fact that many were college sophomores (one was a college junior), even though they graduated from high school in 1985. The college students attend 31 different colleges and universities with five participants attending the Massachusetts Institute of Technology.

Math and Science Coursework

The number of mathematics and science courses taken in high school can be an important factor in choosing college majors and/or careers. In 1982, high

school graduates, on the average, took 2.2 years of science and 2.7 years of mathematics during grades 9-12. The 10th grade is the last time most high school students in the U.S. are exposed to science (NSB Science Indicators: The 1985 Report 1985). In 1982, 6.9 percent of the high school seniors indicated they had attempted calculus, 14.8 percent had attempted physics, and 24.4 percent chemistry (NSF Science and Engineering Personnel 1985).

SHP participants were selected for their interest in science and mathematics. Thus, as expected, they have an extensive high school background in these areas. Table 7 shows the number and percentages of participants who took at least one course in the listed academic fields. Most participants have taken more than one course in several of the academic disciplines.

TABLE 7: MATHEMATICS AND SCIENCE COURSES TAKEN
BY SHP PARTICIPANTS IN HIGH SCHOOL

<u>Have Taken at Least One Course In</u>	<u>Number of Participants^a</u>	<u>% of Participants</u>
Calculus	39	76.5
Biology	49	96.1
Chemistry	50	98.0
Physics	48	94.1
Computer science	42	82.4
Biology, chemistry, and physics	45	88.2

^aOut of 51 participants

In the year following program participation, the students continued their interest in science and mathematics. Table 8 shows the number of students who took at least one course in the listed academic fields. The most common area studied was mathematics, as 91.7 percent of the students took a mathematics course. About 58.3 percent of the participants took a computer science course, 54.2 percent a physics course, and 50.0 percent a course in chemistry. Only 20.8 percent of them took a biology course and 29.2 percent took an engineering course. Nearly three-fourths (70.8 percent) of the students took at least one

course in three of the areas listed in the table. Many of those who did not fall into this category still took two or more courses in at least one area. There was one student who did not take any course of those listed, and five who took only two such courses.

TABLE 8: MATHEMATICS AND SCIENCE COURSES TAKEN BY SHP PARTICIPANTS IN 1985-86 ACADEMIC YEAR

<u>Have Taken at Least One Course In</u>	<u>Number of Participants^a</u>	<u>% of Participants</u>
Mathematics	44	91.7
Biology	10	20.8
Chemistry	24	50.0
Physics	26	54.2
Computer science	28	58.3
Engineering	14	29.2
At least three of mathematics, biology, chemistry, and physics	17	35.4

^aOut of 48 participants

College Plans

Survey data of 1985 college freshmen reflect the decline of freshman interest in the sciences. Only 3.4 percent plan majors in biological sciences (down from 4.2 percent in 1984 and 4.7 percent in 1977), while 2.4 percent anticipate majoring in the physical sciences or mathematics (compared to 2.6 percent in 1984 and 3.1 percent in 1977). Interest in engineering and computer science has also been declining since the early 1980s. The most current survey shows only 10.7 percent and 2.3 percent of the freshmen plan majors in these areas, respectively (Astin 1985).

The survey also reflects a decline in those students interested in technologically oriented careers. Only 10.0 percent plan to pursue an engineering career (down from 10.4 percent in 1984 and from 12.0 percent in 1982 when interest in engineering reached a peak). In 1982, 8.8 percent of the entering freshman planned to pursue a career as a computer analyst or programmer. This figure has declined steadily and was down to 4.4 percent by 1985 (Astin 1985).

The intended college majors of the participants are shown in Tables 9 and 10. As would be expected, they are very interested in the sciences and engineering. More than half (52.5 percent) of the males are planning to major in an engineering field with electrical engineering being the most popular and computer engineering the next favorite. The other most common major for the male participants was computer science, with 17.5 percent interested in this major. The female participants were more interested in the traditional sciences with their interest more evenly split among mathematics, chemistry, and biology. One female expressed an interest in engineering and one in computer science.

Many of the participants (21.6 percent) have not yet decided on a possible career. Of those who have more definite plans, the most common career choice for both the male and female participants was in research (Table 11). None of the females was planning on an engineering or computer science career. They were more interested in teaching (two on the secondary level and one who wants to combine college teaching with research). Many of the male participants expressed an interest in management positions.

TABLE 9: EXPECTED COLLEGE MAJORS OF SHP PARTICIPANTS^a

<u>Major</u>	<u>Number of Responses</u>			<u>% of Total Responses</u>
	<u>Female</u>	<u>Male</u>	<u>Total</u>	
Computer science ^b	0.5	7.0	7.5	15.3
Computer engineering ^c	0.0	4.5	4.5	9.2
Engineering (general) ^c	1.0	2.5	3.5	7.1
Chemical engineering	0.0	3.0	3.0	6.1
Electrical engineering ^d	0.0	7.0	7.0	14.3
Mechanical engineering	0.0	3.0	3.0	6.1
Genetic engineering	0.0	1.0	1.0	2.0
Mathematics ^e	2.0	2.0	4.0	8.2
Physics ^f	0.0	4.5	4.5	9.2
Chemistry	2.0	0.0	2.0	4.1
Biochemistry	0.0	1.0	1.0	2.0
Biology	2.0	1.0	3.0	6.1
Premedicine	0.5	0.0	0.5	1.0
Undecided (but biological or physical sciences)	1.0	1.0	2.0	4.1
Psychology	0.0	1.0	1.0	2.0
Economics	0.0	1.0	1.0	2.0
Political science	<u>0.0</u>	<u>0.5</u>	<u>0.5</u>	<u>1.0</u>
Total	9.0	40.0	49.0	99.8% ^g

^aWhen double major listed, one-half credit given to each major

^bIncludes five double majors (one female and four males)

^cIncludes one double major (male)

^dIncludes four double majors (all male)

^eIncludes two double majors (all male)

^fIncludes three double majors (all male)

^gDoes not total 100% due to rounding error

TABLE 10: SUMMARY OF INTENDED COLLEGE MAJORS OF
SHP PARTICIPANTS, 1983 COLLEGE-BOUND
SENIORS WHO TOOK SAT TEST, AND 1985 COLLEGE FRESHMEN

<u>Major</u>	<u>% of Undergraduate Majors</u>		
	<u>Participants^a</u>	1983 College-Bound <u>Seniors^b</u>	1985 College <u>Freshmen^c</u>
Computer science and computer engineering	24.5	10.1	2.3
Other engineering	35.7	12.5	10.7
Mathematics	8.2	1.1	.8
Physical sciences	15.3	1.8	2.1
Biology ^d	10.2	3.1	3.4
Other	<u>6.1</u>	<u>71.4</u>	<u>81.2</u>
Total	100.0%	100.0%	100.0%

^aOut of 49 participants

^bN NSF Science and Engineering Personnel 1985

^cAstin 1985

^dIncludes biochemistry

TABLE 11: CAREER CHOICES OF SHP PARTICIPANTS^a

<u>Major</u>	<u>Number of Responses</u>			<u>% of Total Responses</u>
	<u>Female</u>	<u>Male</u>	<u>Total</u>	
Computer programmer or analyst ^b	0.0	10.5	10.5	20.6
Research scientist ^c	6.0	15.5	21.5	42.2
Education (secondary) ^d	2.0	0.0	2.0	3.9
Education (college) ^e	1.0	0.5	1.5	2.9
Business ^f	0.0	3.5	3.5	6.9
Law	0.0	1.0	1.0	2.0
Undecided	<u>0.0</u>	<u>11.0</u>	<u>11.0</u>	<u>21.6</u>
Total	9.0	42.0	52.0	100.1% ^g

^aWhen two choices listed, one-half credit given to each choice

^bIncludes five with two choices (all male)

^cIncludes seven with two choices (all male)

^dIncludes two with two choices (all female)

^eIncludes three with two choices (two females and one male)

^fIncludes three with two choices (all male)

^gDoes not total 100% due to rounding error

The participants have high college expectations, as 84.6 percent of them plan to obtain an advanced college degree, including 58.8 percent who intend to receive a doctoral degree. This is a much higher rate than the national average. National surveys indicate about 48.3 percent of college undergraduates (Chronicle of Higher Education 1986) and 50.4 percent of college freshmen (Astin 1985) plan to go to graduate school.

Computer-Related Activities

With the increasing role computers are playing in all facets of American life, one problem facing education today is how to prepare students for using this technology. Students need to become knowledgeable with the computer and its uses to be able to succeed in postsecondary education and to compete effectively in the job market. However, it is generally recognized that a shortage of computer science instruction in our nation's schools exists. A national survey in 1981-82 indicated that less than 13 percent of all U.S. secondary school students had earned computer science credit in secondary school (NCES 1985). However, by 1985 about 58 percent of the college freshman class had taken at least one computer science course in high school (Astin 1985).

Even though all SHP participants were familiar with computers before the program began, only 82.4 percent of them had taken a computer science class in high school. However, only 5.9 percent responded that they had learned most of their computer knowledge from high school classes. More than half (52.9 percent) indicated most of their computer knowledge was self-taught. Another 9.8 percent said most of their knowledge had been learned in college courses. The remaining participants indicated their knowledge had been gained by a combination of sources, including self-instruction, academic courses, and SHP.

Almost all (96.1 percent) of the participants (or their families) own personal computers. On the average, participants have been involved with computers about 5.1 years. Nearly half of the participants had earned income that resulted from their computer knowledge. Incomes were derived from such sources as computer consulting, software development, and teaching computer classes. (One participant even said he used computers to help earn money at

the racetrack.) Several students said the publicity they received from participating in SHP helped them gain some income opportunities. In addition many earned income as 1986 summer employees at LLNL, jobs that resulted from their participation in SHP (see section on summer of 1986).

Attitudes about the Program

An attempt was also made to obtain information on participants' attitudes about various aspects of SHP. Participants were asked to rate how much they agreed or disagreed with a particular statement. Responses were ranked on a scale of 1 to 5, where 1 was strongly disagree with the statement and 5 was strongly agree with the statement. A copy of the statements, their average rankings, and standard deviations is appended to this report. (Quotations in this section of the report have come from comments of program participants and will remain anonymous. Other comments of participants are given in the Appendix.)

Program activities allowed for personal interactions, especially among the participants and laboratory employees and their families. "It was inspiring to meet the lab employees and other participants." There was plenty of opportunity to interact with other participants, and many new friendships were formed. The host family concept was very well received (one participant gave it a 10 on a scale of 1 to 5 and another gave it a "5!"). Some said it was very helpful when there was more than one student in the same home. "Using host families and advisors greatly contributed to the coherence of the program." However, many also felt that other lodging arrangements, such as a motel or dormitory room, would also have been adequate. As one participant said, "it could have been fun." Everyone was in agreement that arrangements for travel and meals were very good. More than 88 percent of the participants said they had kept in contact with other participants and/or their host family, and one student has published a newsletter about the participants.

Participants were asked their feelings about how beneficial various program activities were to their learning experience. Highly successful in this regard were the guest speakers, presentations, and hands-on computer usage, as well as the tours of LLNL facilities. (Of course, social activities were rated highly by everyone!)

The participants gained knowledge about DOE. Prior to participating in the program, 62 percent said they were aware that DOE supported a laboratory system, but only 52 percent said they were aware that DOE was a major sponsor of science and engineering research and development. Fusion energy was the most common response when participants were asked what they learned most about DOE. Participants were impressed with the diversity of scientific areas supportive of the DOE research mission. "There was something for everyone."

SHP had an effect on the educational and career aspirations of the participants. One major benefit of the program expressed by many of the participants was that it broadened their perspectives of the career opportunities available in science. Even among those who said the program did not really change their intended courses of study in college, the idea that the program strengthened or reinforced their educational and career goals was prominent, and they became more interested in the various applications of their intended college majors. One student expressed this idea by stating that, "Participation broadened my knowledge of new career options I had not seen as related to engineering before."

As a result of participating in the program, the majority (58 percent) agreed that they are more likely to consider an energy-related career and another 32 percent were undecided on this issue. Almost all of them (90 percent) indicated they would give serious consideration to working at a national laboratory.

From the participants' viewpoint, SHP was not without its problems. Several areas were consistently mentioned. More than half of the participants expressed some concern that they had not received enough prior information about the nature and content of the program and what would be expected of them. The participants suggested that support literature on some basic information about physics, supercomputers, computer languages, and calculus should be made available as a benefit to those with weaker backgrounds. About 20 percent of the participants felt they did not have the scientific and/or computer background to handle the program's activities.

Several of those with strong backgrounds said they wish they had received more technical information about the projects. This would have helped them accomplish more in the time they had at SHP. (Since they left Livermore, 26 percent have continued working on projects started at SHP.) However, many other participants felt the assigned projects were not as beneficial as other

program activities to their learning experience. One participant's opinion was, "My computer experience was insufficient to allow me to work on a project which would have benefitted from the Crays. Many at the program were like this. Only the 'computer whizzes' and people with very strong mathematics backgrounds/interests could actually make use of the Crays for projects. Nevertheless, I learned from the time spent on the Crays, if only as a small child learns from a tour of the Smithsonian Institute--he/she cannot fully appreciate it, but still grows from the experience and is enriched by gaining a wider perspective."

One of the most common recommendations was to change the dates of the program to earlier in the summer, even if by just a few weeks, as it interfered with college schedules for many participants.

Even though many students gave the advisor concept high ratings, others were not as pleased. The availability of advisors was a problem for some participants. Forty percent were undecided about this, including 16 percent who felt their advisors were not available at all. More than one-third of the participants did not feel comfortable asking their advisors questions. However, no one really felt his/her advisor expected too much of him/her. One participant thought that "such a resource [having an advisor] could have been far more valuable if it had been worked into the program in a more structured way. Perhaps having advisors take students on a mini-tour of a particular area, etc. Or having a short course for advisors outlining some things for them to talk about with students."

In conclusion, the most common attitude expressed by the SHP participants was what a great overall experience it had been. It was "rewarding," "productive," "educational," and "enjoyable." SHP provided the participants with exposure to technologies and skills they could not have obtained in any other way. The opportunity to work with supercomputers, to learn about career opportunities, and to meet leading scientists in such a diversity of areas were cited as the program's highlights. From the students' viewpoint, SHP was a great success, and they felt programs like this one should be continued for years to come.

Summer of 1986

There were 21 applications from SHP participants to return to LLNL for summer employment in 1986 that resulted in nineteen offers. Eighteen participants accepted positions and were involved in a number of research areas, including the development of computer graphics, personal computer software design, design of process alarm for local interface to the storage system, and other programming projects.

Other participants also had interesting summer experiences in 1986. After the SHP session, one participant joined the military where he serves as a computer programmer. Another student spent the year following SHP running his own computer programming business developing office management software for physicians and other small businesses. One participant is currently a missionary in Argentina. Quite a few of the students held summer jobs as computer programmers. One student worked in a research laboratory on a radon gas detector. Many of the other participants attended summer school or participated in other educational activities, including one student who spent a week studying Chinese and then studied mathematics for six weeks at an advanced studies program.

CONCLUSION

There is the potential for shortages in the future of those trained in science, engineering, and other technical areas. Improving the quality of precollege science and mathematics education is of concern to DOE from the perspective of the technical manpower needed to implement its future research and development mission. DOE also recognizes the importance of providing quality education and of stimulating and encouraging students at an early stage to pursue science and technology careers. Programs such as SHP are one way to provide stimulus and incentive for students to continue their education in the fields of science and engineering.

All indications are that the program was very successful. The scholastic achievements of the participants indicate that they are among the country's outstanding students. The program strengthened their interests in scientific and engineering fields. Not only did they learn about supercomputers, but also

they were exposed to numerous other technological advancements that they could not have obtained elsewhere. Through the career awareness phase of the program, participants learned of many opportunities in technical fields they had not realized before the program. Many of them left LLNL with the goal of someday returning to work there or for other national laboratories. Many did return in 1986 and made contributions to ongoing research projects.

One message expressed by both Trivelpiece and the President was that participants should continue to strive for excellence. By participating in the program, the students acquired an obligation that could be repaid by "simply doing well; by doing a good job at what it is you're setting out for" (Trivelpiece 1985). It appears that, in the past year, the program participants are meeting this challenge.

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APPENDIX

Information Form--DOE High School Supercomputing Honors
Program

Participants' Attitudes about the Program: Average Rankings
and Standard Deviations

Comments of Participants

Information Form
DOE High School Supercomputing Honors Program

Please type or print clearly.

I. GENERAL INFORMATION

1. Name _____
2. Current address _____

3. Permanent address _____

4. Current phone no. () _____
5. Permanent phone no. () _____
6. Sex M _____ F _____
7. Birthdate _____
8. Are you
_____ a. American Indian or Alaskan Native
_____ b. Asian or Pacific Islander
_____ c. Black
_____ d. Caucasian
_____ e. Other, specify _____
9. Are you of Spanish/Hispanic origin or descent? Yes _____ No _____
10. Are you a U. S. citizen? Yes _____ No _____
11. What is your best estimate of your parents' total income for 1985? Consider income from all sources before taxes.
_____ a. Less than \$10,000 _____ d. \$30,000-39,999 _____ g. \$75,000-99,999
_____ b. \$10,000-19,999 _____ e. \$40,000-49,999 _____ h. Over \$100,000
_____ c. \$20,000-29,999 _____ f. \$50,000-74,999
12. What is the highest level of formal education obtained by your parents?
(Mark M for mother, F for father)
_____ a. Eighth grade or less _____ f. Bachelor's degree
_____ b. Some high school _____ g. Some graduate school
_____ c. High school graduate _____ h. Master's degree
_____ d. Postsecondary school--other _____ i. Ph.D., M.D., LL.D., or similar
than college professional degree
_____ e. Some college

II. EDUCATION

13. What is your current school classification?
- High school: a. Senior _____
- College: b. Freshman _____ d. Junior _____
- c. Sophomore _____ e. Senior _____
14. Check the category that best corresponds to your high school class ranking.
- _____ a. Top 1% _____ d. Top 10%
- _____ b. Top 2% _____ e. Top 25%
- _____ c. Top 5% _____ f. Don't know
15. Indicate your approximate average grade in high school.
- _____ a. A or A+ _____ c. B+ _____ e. B- _____ g. C
- _____ b. A- _____ d. B _____ f. C+ _____ h. Below C
16. Indicate the number of high school mathematics or science courses taken in grades 9-12 in each of the following areas.
- _____ a. Algebra _____ e. Biology _____ i. Other math, specify _____
- _____ b. Geometry _____ f. Chemistry _____ j. Other science, specify _____
- _____ c. Trigonometry _____ g. Physics
- _____ d. Calculus _____ h. Computer science
17. During the current academic year, how many courses (high school or college) will you take in each of the following areas? (Do not include college courses for which you received advanced placement.)
- _____ a. Mathematics _____ d. Physics _____ g. Other science, specify _____
- _____ b. Chemistry _____ e. Computer science
- _____ c. Biology _____ f. Engineering
18. Did you take the ACT test? Yes _____ No _____
- If yes, give your score on
- _____ a. English _____ c. Science
- _____ b. Mathematics _____ d. Composite
19. Did you take the College Board SAT test? Yes _____ No _____
- If yes, give your score on
- _____ a. Verbal _____ b. Mathematics (quantitative)

20. Did you take the National Merit Test? Yes _____ No _____
If yes, were you a _____ semi-finalist _____ finalist
21. Are you now receiving or have you ever received a college academic scholarship, or have you been granted one for the next academic year? Yes _____ No _____
If yes, total value of scholarships offered (even if not accepted). \$ _____
22. Are you currently enrolled in college? Yes _____ No _____
If yes, give name and location _____
-
23. Where did you get the money to pay for college this year? (Write in actual dollar amounts, write "0" if none.)
_____ a. Grants and scholarships	_____ d. Savings
_____ b. Loans	_____ e. Parents and/or spouse
_____ c. Work	_____ f. Other sources
- Answer the following questions if you have earned any college credit.
24. How many credit hours have you earned to date? _____ (semester _____ quarter _____)
25. How many of these hours are from CLEP or other advanced placement tests? _____
26. What is your college GPA on a 4 point scale (A=4, B=3, C=2, D=1)? _____
27. Indicate the number of college courses for which you have received credit in each of the following areas. Include courses for which you received advanced placement credit.
_____ a. Mathematics	_____ d. Physics	_____ g. Other science,
_____ b. Chemistry	_____ e. Computer science	specify _____
_____ c. Biology	_____ f. Engineering	

III. EDUCATION AND CAREER ASPIRATIONS

28. Write in the name of your expected college major. _____
29. Pick the category below that best corresponds to your expected college major.
_____ a. Mathematics	_____ h. Physical sciences
_____ b. Biological sciences	_____ i. Psychology
_____ c. Engineering	_____ j. Business
_____ d. Social sciences	_____ k. Health occupations or
_____ e. Education	health sciences
_____ f. Preprofessional (law,	_____ l. Arts and humanities
medicine, dentistry, etc.)	_____ m. Other, specify _____
_____ g. Computer sciences	

30. What is the highest academic degree you intend to obtain? (Pick from B.S., B.A., M.S., M.A., Ph.D., M.D., D.D.S., D.V.M., LL.D., if other, specify.) _____
31. Write in the name of the job or occupation (be specific) that you expect or plan to have when you are thirty years old. _____
32. Pick the category below that comes closest to describing this job.
_____ a. Artist	_____ i. Lawyer
_____ b. Business	_____ j. Military career
_____ c. Education (elementary)	_____ k. Research scientist
_____ d. Education (secondary)	_____ l. Computer programmer or analyst
_____ e. Education (college)	_____ m. Skilled or semiskilled worker
_____ f. Health profession (non-doctor)	_____ n. Protective service
_____ g. Health profession (doctor)	_____ o. Other

IV. COMPUTER-RELATED ACTIVITIES

33. Do you (or your family) own a personal computer? Yes _____ No _____
34. How long have you used computers? _____
35. Where did you learn most of your computer knowledge?
- _____ a. Self-taught
- _____ b. High school classes
- _____ c. College classes
- _____ d. Business sponsored instruction classes
- _____ e. DOE Supercomputing Honors Program
- _____ f. Other, explain _____
36. Have you earned any income from any of the following (check all that apply)?
- _____ a. Computer consulting
- _____ b. Software development
- _____ c. Computer instruction
- _____ d. Other, explain _____
37. Did any of the above income opportunities come as a result of your participation in the DOE Supercomputing Honors Program? Yes _____ No _____
- If yes, explain. _____
- _____

V. PROGRAM

Please respond to the following by giving the number that corresponds to your degree of agreement or disagreement with each statement about the DOE Supercomputing Honors Program.

- 38. Prior information on arranging transportation was very complete. _____
- 39. Travel arrangements were very good. _____
- 40. Arrangements for meals were very good. _____
- 41. Having a host family was very helpful. _____
- 42. Other lodging arrangements, such as a motel or dorm room, would have been preferable. _____
- 43. Your advisor was available to assist and guide you. _____
- 44. You felt comfortable asking your advisor questions. _____
- 45. Your advisor expected too much of you. _____
- 46. You received enough prior information about the nature and content of the program and what would be expected of you. _____
- 47. The dates the program is held should be changed. _____
- 48. The following activities included in the program were very beneficial to your learning experience:
 - a. Guest speakers/presentations _____
 - b. Tours of LLNL facilities _____
 - c. Hands-on computer use _____
 - d. Projects _____
 - e. Social activities _____
- 49. You had sufficient computer background to handle the program's activities. _____
- 50. You had sufficient scientific background to handle the program's activities. _____
- 51. Compared to other students at the program you felt adequately prepared. _____

52. There was enough hands-on experience. _____
53. Ample opportunity was provided for interaction with other participants. _____
54. Prior to participating in the program you were unaware that DOE supported a laboratory system. _____
55. Prior to participating in the program you were unaware that DOE was a major sponsor of science and engineering research and development. _____
56. You would give serious consideration to working at LLNL or another national laboratory. _____
57. As a result of your participation in this program, you are more likely to consider an energy-related career. _____
58. Attending the supercomputing program influenced or changed what course work or major you might study in college. _____
59. Have you remained in contact with your host family or other participants since leaving the program? Yes _____ No _____
60. Did attending the program influence or change your career goals? Yes _____ No _____

Explain _____

61. Have you continued working on projects started while in the program? Yes _____ No _____
62. Provide any additional comments that you feel would be helpful to our evaluation efforts. _____

Participants' Attitudes about the Program:
Average Rankings and Standard Deviations

PROGRAM

Please respond to the following by giving the number that corresponds to your degree of agreement or disagreement with each statement about the DOE Supercomputing Honors Program.

5	4	3	2	1	
strongly agree	agree	undecided	disagree	strongly disagree	Mean/S.D.

Prior information on arranging transportation was very complete.	4.48/.54
Travel arrangements were very good.	4.64/.48
Arrangements for meals were very good.	4.58/.60
Having a host family was very helpful.	4.74/.52
Other lodging arrangements, such as a motel or dorm room, would have been preferable.	1.98/.96
Your advisor was available to assist and guide you.	3.56/1.02
You felt comfortable asking your advisor questions.	3.78/.95
Your advisor expected too much of you.	1.74/.66
You received enough prior information about the nature and content of the program and what would be expected of you.	3.39/.92
The dates the program is held should be changed.	2.82/1.03
The following activities included in the program were very beneficial to your learning experience:	
a. Guest speakers/presentations	4.42/.70
b. Tours of LLNL facilities	4.52/.54
c. Hands-on computer use	4.58/.67
d. Projects	3.71/.92
e. Social activities	4.52/.61
You had sufficient computer background to handle the program's activities.	4.08/.96
You had sufficient scientific background to handle the program's activities.	4.22/.92
Compared to other students at the program you felt adequately prepared.	3.96/.87

There was enough hands-on experience.	3.80/.98
Ample opportunity was provided for interaction with other participants.	4.48/.61
Prior to participating in the program you were unaware that DOE supported a laboratory system.	3.58/1.33
Prior to participating in the program you were unaware that DOE was a major sponsor of science and engineering research and development.	3.30/1.40
You would give serious consideration to working at LLNL or another national laboratory.	4.49/.67
As a result of your participation in this program, you are more likely to consider an energy-related career.	3.63/.03
Attending the supercomputing program influenced or changed what course work or major you might study in college.	2.83/.90
Have you remained in contact with your host family or other participants since leaving the program?	Yes 45 No 6
Did attending the program influence or change your career goals?	Yes 31 No 19
Explain _____	

Have you continued working on projects started while in the program? Yes 13 No 37

Provide any additional comments that you feel would be helpful to our evaluation efforts.

Comments of Participants

"The people made the program; it is they who stick out in my mind. Working with very cooperative, knowledgeable, and eager people made my stay productive, educational, and downright enjoyable."

"The program was incredible. I still think of it highly. Usually impressions wear off; but not for this program."

"The organizers of the program adapted well to the needs and wants of the students."

"The program provided me with many experiences which I would have gotten in no other manner. It broadened me as a person, and I am very grateful to you."

"Although over time the memory of LLNL would dim, the comments on the value of the program might get better with the perspective of time."

"And of course, I gained immensely from the other aspects of the program. Meeting the research and researchers at major lab was most instructive. In short, getting a 'taste' of science for the sake of science was exciting, and such experiences are of value to all--regardless of intended fields or majors. Just being given the chance to see the latest in fusion reactors is something which I treasure."

"The DOE SHP was by far the most enjoyable and educational experience I can think of. I am constantly using the information (computer and other) I collected in my daily work and discussions."

"My only regret is that I'm ineligible to do it again."

"If the program can remain as incredibly organized as it was when I attended, I see no problems with its future success."

"A fun learning experience."

"The program was broad enough to encompass many students with different scientific interests. This is essential to show the many different opportunities today."

"The program raised my expectation and preparedness for what I might achieve."

"The program changed my approach toward problems and future goals. This was an important and useful effect of the program for me."

"All the smart people made me shift my goals upward."

"Enhanced my awareness of scientific and technological achievement and capability."

"Host families were good, but not living with the other students was bad. Perhaps a balance could be found. For most, having host families to provide a 'friendly environment' was superfluous--we could have managed quite well living in a dormitory-type situation. Indeed, this would generate the opportunity of getting to make better friends. However, for me host families were useful because it gave me a chance to meet a lab employee on a personal basis--and to learn 'from the horse's mouth' lots of general information about the labs. Perhaps spending some nights with a host/some in dorms would be best (fussier to schedule, better for participants)."

"My only real complaint is that the organizers seemed almost scared of group discussions on social and moral issues relevant to areas of LLNL study. There are real issues that will have to be faced by the type of people selected for the Supercomputing Program, and I see nothing wrong with the laboratory encouraging discussion among the participants along these lines."

"Working for a government organization became more plausible."

"I believe the atmosphere at the lab can only be learned by spending time there. I am very motivated and excited with my college courses because of my dreams of working somewhere like LLNL."

"I became more interested in the various applications of physics."

"It helped me decide to be in physics - until I had taken a college physics course."

"Prior to the program, I had considered majoring in liberal arts. I was interested in science, but was unaware of career opportunities. Now I want to do research."

"I am not fully decided upon a career choice, and the program provided a timely opportunity for discovering what opportunities were available to me."

"More interested in laser, energy, and fusion."

"The importance of an MS and PhD."

"The program opened some doors I had not considered."

"Program gave me a much broader view of computer-related work. It helped me to determine both what I would like to do and what I would not wish to do."

"Gave me a better understanding of what an engineering or computer career would be like."