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Review of Sandia National Laboratories - Albuquerque, New Mexico DOE/DP Critical Skills Development Programs FY03

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Abstract

Sandia National Laboratories has developed a portfolio of programs to address the critical skills needs of the DP labs, as identified by the 1999 Chiles Commission Report. The goals are to attract and retain the best and the brightest students and transition them into Sandia – and DP Complex – employees. The US Department of Energy/Defense Programs University Partnerships funded nine laboratory critical skills development programs in FY03. This report provides a qualitative and quantitative evaluation of these programs and their status.

ACKNOWLEDGEMENTS

The participating students, technical line staff, university and community college faculty, and support staff are the foundation of our programs' success and are commended for their efforts. Sincere appreciation to NNSA Office of University Partnerships for sponsorship of – and commitment to – these programs and to Karen Scott, program manager at Sandia.

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 - Barbara Vigil-Lowder – Bernalillo High School
-
- Katherine Clark – Science Policy Research
-
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-
- Department 03555 Student Programs/Secretarial Services/Records – Infrastructure and support of student internship programs.

This evaluation shows a strong correlation between focused critical skills development programs and full-time employment within the Complex, as well as showcasing the importance of the pipeline programs in helping the Labs meet the recommendations of the 1999 Chiles Commission Report.

Thank you for your interest and attention.

Sincerely,

A handwritten signature in black ink on a light blue background. The signature reads "Dominique Foley Wilson" in a cursive, flowing script.

Dominique Foley Wilson
Consultant, DOE/DP Laboratory Critical Skills Development Programs

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Summary

Sandia National Laboratories' (Sandia) national defense mission requires a well-trained, experienced, and agile workforce; a workforce in technical areas of increasing demand and competition.¹ This need is made more pressing by the expected retirement in the next decade of a large part of Sandia's current technical workforce. Sandia has developed a portfolio of pipeline programs using Department of Energy, Office of Defense Programs (DOE/DP) funding to address the critical skills needs recommended by the 1999 Chiles Commission Report with the goal of producing the highly qualified technical staff needed by Sandia. The programs are focused at two levels—postsecondary and secondary. Integral to the postsecondary programs shown in Table 1 are internships that bring promising students to Sandia—technical staff can identify promising employees, and students are introduced to Sandia as an employer of choice.

Table 1: Post-Secondary Pipeline Programs

Program	Primary Academic Level	Start Date	Student Participants	Conversions to Staff
College Cyber Defenders Institute (CCD)	Undergraduate	FY 01	FY 03: 22 Total: 42	12
Microsystems and Engineering Sciences Applications Institute (MESA)	Graduate	FY 01	FY 03: 40 Total: 50	6
Materials Science Research Institute (MSRI)	Undergraduate and Graduate	FY 02	FY 03: 6 Total: 7	1
National Collegiate Pulsed Power Research Institute (NCPPRI)	Undergraduate	FY 02	FY 03: 27 Total: 33	1

The secondary programs shown in Table 2 are focused on encouraging students in the challenging academic preparation needed to work at Sandia and involve West Mesa High School (WMHS), Albuquerque High School (AHS) and Albuquerque TVI, a community college, as well as internships at Sandia.

Table 2: Secondary Pipeline Programs

Program	Levels	Start Date	Student Participants	Conversions to Staff
Advanced Manufacturing for Education (AME)	WMHS & AHS TVI Sandia Interns	FY 02*	FY 03: 270 FY03: 151 FY 03: 25	FY 03: 8 Total: 12
Photonics Academy	WMHS & AHS TVI Sandia Interns	FY 03	FY 03: 36 FY 03: 58 FY 03: 0	

*Pilot Program began at WMHS in 1996 and evolved through curriculum development and program initiation. Consistent collection of data began in FY 02.
FY=Fiscal Year and in this case corresponds to the relevant academic year and summer, for example FY 03 corresponds to Academic Year 02/03 and summer 03.

¹ Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the US Department of Energy under contract DE-AC04-94AL85000.

Critical Skills Program Highlights

The attraction and retention of highly qualified people as Sandia employees in critical skills areas are the primary goals of these programs. In parallel with developing these programs: program staff implemented an information collection process to evaluate how the programs meet their goals, to identify the impacts of the program, and to suggest areas for improvement. The following is a summary of the highlights that were identified through this information collection for the period ending summer 2003.

College-level Pipeline Programs

- Technical staff members have primary responsibility for establishing recruiting practices and for recruiting students.
- To date, through these critical skills programs, staff have recruited students from more than 40 schools (includes both colleges and universities), and have focused recruiting efforts at 17 schools. Some of these relationships involve influencing school curricula to better expose students to the training needed by Sandia.
- The numbers of technical staff members involved in the critical skills programs have increased, from 34 in FY 02 to 70 in FY 03.
- The critical skills programs have begun producing technical staff, as of FY 03, 20 staff members have been converted from interns in the program.
- The critical skills programs have a return rate from FY 02 to FY 03 ranging from 38% to 100%, depending on the program, this reflects the percentage of interns that returned as interns or as staff members in FY 03.
- Students are clearly pleased with the critical skills programs, as are the Sandia staff members that are involved in them.
- The exit survey and focus group show that the critical skills programs are highlighting Sandia as an attractive career option, and are influencing students to focus their career plans to be more in-line with work at Sandia.
- About one-third of interns represent minority ethnic backgrounds, and one-third are female.
- Internships are highly competitive, as indicated by GPA of 3.6 or higher for all of the programs.
- Students made several suggestions about things that would improve the programs from their perspective. There are no strong common themes or concerns among these things but they warrant review by program staff.

High School-level Pipeline Programs

- Focused programs are in place that encourage high school students to pursue the advanced math and science training necessary to work at Sandia.
- Students are moving through the pipeline. In FY 03, there were students at all levels, from high school, to community college, to Sandia interns, to conversions to staff members.
- The high school model has proven itself flexible and transportable, and has been endorsed by national professional associations.
- The Photonics Academy has enabled a middle school to Ph.D. pipeline that prepares students for a career in a field of sharply increasing demand both at Sandia and nationally. This pipeline may be unique in the country.

Summary Recommendations

Overall

Review data collection practices to streamline the process.

Review student suggestions from the focus groups and the exit surveys for changes that are feasible.

Critical Skills Programs

As part of a systematic approach to addressing workforce needs, Sandia National Laboratories² (Sandia) has developed a portfolio of pipeline programs using Department of Energy, Office of Defense Programs (DOE/DP) funding. These programs address the critical skills needs recommended by the 1999 Chiles Commission Report and are focused at two levels—postsecondary and secondary.

Technical staff members are involved in program development—from developing recruiting strategies, to recruiting students, to identifying appropriate student projects and supervising and mentoring students. The critical skills programs bring promising students to Sandia, so allowing technical staff to identify potential employees and students to learn about the benefits of working at Sandia. Sandia has also encouraged and supported active collaboration between two local high schools and the Albuquerque TVI, a community college, to develop and articulate the curricula leading to an AAS in advanced manufacturing and in photonics. These programs encourage students by providing a pathway to jobs at Sandia, address Sandia’s need for technicians, and reduce the need for on-site training. Six Sandia pipeline programs were funded in FY 2003 and are shown in Table 3.

Table 3: SNL Pipeline Programs

Program	Primary Academic Level	Status
College Cyber Defenders Institute (CCD)	Undergraduate	Initiated summer 01
Microsystems and Engineering Sciences Applications Institute (MESA)	Graduate	Initiated summer 01
Materials Science Research Institute (MSRI)	Undergraduate and Graduate	Initiated AY 01/02
National Collegiate Pulsed Power Research Institute (NCPPRI)	Undergraduate and Faculty	Initiated AY 01/02
Advanced Manufacturing for Education:		
Advanced Technology Academy at West Mesa High School (ATA/WMHS) at Albuquerque High School (ATA/AHS)	High School	AY 01/02: 1 st year with students
Advanced Manufacturing for Education: Advanced Technology Academy at West Mesa High School (ATA/WMHS)	High School	ATA program pilot, implemented 1996
Photonics Academy at West Mesa High School	High School	AY 02/03: 1 st year with students:

AY=Academic Year

In addition to focused intern programs, the critical skills program broadened efforts to expose students to Sandia in FY 03 by supporting a high school level program to encourage students in math—Go Figure involving 198 students—and by sponsoring a group of 7 Computational Science Graduate Fellows (CSGF) who chose to do their practicum at Sandia.

² Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the US Department of Energy under contract DE-AC04-94AL85000.

Goals and Objectives of Critical Skills Programs

The attraction and retention of highly qualified people as Sandia employees in critical skills areas are the primary goals of the critical skills programs. Sandia also benefits when students with a positive personal and professional experience at Sandia move into the larger research community. The following objectives of the programs have been developed as a means of accomplishing the stated program goals.

Pipeline programs objectives that are integral to the program goal

- *Increase the pool of technical staff involved in DP pipeline programs*
- *Identify and recruit promising students in critical skills areas (CSA)*
- *Showcase Sandia as an attractive career option*
- *Retain qualified technical students in CSA both at Sandia and in the DP complex*

The objectives have been further broken into the strategies and program elements used to accomplish the goals and objectives of the pipeline programs, as well as evaluation metrics (see the Program Matrix at the end of this section in Table 3). The program matrix is an evolving tool and is reviewed annually by program staff to ensure its relevancy to the program goals.

Information Collected

In parallel with developing and coordinating these pipeline programs, program staff collect information to ascertain how the programs meet their goals. During 2003, the following information was collected:

College-level Pipeline Programs

- Demographic data on college-level interns.
- A subset of MSRI, NCPPRI, and CSGF students were interviewed in a group meeting on June 26, 2003. The meeting was held to provide an informal opportunity for participants to discuss their experience and to articulate issues that they feel to be important to the success of the program—important either from a positive or negative perspective.
- The program managers for MSRI and NCPPRI were interviewed to obtain information about recruiting practices in these programs.
- A survey instrument was provided to each program manager to be offered to all interns, intern conversions to employees, and supervisors. Return of surveys was voluntary. The surveys, with aggregate responses, are included in Appendices 2, 3 and 4.

High School-level Pipeline Programs

- Information collection during AY 2002/03 continued data collection efforts within the high schools. Demographic data was provided by the ATA coordinators in each high school.
- Initial efforts were made to discuss with Albuquerque TVI the types of data that would be useful in tracking academy students going from high school to TVI to pursue an AAS. This component of tracking pipeline students will become more important in the future.
- High school and TVI students that are accepted into one of the limited number of Sandia internships are accepted into the MEST intern program. Data on pipeline interns in the MEST program was collected this year.

This report presents the results of information collection including the 2002/2003 academic year and summer 2003. This period closely corresponds to, and for the purposes of this report will be considered to be the same as, fiscal year 03 (FY 03—October 1, 2002 through September 30, 2003).

Table 4: Program Matrix for Critical Skills Programs

Objective	Strategy	Program Elements	Evaluation Method
<p>Increase the Pool of Technical Staff in DP Pipeline Programs</p>	<p>Target & recruit uninvolved tech staff in critical skills areas Maintain pool of involved technical staff</p>	<p>Presentations to recruit and inform staff Staff involvement as appropriate in pipeline programs (see below) Staff involvement in career development of interns Upper mgmt support/recognition for mentoring/conversions of interns</p>	<p>Trend Data: # of participating staff, # of students/staff member</p>
<p>Identify and Recruit Promising Students in Critical Skills Areas (CSA)</p>	<p>Identify CSA anticipated needs</p>	<p>Tech staff involvement Chiles Commission Report HR Staffing Plan</p>	<p>TREND DATA: # of recruits, # of acceptances, # who return, # who convert to FTE.</p>
	<p>Identify and recruit promising candidates in CSA</p>	<p>Technical staff recommendations in relevant program areas Standard ranking indices for academic achievement (for example Gourman) Nationally recognized programs Technical staff contacts with universities referrals HR resumix</p>	<p>SURVEY OR INTERVIEW: Query supervisors as to promise of students.</p>
	<p>Choose students for participation that meet program criteria</p>	<p>Program staff review resumes for eligible candidates Involve technical staff in review of resumes and choosing students for offers Manage process of review, making offers, and hiring using existing tools</p>	

Program Matrix continued

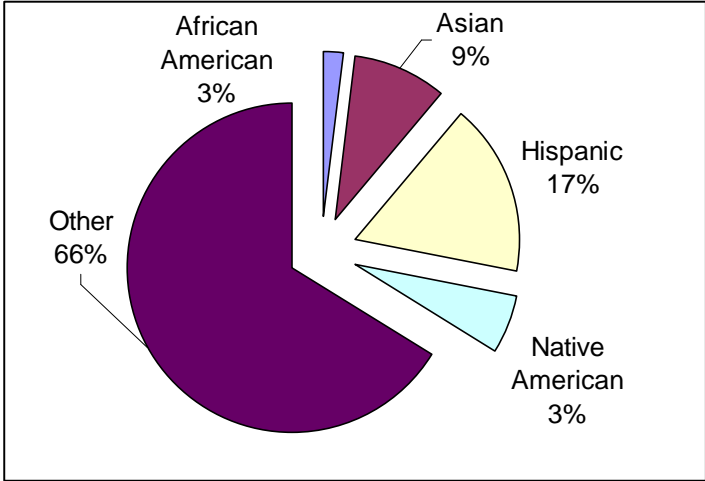
Objective	Strategy	Program Elements	Evaluation Method
Showcase Sandia as an attractive career option	Ensure technical managers offer “real” work	Technical staff involvement	SURVEY OR INTERVIEW: Query students
	Treat students as professionals, facing career choices. Provide broad-based overview of SNL Offer professional development at SNL	Technical SNL Speakers Mini-Institutes Tours of and talks about SNL Conference/travel Orientation Administrative support for flexibility in self -identifying future work Technical mentor Experienced students as role models (SNL Ambassador) Information on graduate programs and hiring tools Employee/staffing benefits information	
	Provide assistance with non-work related aspects of the program that support the work experience	Salary Relocation assistance Assistance in identifying housing Transportation assistance Social mentor for questions and support	
	Provide students with Albuquerque info	Existing SIP infrastructure Social mentor for questions and support	
Retain qualified technical students in critical skills areas both at Sandia and in the DP complex	Create a positive work experience at SNL Opportunities for career development through student & hiring programs Provide support in navigating the hiring process.	See Above Technical and social mentors discuss opportunities Information on graduate programs and hiring tools Accessible source of information for funding sources for school/work opportunities. Administrative support in pursuing the hiring process	BASELINE DATA for comparison. TREND DATA: Trends in those students who return. SURVEY OR INTERVIEW: Query supervisors and students about retention issues.

Post Secondary Critical Skills Programs

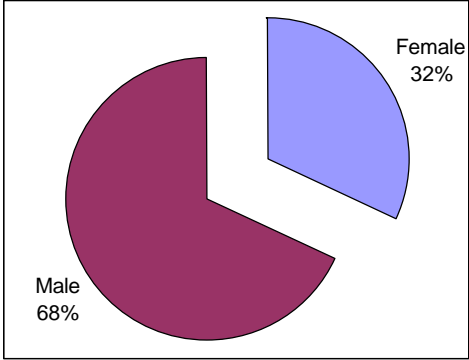
This section provides a demographic overview of the postsecondary students that participated in the critical skills programs as interns at Sandia as well as information on the perspectives of students and their supervisors on the programs.

Student Demographics

The Sandia critical skills programs are all focused on recruiting well-qualified students in a specific critical skills area and they all involve technical staff in identifying needs, in recruiting promising students, and in working with interns at Sandia. While these criteria are primary, program staff members are also interested in whether the programs are accessible to a broad range of students. Critical skills interns that have come to Sandia represent diverse



ethnic backgrounds. Students are able to choose not to provide ethnicity information. Of those students who chose to provide information in FY 2003, about one-third represented a minority ethnic background and about one-third were female. Both of these indices are higher among the students at the high schools that are participating in the program.



Student Perceptions of the Critical Skills Programs

An effort has been made each year to collect information from students about their experience of the program. In 2003, a focus group of college-level interns was convened, and all Sandia interns and supervisors in the program were asked to fill out a survey about their experience in the program. The complete responses from both of these sources are included in appendices 1 through 4, and provide a wealth of detail for program managers in reviewing their efforts for the coming year. The following provides an overview of the information that was developed from these sources.

Focus Group

On June 26, 2003, a group of 11 college-level interns in the MSRI and NCPPRI as well as several CSGF participated in a focus group to discuss their experience as interns at Sandia. The group identified a list of elements out of this discussion that they considered to be important to the success of the program in making Sandia an attractive career option for them. Each member was then given three “votes” that they

could cast singly or all together for the elements that they considered most important. The total number of votes each element received was used to rank the elements as to their overall importance relative to each other. See Appendix 1 for details of the discussion. These elements fell into three areas:

- elements that make Sandia an employer of choice for interns,
- elements that are suggestions for improving and strengthening the programs, and
- elements that constitute concerns for students about Sandia being an employer of choice.

What makes Sandia an EOC

Two-thirds of the votes were given to elements that make Sandia an employer of choice.

- The people at Sandia are its biggest and most important element in attracting students to Sandia. This ranged from mentors to all staff members with whom students come into contact. (48% of votes)
- The internship and the work experience at Sandia is of great value to students in terms of professional development. In addition, the access to state of the art facilities and equipment was praised. (15% of votes)
- Although it did not receive a vote, the career stability at Sandia was mentioned as a good thing.

Student suggestions for improvements

One-quarter of the “votes” for important elements had to do with suggestions by students for strengthening or improving the program.

- A voluntary course in business and professional etiquette would be helpful (business dining, interview skills, interview clothes). (9% of votes)
- It would be appreciated if students were kept better informed as to their application status, and about what is needed to begin work, for example the paperwork needed to get onto base. (6% of votes)
- More explicit information about employment opportunities and how to get hired at Sandia would be appreciated. (6% of votes)
- It would be good to improve awareness of the existence of the MSRI and NCPPRI Programs, at SNL and in academia. (6% of votes)
- Several other issues were raised in discussion that did not receive a vote.
 - It would be convenient to have a place to forward mail or email prior to getting to Sandia.
 - It would be good to know all of the financial support for education opportunities that are available.
 - Access to Sandia benefits such as the clinic, credit union and child care would be appreciated.
 - It would be helpful to have a notebook that explains everything from what is needed to start work to the benefits that are available.
 - Students suggested that the statement be removed from the web about not needing a car.

Student-identified concerns

Just less than 10% of the votes were for elements that posed a concern for some students.

- The security issues related to working at Sandia was a cause for concern to the extent that they inhibited publishing, work with foreign nationals, or access to people.
- Although it did not receive any votes, a concern was voiced that bureaucracy could make it difficult to try new research areas.

Survey Results--Students

Almost half of the interns at Sandia in the critical skills programs returned surveys at the end of summer 2003—41 interns from 20 schools and from all of the programs. In addition, two interns that have been converted to full time employees also filled out surveys. The responses were consistent across the programs and so are summarized here. This summary includes most frequent responses, those by at least 10 students, complete responses from interns are in Appendix 2, and from conversions to employees are in Appendix 3.

The internship encourages students to see Sandia as an employer of choice (EOC). Almost all, 40 of 41 or 98%, considered Sandia to be an employer of choice after completing the internship, an increase from 36 of 41 prior to the internship. When asked whether the internship at Sandia has changed their future plans, by far most said yes. Two said that it has had no effect on their plans, three said it had changed their career focus to an area unrelated to work at Sandia, and one said it was too soon to tell. Of the rest, 85% said that it had affected their plans and more than half noted that the internship helped them to focus their career objectives or encouraged them to pursue further education in an area related to work at Sandia. The ability of the internship to show students that Sandia is an attractive employer is important given the competition for talented students. With the exception of the MEST interns, many of whom are recently out of high school, almost half of the interns have had experience at organizations that could be considered a competitor with Sandia for hiring potential employees. When asked what makes Sandia an EOC, the most frequent answers are listed below. (Students were able to provide multiple choices.)

- Challenging, interesting, and cutting edge research (the most frequent response—from 85% of respondents),
- Work on areas that are important to the nation
- Flexible research opportunities
- Financial support for further education
- Work on state of the art equipment
- Job-related benefits (such as health benefits, retirement)
- Work with the people at Sandia
- The ability to work independently
- The professional work environment

One student indicated that Sandia is not an EOC for him, the reasons being a combination of its location in Albuquerque, personal reasons unrelated to Sandia, and low pay and no funds being offered for education.

The internship is a clearly positive experience for interns. Students responding to the exit survey gave the internship an average ranking of 4.8 out of a possible 5 (5 is excellent) for their overall experience, and an average ranking of 4.8 out of a possible 5 (5 is extremely important) to their career development. Most of the students indicated that the program had given them an opportunity to learn about the career options at Sandia, primarily through introducing them to people or through tours. The greatest strengths of the program include:

- The opportunity to do challenging/interesting work contributing to Sandia's research program.
- The presence of someone to talk with about the field or career options.
- Putting classroom theory into workplace use.
- Flexible research opportunities as an intern.
- Being treated as a responsible adult.
- Working with the people at Sandia.
- Financial support for education.

Students were also asked to describe problems with the program. The breadth of suggestions by students precludes listing them in their entirety here, although all are listed in Appendix 2. The suggestions warrant review by program managers as they suggest areas of interest to students, for example in communication, training, and preparation for students. Students were also asked what they got from the program that they would not have gotten if they had not participated. The answers largely reflect the things suggested above as making Sandia an EOC, but again, warrant review by program managers because of the nuance that they provide.

Supervisors Perspectives on the Critical Skills Programs

Fourteen supervisors who have had 79 interns among them over the past 10 years responded to a survey for critical skills programs supervisors.

All of the supervisors see the intern program as successful and positive and are willing to continue participating in the program. The average ranking of the group for the program was 4.4 out of a possible 5 (5 is excellent). When asked why the time the spent as supervisors and mentors was worth their cost in time and resources, the most frequent responses were

- Interns are good candidates for becoming a member of the staff.
- Interns do work that would not otherwise have been done.
- Interns brought technical expertise and knowledge that benefited the program.
- Interns brought a different perspective to the work that was helpful.

Mentors also provided information about what elements contribute to a successful internship, and provided some suggestions for consideration by program staff, as shown in Appendix 4. The information in this survey would be a useful starting place should program staff want to develop a mentor training guide or session for new mentors.

College Cyber Defenders (CCD) Institute

Table 5: CCD Student Participants

Year*	# Enrolled	# Schools	Gender		Degree Level			Avg GPA	Converted to Staff
			M	F	HS	AS/BS	Grad/Ph.D.		
03	22 (7R**)	9	16	6		20	2	3.6	7
02	24 (10R**)	13	16	8	2	21	1	3.7	5
01	15	9	10	5	1	13		3.7	

*Corresponds to Academic Year 02/03 and summer 03 and to FY 03.

**R shows the number of students returning from the previous year.

CCD Recruiting

(Recruiting information taken from 2002 report.)

The College Cyber Defenders (CCD) Institute is focused on a critical skills need in which there is a national shortage of trained people. There are no formal university programs that prepare students for a career in cyber security. Therefore, program technical staff began with identifying the schools that have academic expertise in areas related to cyber security, have indicated an interest in cyber security, that are interested in working with Sandia in this area, and that are working in areas of interest to Sandia. They were assisted in this effort by a list compiled by the National Security Agency of schools and universities that have indicated an interest in cyber security. Program technical staff members have focused their recruiting efforts on four schools that meet the criteria—encouraging them to develop a cyber security program and/or related course work. The schools are:

- New Mexico Tech,
- University of Illinois at Urbana-Champaign,
- University of Colorado at Boulder, and
- Texas A&M.

Staff members recruit students for the program by contacting university chairs and professors of targeted schools, visiting the schools, meeting with students, and encouraging qualified students to submit intern applications to the CCD Institute through the Sandia student intern program (SIP). CCD program staff review student applications from the entire student pool for students that have appropriate expertise and interest in cyber security and that meet minimum Sandia hiring requirements. They then conduct telephone interviews. According to the technical staff coordinator, most (about 80%) of the interview questions are designed to winnow out individuals with an interest in learning about computer hacking rather than cyber security.

CCD Objectives

Objective: Increase the pool of technical staff in DP pipeline programs.

Technical staff members are directly involved in developing recruiting practices, in recruiting of interns, and in mentoring those interns. The number of technical staff formally involved in the program has increased from last year, from one to eight supervisors. The program is overseen by one overall program manager.

Objective: Identify and recruit promising students in areas of critical skills needs.

Twenty-two students from 9 different colleges or universities with a GPA of 3.6 were brought to Sandia as interns. Program staff members are developing research relationships that include curricula development with four schools in this area of importance to Sandia. This interaction is intended to increase the number of trained people as well as to develop university relationships that will help to identify promising students.

Objective: Showcase Sandia as an attractive career option.

The exit survey and focus group interview results show that the critical skills programs are highlighting Sandia as an attractive career option. In addition, it has influenced students to change or focus their career plans to be more in-line with the work at Sandia.

Objective: Retain qualified technical students in critical skills areas both at Sandia and in the DP complex.

One-fifth of the interns to date have been converted to technical staff members. One third of last year's interns returned to Sandia either as employees or interns in 2003.

Microsystems & Engineering Sciences (MESA) Institute

Table 6: MESA Student Participants

Year*	# Enrolled	# Schools	Gender		Degree Level			Avg GPA	Converted to Staff
			M	F	HS	AS/BS	Grad/Ph.D.		
03	40 (8R**)	19	24	16		6	34	3.7	3
02	19 (16R**)	15	13	6		5	14	3.7	3
01	16	15	12	4		4	12	3.7	

*Corresponds to Academic Year 02/03 and summer 03 and to FY 03.

**R shows the number of students returning from the previous year.

MESA Recruiting

(Recruiting information taken from 2002 report.) The MESA Institute focuses its recruiting efforts not on students, but on professors with whom Sandia wants to collaborate because of their expertise. The Institute first recruits Sandia technical staff in the microsystems area to inform them about the MESA Institute. If the line organization is willing to pay 30% of an intern's salary and any equipment or conference costs, and to be responsible for the student, then the Institute will pay the remaining 70% of the intern's salary costs.

Technical staff must identify a professor at a university who is doing work in which Sandia is interested and who is interested in working with Sandia. If the professor has a promising student, then the staff person and professor develop a proposal for research that is appropriate for the student, that supports the professor's work, and that benefits Sandia's research program, and submits the proposal for review for funding.

In FY 2002 the MESA Institute initiated a Strategic University Partners Program that includes three universities with which Sandia wants to work, that want to work with Sandia, and that have research programs complementing Sandia's microsystems research program:

- University of Michigan,
- University of Colorado, and
- Georgia Tech.

Line organizations at Sandia identified these universities and will be responsible for developing strategic relationships with them. There are three components to creating a strategic university partnership:

1. A line organization must set up a manager-level contact to work with a university.
2. The university must set up a formal agreement with Sandia regarding the handling of intellectual property.
3. Student works on-site with technical staff member.

Between one-half and two-thirds of the program's recruiting efforts are expected to be focused on professors at the strategic universities, with the remaining effort being open to any university or professor that meets program objectives.

The issue was raised at the end of summer 2001 as to whether the program should focus on undergraduates as well as graduate students. Important elements to the program's recruiting strategy are to have technical staff choose the professors doing cutting edge research that complement Sandia's research and to be ultimately responsible for the interns. As a matter of practice, according to the technical program coordinator, staff and professors choose students who can make the greatest contribution to their research programs and who can derive the greatest benefit from this opportunity. Such students tend to be graduate students because of their knowledge and experience. It was noted that these students are early enough in their careers to be still in the process of identifying employers of choice. The MESA supervisors see this program as a valuable tool to develop research relationships with universities and to influence university curricula in such a way as to have more focus on critical skills areas of interest to Sandia. Further, as the relationship continues, it is hoped that professors will continue to see Sandia as an attractive place to send their promising students.

MESA Objectives

Objective: Increase the pool of technical staff in DP pipeline programs.

Technical staff members are primarily responsible for recruiting and mentoring interns. In FY 03 the number of staff involved in supervising interns rose from 15 supervisors and 9 managers to 17 supervisors and 12 managers.

Objective: Identify and recruit promising students in areas of critical skills needs.

The number of interns increased by 100% in FY 2003, from 19 to 40. These 40 interns came from 19 schools and had a GPA of 3.7.

Objective: Showcase Sandia as an attractive career option.

The exit survey and focus group interview results show that the critical skills programs are highlighting Sandia as an attractive career option. In addition, it has influenced students to change or focus their career plans to be more in-line with the work at Sandia.

Objective: Retain qualified technical students in critical skills areas both at Sandia and in the DP complex.

There have been 6 conversions from intern to Sandia technical staff from this program. Half of the interns from 2002 returned to Sandia in FY 2003 as employees or interns.

Materials Science Research Institute (MSRI)

Table 7: MSRI Student Participants

Year*	# Enrolled	# Schools	Gender		Degree Level			Avg GPA	Converted to Staff
			M	F	HS	AS/BS	Grad/Ph.D.		
03	6	5	2	4		4	2	3.7	1
02	4	3	2	2	2	1	1	3.8	

*Corresponds to Academic Year 02/03 and summer 03 and to FY 03.

**R shows the number of students returning from the previous year.

MSRI Recruiting

Recruiting for the MSRI program is staff-driven. The MSRI program identifies promising students in materials science research by developing and maintaining close ties with the broader materials science research community, particularly at those universities that are doing cutting edge work in areas of interest to Sandia. The initial focus is on those 25 universities that are already identified as lab partners, and in particular the subset of universities working in materials science. In addition, Sandia researchers are aware of where the cutting edge work is being done, including any universities not encompassed by these 25. At this point, colleges and universities at which there is a primary focus on recruiting include:

- MIT
- NM Tech
- Penn State
- U of Arizona
- U of Illinois
- U of Missouri—Rolla
- UC—Cornell
- UC—Davis
- UC—Santa Barbara
- UNM

Sandia researchers develop long-term relationships with university professors who want to collaborate and who are doing cutting edge research complimentary to that at Sandia. The professors, in turn, are in the best position to identify promising students that are interested in this research area. The focus of the program is on students just beginning their graduate studies who are then encouraged and supported while completing their Ph.D.s. This is considered early enough in a student's academic career that they have not yet focused their career plans and can be introduced to Sandia and what it has to offer. A student's presence at Sandia over time also allows Sandia to identify promising employees. Because recruiting is staff-driven, and because it requires a significant amount of volunteer time, staff researchers are not willing to pursue interactions with a university professor or his/her student unless it is beneficial to Sandia's research program.

The program currently has 6 students, including both undergraduates and graduates. The program manager would like to increase the number of students to between 8 and 10 to allow for a combination of year-round and summer interns, and to develop a pipeline sufficient to meet the future needs of the program. The limitation on number of interns is due primarily to funding—both the amount of funding,

and the fact that the funding in the past has come late in the year after many students have already committed to other programs. Lack of funding is the primary reason that the program has not recruited more heavily as staff mentors do not want to raise hopes of an internship and then not be able to meet resulting expectations. This would negatively affect relationships staff are cultivating with university professors, as well as lab and university relationships in general.

MSRI Objectives

Objective: Increase the pool of technical staff in DP pipeline programs.

Technical staff members are responsible for recruiting and mentoring student interns. In FY 03 the number of staff directly involved in the program tripled, from one supervisor and one manager, to three supervisors and three managers.

Objective: Identify and recruit promising students in areas of critical skills needs.

In this second year of the program, six interns were recruited for the program, two more than in the previous year. They had a GPA of 3.7.

Objective: Showcase Sandia as an attractive career option.

The exit survey and focus group interview results show that the critical skills programs are highlighting Sandia as an attractive career option. In addition, it has influenced students to change or focus their career plans to be more in-line with the work at Sandia.

Objective: Retain qualified technical students in critical skills areas both at Sandia and in the DP complex.

One intern has been converted to a technical staff member.

National Collegiate Pulsed Power Research Institute (NCPPRI)

Table 8: NCPPRI Student Participants

Year*	# Enrolled	# Schools	Gender		Degree Level			Avg GPA	Converted to Staff
			M	F	HS	AS/BS	Grad/Ph.D.		
03	27 (6R**)	13	16	11		19	6	3.7	1
02	8	4	7	1		7	1	3.6	

*Corresponds to Academic Year 02/03 and summer 03 and to FY 03.

**R shows the number of students returning from the previous year

NCPPRI Program News

NCPPRI was implemented in 2002, and this is the end of the first full year and second summer of the program. It is an informal program in the research area of z-pinch physics and pulse power. The program has both undergraduate and graduate students, but focuses on identifying talented students in their junior or senior year of undergraduate school and encouraging them to pursue further study leading to a Ph.D. in the field. Identifying students at this level allows interested students to more directly focus and direct their studies in the research areas important to Sandia.

During the summer of 2003, the program had two students from the University of Missouri, and is supporting the research work of two additional students at the same university. One of these students was so impressed by the program that she has transferred to the University of New Mexico so that she can work at Sandia during the school year.

Recruiting for the program is carried out by the technical staff in the pulse power department. Technical researchers at Sandia are most aware of the universities, and the professors at those universities, that are doing the work that is relevant to Sandia's research interests. At this point, the universities with which Sandia researchers are most involved are:

- University of Missouri at Columbia
- University of Nevada at Reno
- ongoing discussions with Texas Tech

In addition, other managers in the pulse power area are working with researchers at the

- University of Michigan
- Cornell
- UC—Davis

NCPPRI Objectives

Objective: Increase the pool of technical staff in DP pipeline programs.

Technical staff members are responsible for recruiting and mentoring students. In FY 03 there were 15 supervisors and 13 managers involved with interns in the program, an increase from 4 supervisors and 2 managers in FY 02.

Objective: Identify and recruit promising students in areas of critical skills needs.

Twenty-seven students with a GPA of 3.7 were recruited for the program this year.

Objective: Showcase Sandia as an attractive career option.

The exit survey and focus group interview results show that the critical skills programs are highlighting Sandia as an attractive career option. In addition, it has influenced students to change or focus their career plans to be more in-line with the work at Sandia.

Objective: Retain qualified technical students in critical skills areas both at Sandia and in the DP complex.

One intern has been converted to a technical staff member in the second year of the program.

Secondary Critical Skills Programs—Advanced Technology Academies—AHS and WMHS

The first advanced technology academy, the Advanced Manufacturing for Education (AME) Program, was initiated at West Mesa High School (WMHS). The students at WMHS were responsible for giving it the name of Advanced Technology Academy (ATA). The model was implemented at another local high school, Albuquerque High School (AHS) and was flexible enough to allow AHS to make changes to it to meet the needs of that high school. In this last year, WMHS was chosen as the site for a Photonics Academy that is focused on photonics rather than manufacturing but builds on the same model. In addition, the Photonics Academy, as described later, has made its own changes to create a pipeline that may be unique in the country. The academy model embodied by the ATA for manufacturing and the Photonics Academy has been endorsed by NACFAM (the National Coalition for Advanced Manufacturing) as an innovative model and an effective pilot for the entire nation.

There were 263 students in the two high school ATA—Manufacturing programs at the end of the 2002/03 academic year. Of those 263, 41% were female. Three-fourths (78%) of the students are Hispanic, 14% were Anglo, and another 14% were categorized as other. The numbers in this report have been provided by the schools to Sandia program coordinators.

Table 9: High School Students in ATA Pipeline

Academic Year	Combined Freshman	Combined Sophomore	Combined Junior	Combined Senior	TOTAL
02-03	67	145	26	25	263

Academic Year goes from September of 2002 to May of 2003.
Combined includes WMHS and AHS students

Both schools use the same basic model for their academies but have implemented their ATA to best meet their objectives. For example, WMHS requires sustained high academic accomplishment to remain in the program where AHS makes the academy more broadly accessible to a wider range of students. Because of these differences, care should be taken in making direct comparisons between the two academies. However, it is worth noting that the model has sufficient flexibility to meet different needs.

The Albuquerque Technical Vocational Institute (TVI—a community college) has been working closely with the high schools and with Sandia and other relevant business organizations to develop a curriculum that is articulated with those at the high schools, that will train students to meet identified workplace needs, and that will meet their standards for preparing students either to enter the workforce or to continue to further education. Students graduate from TVI with an AAS in advanced manufacturing. The program at TVI is called advanced manufacturing and is referred to here as AME for convenience.

In FY 03, TVI and Sandia began discussions about the data that will help to track students through the pipeline. Reporting requirements and the need to protect student confidentiality will limit the ability of TVI to report out data until the number of students from these two high schools becomes large enough to protect student privacy. At this point, the high school program directors indicate that seven ATA students graduating in academic year 02/03 have indicated plans to pursue an AAS from TVI. TVI's advanced

manufacturing program is open to all students that qualify. As of the end of academic year 02/03, the program had 151 total students with an average GPA of 3.1.

Table 10: FY 03 TVI Students from all schools in ATA Pipeline

All TVI AME students
151

Students in the advanced manufacturing academies at the high schools and at TVI are eligible to apply for internships at Sandia National Laboratories. Students that are accepted are made interns in the MEST Program, which accepts applications from students from all schools that meet their qualifications. The interns that are part of the pipeline are shown in the Table 11 below.

Table 11: Sandia MEST Interns

Year*	# Interns	Gender		Schools					Avg GPA	Converted to Staff
		M	F	WMHS	AHS	TVI	Other CC	UNM		
03	25 (13R**)	18	7			18	2	1	3.6	8
02	19 (7R**)	12	7	1	1	11	2	1	3.6	3
01	15	11	4	1	1	10			3.6	3

*Corresponds to Academic Year 02/03 and summer 03 and to FY 03.

**R shows the number of students returning from the previous year.

WMHS ATA—Manufacturing

The Advanced Manufacturing for Education (AME) program was piloted at West Mesa High School (WMHS) in 1996 where student participants early on renamed it the Advanced Technology Academy or ATA—the name that it has continued to carry.

Table 12: WMHS ATA—Manufacturing Student Participants

Academic Year	Freshman	Sophomore	Junior	Senior	Classes at TVI	To TVI as students	Sandia Summer Interns
02-03	35	29	24	24		7	5
01-02	41	27	30	15	34	8 to date	2
00-01	0	15	20	16			

N.B.: Academic Year goes from September of first year shown to August of second year shown.

Enrollment

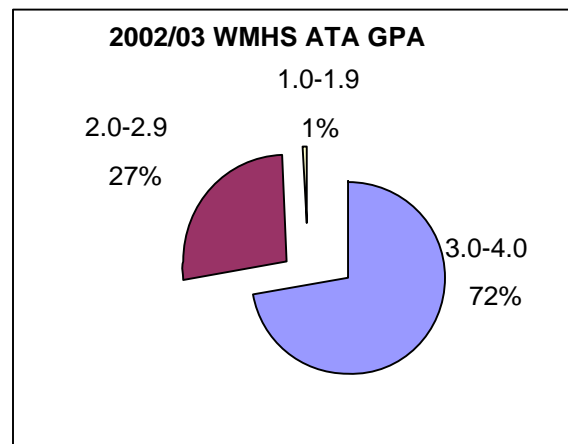
Enrollment is holding steady at about 100. During the 01/02 school year, WMHS began “boxing” its freshman class in the ATA. This means that the ATA group at each grade level has at least one class together each day. In the 02/03 school year, the 01/02 freshman cohort advanced to the sophomore cohort, and a new freshman cohort was formed. Boxing allows the ATA students to get to know each other and to more easily identify themselves as ATA students. It is expected that each freshman cohort that is brought into the program will be about 25; therefore, the size of the program will probably remain at about 100.

GPA

The average GPA of students in the WMHS-ATA has increased. Three-quarters of the students have a GPA between 3.0 and 4.0.

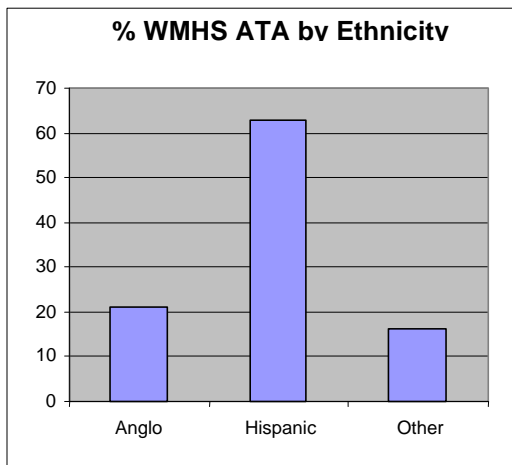
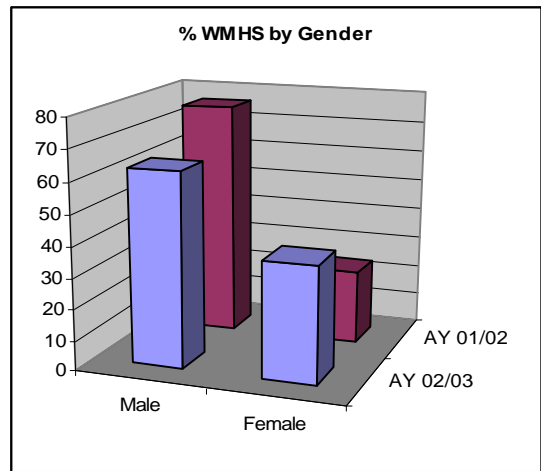
The WMHS-ATA requires that students maintain a GPA of 2.5 or higher to remain in the program. Students who drop below this level are put on probationary status.

In academic year 01/02, the average GPA was provided by gender and grade level, and ranged between 1.8 and 2.7. For academic year 02/03 average GPA was reported slightly differently but showed a clear increase in GPA—72% of the students in the WMHS-ATA had an average GPA between 3.0 and 4.0 and 27% had an average GPA between 2.0 and 2.9.



Gender

The percentage of female students pursuing the WMHS-ATA curriculum increased to 38% in the 02/03 school year from 24% in the 01/02 school year.



Ethnicity

About two-thirds of the WMHS-ATA students are Hispanic, and about 30% of these students are female. No data on ethnicity was collected for the 01/02 school year.

Teachers and Administrators

WMHS had 10 teachers, 3 counselors, and 3 principals and assistant principals involved in the program. During the 02/03 school year, there were 4 conferences, and 12 talks given for these teachers and administrators involved.

AHS ATA—Manufacturing

The Advanced Manufacturing for Education (AME) program begun at Albuquerque High School has completed its second year. It had 151 students during the 2002/03 academic year.

Table 13: AHS ATA Student Participants

Academic Year	Freshman	Sophomore	Junior	Senior	Classes at TVI	To TVI as students	Summer Interns
02-03	32	116	2	1			
01-02 (1 st yr)	83	22	0	0			1*
00-01	No Program						

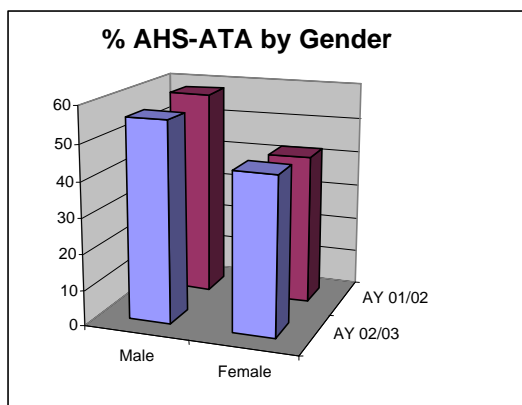
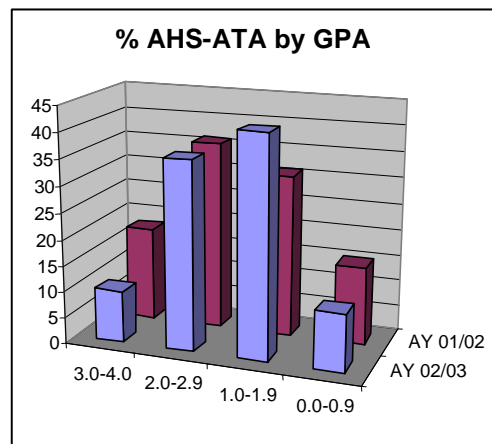
*An upper-class student who asked to participate in the program

Enrollment

Enrollment in the AHS-ATA program increased by 50% in the 02/03 academic year to 151 students. This is the second year of the program. The 10th grade class is by far the biggest class, accounting for 77% of the students.

GPA

The AHS-ATA is included within a larger learning communities group of programs that is open to all students. The percentage of students with a GPA of 3.0 to 4.0 decreased by about half that of the previous year, 10% from 18%. The percentage with a GPA of 2.0 to 2.9 stayed at about the same level, 36%. All of the students with a GPA of 3.0 to 4.0 are 10th graders.



Gender

Almost half, 44%, of the students in the AHS-ATA are female, a slight increase over the previous years 42%.

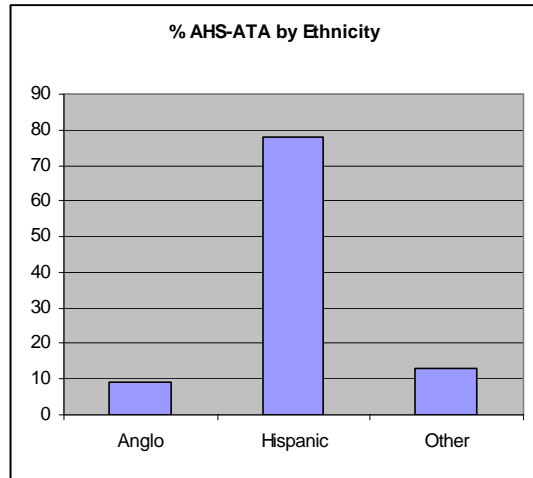
Ethnicity

Three-quarters, 78%, of the students in the AHS-ATA are Hispanic and 9% are Anglo.

Teachers/Administrators

There were 8 administrators involved in the program including 4 principals, a curriculum assistant, 2 assistants, and an Academy Director. Eight students submitted resumes for internships at 6 different organizations for the summer 2003. Six students submitted resumes to 4 organizations for jobs for the summer 2003.

There were 18 professional development opportunities for teachers in the program including workshops and teacher talks. Each had an attendance of between 9 and 12 teachers.



ATA for Manufacturing Objectives

Objective: Increase the Pool of Technical Staff in DP Pipeline Programs

A technical staff person has been involved from the beginning in development of the ATA and in supporting curricula development efforts.

Objective: Identify and Recruit Promising Students in Critical Skills Areas

The ATA had 263 high school students during academic year 2002/03.

Data collection at the high school level is critical to tracking the success of the program. The process of this data collection is still under development, and continuing effort is important to maintaining and updating this database.

The two high schools—West Mesa High School (WMHS) the site of the first academy where early piloting efforts began in 1996, and Albuquerque High School (AHS), the second academy found in AY 2001/02—have well-established programs now that are beginning to feed students to Albuquerque TVI to pursue an AAS in Advanced Manufacturing and to interns and employees to Sandia. Both academies “reach back” to encourage middle school students to take the math and science classes they need to prepare them to enter the academy.

Objective: Showcase Sandia as an attractive career option

Interviews in past years with students clearly suggest that the program has caused students to see Sandia as a potential employer, and has encouraged them to pursue the challenging academic preparation necessary to become an employee.

Objective: Retain qualified technical students in critical skills areas both at Sandia and in the DP complex

Fifteen employees in the advanced manufacturing area have come out of the pipeline program to date.

Recommendations:

1. Sandia should continue to work with the high schools to further refine data collection.
2. Continue to work with TVI to collect information about ATA students from AHS and WMHS that are in the AAS program. It may only be possible to collect information from TVI on all students in the manufacturing AAS program that came from AHS and WMHS, rather than just those students that have come from the ATA—Manufacturing programs.
3. Continue to work with Sandia staff to compile database information on interns.

Photonics Academy

During AY 2002/03 there were 36 students enrolled in the photonics academy. Of the 7 seniors, about half were placed in internships at Sandia or other local organizations. The average GPA of these students was 3.2. The number of enrolled students during the 2003/04 academic year increased, with a GPA of more than 3.0. TVI has had photonics training since the mid-1970s, and currently has 58 students enrolled in its AAS in photonics program.

Table 14: Photonics Academy High School Participants

	Freshman	Sophomore	Junior	Senior	Total	Interns
AY 2003/04					37	
AY 2002/03		2	5	7	36	3

Photonics Academy Program News

In the 2002/2003 academic year the Photonics Academy, based on the WMHS ATA model, was implemented at WMHS. This Academy will allow students to focus in their junior and senior years on photonics preparation. The curricula in the Academy have been closely articulated with that at the Albuquerque TVI so that students are able to take concurrent classes at TVI while they are at WMHS, and later to go on to TVI for an AAS in photonics.

This technology has been predicted by the National Academies of Science and Engineering to be the next major technology to drive the economy, to improve our quality of life, and to have a demand for skilled labor that far outstrips supply.³ The optics and photonics technology area corresponds to a critical skills need for Sandia. There are five organizations within Sandia that have an interest in the students graduating from the Photonics Academy:

- Photonics & Microfabrication
- MESA Microfabrication
- Laser, Optics & Remote Sensing
- Firing Set & Optic Engineering
- Semiconductor Material & Device Science

The program coordinators have worked with Sandia technical staff, local business, and national associations for the purpose of curriculum development focused on both academic standards and national employability skills standards in the field. Early involvement by Sandia in curricula development will help to ensure that graduates are trained in areas of Sandia's need and to reduce the need for on-site training.

While still young, graduates from this program already seem to be in demand. A TVI representative has indicated that all graduates from their program who have wanted a job in the field have gotten one. The Sandia program coordinator says that every DOE/DP dollar from Sandia for the program has been matched by another organization.

The high school is "reaching backward" to encourage middle school students to take math and science courses. In addition, they are "reaching forward" to incorporate local business through work experiences

³ National Academies of Science and Engineering. Commission on Physical Sciences, Mathematics, and Applications. *Harnessing Light, Optical Science and Engineering for the 21st Century*. 1998.

such as internships and business advisory groups and national business by looking for appropriate interactions with professional associations.

The Photonics Academy coordinators are also collaborating with the University of New Mexico as it develops a related BS in Optical Science and Engineering to accompany its existing MS and Ph.D. in the area. Students in the AAS program have the option of entering the photonics workforce as technicians, or going on to further education to pursue a BS.

In 2003, Sandia continued to work with the high schools to collect data to track students in the pipeline. In addition, Sandia initiated discussions with TVI in 2003 regarding tracking of Academy students as they begin the TVI portion of the photonics pipeline in the coming years.

TVI has indicated a willingness to work with Sandia and an interest in collecting this tracking information. The ability to track the information will be dependent on maintaining data continuity from the high schools. In addition, because of federal reporting requirements, TVI will be able to report out numbers only after they reach a sufficient size to ensure confidentiality of the individuals.

TVI has had an optics training program in place since the mid-70's, and built on that foundation to work with the high schools in building an articulated curricula. Representatives of TVI talked about how the program is designed to benefit both students and employers. Students are prepared to both go directly into the job market and are also given the skills that will allow them to choose to pursue further education. Employers are involved through an advisory committee to ensure that training is kept current. One TVI teacher noted that the biggest strength of the program is that it is flexible enough to respond to emerging needs, and by reaching back to the middle schools with information and a pathway it is enabling students to make better choices.

Photonics Academy Objectives

Objective: Increase the pool of technical staff in DP pipeline programs.

Technical staff members have been involved from the beginning in identifying staff and training needs, and in curriculum development for the photonics academy. One staff member has primary responsibility for oversight of interns at Sandia.

Objective: Identify and recruit promising students in areas of critical skills needs.

In its first year, 36 students, and 37 students in the beginning of the 2003/04 school year, chose to participate in the Photonics Academy. The GPA of these students is 3.0.

Objective: Showcase Sandia as an attractive career option.

Insufficient data this year.

Objective: Retain qualified technical students in critical skills areas both at Sandia and in the DP complex.

The program has just been implemented and is in its second year at the high school level.

The Photonics Academy is the only place in the US that offers a seamless pipeline from middle school to Ph.D., that provides an education and training pathway to high demand careers and that allows students to make choices along that pathway to enter the job force or to continue to further education.

Dominique Foley Wilson

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Appendix 1: Focus Group

A group of student interns from the MSRI, the NCPPRI critical skills programs, and from the Computational Science Graduate Fellows (CSGF) Program who participated in the framework of the critical skills program met on June 26, 2003 to discuss their experience in the program. The students were articulate, thoughtful, and pleased with the opportunities presented by the critical skills programs.

The objective of the meeting was to provide an informal opportunity to interns to identify and discuss issues relevant to making the critical skills programs a success. This type of meeting is valuable in surfacing information that is not likely to become available through survey instruments. The opportunity to participate in the meeting was made available to interns, and those students who wanted to participate self-selected themselves.

There were eleven students in the meeting representing a range of experience at Sandia: six of those students had been at Sandia for four weeks or less, one had been at Sandia for two months, and four had been at Sandia for more than one year. Almost all of the students had had previous experience as interns or employees at organizations that would be considered competitors with Sandia for employees. Students were told that the overall focus of the meeting was to answer the following question:

What are the things about your time in this program at Sandia that have contributed to, or detracted from, your perspective of Sandia as an attractive career option?

The evaluator asked students to keep this question in mind in discussing the positive and negative components about the aspects listed below. These aspects were used as prompts to elicit comments, not as a formal protocol.

- Administration of the program
- Recruiting
- Application process
- Internship experience overall
- Work experience
- Interaction with SNL staff
- Strengths and weaknesses of SNL as an employer of choice.

After general discussion, students were asked to group the general discussion into a list of specific issues about the critical skills program that, for them, have contributed to, or detracted from, Sandia as an attractive career option. Students were then given three votes, and asked to distribute those votes as they liked, across the list of issues as to their importance to making Sandia an attractive career option. Students could place all of their three votes on one issue, or spread them across issues. The votes that were given to each issue should be used only as an indicator of their relative importance to this group.

Issues

Students in the meeting identified the following prioritized issues as being important to them in considering Sandia to be an attractive career option.

People at Sandia
Career Development
Mentor
Security Issues

Business/Professional Etiquette
Application Process
Employment Possibilities
Recruiting
The Work Experience

PEOPLE at Sandia

11 votes

The people at SNL were considered by all to be the strongest draw to seeing Sandia as an attractive career option. This is of course no surprise and only continues to confirm that Sandia's current staff is its strongest recruiting tool for future staff. Some specific comments about this issue include:

- Staff members at Sandia have been extremely helpful, making interns welcome and integrating them into the lab culture. Students noted that they are treated with respect and as adults, but with the recognition that there are a lot of things that they don't know about Sandia.
- The "WOW" factor was mentioned several times—being able to work with people of the caliber as those at SNL
- One student said he was in an office with both a tech staff person and another intern, and this combination was very good, helping to encourage integration with the city and the labs.
- Several students noted that people at SNL appear happy to be at Sandia, which makes it a good place to work.
- People are trusted to make their own schedule as long as they get their work done.
- The people at Sandia seem to want you to succeed, which is not the case in some organizations.

Career Development

5 votes

The value of the time spent at SNL for career development was mentioned several times. Specifics:

- It will look good on the resume, will show that the student is capable of good work
- The security clearance, once you have it, opens doors elsewhere as well
- The opportunities for networking at Sandia are excellent. It is a good means of networking, and creating that professional network that students will maintain for their professional life. Students are meeting non-Sandians as well as Sandians through conferences and meetings.
- It is a good way to learn how research is done.
- Access to the equipment is good, much better than anything available at university

Mentor

4 votes

Clearly related to the people at Sandia, mentors were singled out as being important to the success of the program.

- Mentors play an important role in career development. Having tech staff willing to take the time to talk about what skills are needed, what processes need to be followed, to make suggestions.
- Mentors at SNL take more time than do those at the university. Mentors have gone out of their way to offer suggestions and be available.
- It was noted that having the project plan reviewed prior to intern arrival is good.
- Students should be encouraged to contact their mentor/advisor prior to coming.
- Mentors help in introducing students to other professionals.
- It would be helpful to have a list of prior interns available, by university and by area or program to contact prior to applying and prior to coming once they have been accepted.

Security Issues

3 votes

Several comments were raised related to the effect of security issues on employment.

- Several students voiced concerns about the extent that being an employee at Sandia, because of security issues, would limit publishing potential and the ability to work with foreign nationals.
- One student noted that he was happier working outside the fence with everyone although that presented an access issue to people like his boss who worked inside the technical area. He noted that Sandia feels like a military base.
- The need for a clearance to have access to people and work areas was mentioned in the context of suggesting that the process of application for a clearance be begun earlier so that an intern can get a clearance and be with people in his or her group sooner.

Business/Professional Etiquette

3 votes

There was some interest in having a voluntary course on business and professional etiquette, including things like business dining, clothes, interview skills, presentation skills.

Application Process

2 votes

- The suggestion was made that new students be given a better sense of the paperwork required before they actually arrive, for example, that to get on base you need insurance, registration, and drivers license, as not all states require that all of these be in the car.
- Several students noted that they would like to be kept better informed as to the acceptance process and what is happening as they need to make plans.
- The CSGF students noted that their program pays for a student to visit once prior to receiving a position. Also, students in this program must plan their project in advance and fill out a project description plan that is reviewed and approved prior to student arrival by the student, professor, university advisor, SNL staff, and the site coordinator.

Employment Possibilities

2 votes

Several students, when asked about SNL as an attractive career option, asked for more information about employment opportunities. Specifically, students:

- would like a more explicit show of interest in them as employees if their supervisors are interested,
- would like to know what are the criteria for employment and do they have a chance at employment,
- would like to know if there a listing of positions that are or would be available to them,
- would like to talk to interns who have been there before about their experience in getting jobs, how did they do it and what do they suggest?

Recruiting

2 votes

It was noted that there needs to be a better and broader awareness of the NCPPRI and MSRI programs, both within SNL and in the relevant universities.

Work Experience

1 vote

While several comments were made about the work experience overall, it only received one vote, which suggests that students, by and large, are pleased with their work experience and don't see it as an issue.

One area that was specifically raised by several people was an interest in knowing more about what is possible in research at SNL, both security and non-security research areas. One student noted that she thought there was a perception that the Labs are behind the curve in some research areas because they are playing it safe and that this may be due to nuclear weapons work and need to be sure. In particular, the student said that it would be good to know where SNL is at the cutting edge. Related to this was the comment that in some areas SNL can do broad research where it is limited in others by the mission.

Regarding their specific work experience, one student noted that being able to work in an area in which publishing is possible makes it possible to learn something and take it back to the school. Another was very pleased that the program allows the student to have a much focused research experience. The group as a whole noted that the equipment is very good, better than at most universities. One student said that the program pays well, but the scale needs to somehow take into credit that by the time interns get to SNL they have more credits than they are paid for.

Other Issues

The following issues were raised in discussion, but that did not receive any votes. They are included here because they offer additional information to program coordinators that may be of use.

Gender Issues. While it was noted that there are not many women tech staff members, the women in the group agreed that this actually provided them with an opportunity to be more visible. No one indicated any sense of discomfort with being a female tech staff member. There was general agreement that it would be good to have more women.

Career Stability at SNL is good.

Bureaucracy may make it difficult to try new things, or to make decisions to do different things.

Transition Issues. It would be good to have a place to forward mail or email before getting to SNL.

Education Support. Support for graduate school is a good thing, and the students would like to make sure that they know all of the opportunities available.

SNL Infrastructure. Clinic, credit union, child care is good to have. The **CSGF would like** access to the library and to the to clinic/health benefits

MISC

- Would like a folder describing all benefits (clinic, etc.), and what is needed to get on base (registration, etc.).
- ALSO, students do need a car. Remove statement from web site about not needing a car.
- None of students were using intern housing (too expensive)

Appendix 2: Intern Survey Information

Critical Skills Programs Survey 03 Interns—Responses

Numbers in parentheses show number of responses for that choice by intern program. Comments have been combined without distinguishing between programs and are shown in italics as they were received.

Background

1. Degree Level
 - a. High School (2)
 - b. AS (8)
 - c. BA, BS (24)
 - d. MA, MS, MBA (5)
 - e. Ph.D., MD (2)
2. Academic Field:
3. School:
4. Intern Program:
 - a. CCD (15)
 - b. MESA (6)
 - c. MSRI (1)
 - d. NCPPI (8)
 - e. MEST (11)
5. Prior to this internship, I (circle all that apply)
 - a. Have never had an internship or co-op (17)
 - b. Have had an internship or co-op before at Sandia (11)
 - c. Have had an internship or co-op before at another national laboratory (2)
 - d. Have had an internship or co-op before at a university (8)
 - e. Have had an internship or co-op before in the private sector (11)

Future Plans

6. Has being an intern at Sandia changed your future plans? (Circle all that apply)
 - a. No, it has had no effect (2)
 - b. Yes, it has reinforced my plans (20)
 - c. Yes, helped me to focus my career objectives (22)
 - d. Yes, changed my career focus to the area related to my work in at Sandia (8)
 - e. Yes, changed my career focus to the area related to other work at Sandia (2)
 - f. Yes, changed my career focus to an area unrelated to work at Sandia (3)
 - g. Yes, encouraged me to pursue further education (20)
 - h. Other: (3)
It has caused me to consider focusing in the area in which I work here at Sandia, but I haven't made any decisions yet.
Broadened my career choices.
Not yet, I've only worked here for a week and a half.

Sandia as an Employer of Choice (an employer that you would prefer or choose)

7. Would you have considered Sandia as an employer of choice before being an intern at Sandia?
 - a. Yes (36)
 - b. No, why? (5)
I didn't know much about Sandia, I didn't think they would have anything pertaining to my interests.
Didn't really know of Sandia beforehand.
General negativity associated with government work/non-work.
Didn't know enough about Sandia...
8. Would you consider Sandia as an employer of choice now that you have been an intern?

Yes (40)

No (1, was no before being an intern))

9. If you consider Sandia as an employer of choice, what aspects make it so? (Circle up to 3.)
- a. Flexible research opportunities (17)
 - b. Work on areas that are important to the nation (18)
 - c. Challenging and interesting work (35)
 - d. Work with the people at Sandia (13)
 - e. Work on state of the art equipment (15)
 - f. Stable funding (9)
 - g. Work on long-term research programs (8)
 - h. The ability to work independently (11)
 - i. Financial support for further education (17)
 - j. The Professional work environment (11)
 - k. Job-related benefits (15)
 - l. Location in Albuquerque (7)
 - m. Other: (1)

(Re: h above) In my experience, this seems to be the most unrelated field in working with Sandia possible; Sandia is about teamwork. Productive environment with interesting work.

10. What aspects would make Sandia less than desirable to you as an employer?
- Location in Albuquerque*
 - Personal, unrelated to Sandia*
 - Low pay, has not offered funds for school, need funds for school.*

Intern Experience

11. Please rank your overall experience in this internship program:
Average Ranking 4.8 out of possible 5
12. Please rank the importance of this program to you in career development
Average Ranking 4.8 out of possible 5
13. This program has given me an opportunity to learn about the range of career options at Sandia.
(Check all that apply)
- a. Not at all (3)
 - b. Has introduced me, individually or in a group, to people in different organizations who have talked about their work (34)
 - c. Has provided tours of Sandia's research areas (26)
 - d. Has provided me with other ways to learn about different research programs, such as:
Speakers forums.
SIP speakers series.
14. What are the greatest strengths of this intern program from your perspective? (Circle up to 3.)
- a. Flexible research opportunities (14)
 - b. The opportunity to do challenging and interesting work that contributes to Sandia's research program (31)
 - c. Work with the people at Sandia (11)
 - d. Presence of someone to talk with about my field or career options (17)
 - e. Work on state of the art equipment (11)
 - f. The ability to work independently (9)
 - g. Being treated like a responsible adult (12)
 - h. Financial support for further education (10)
 - i. Other:
The concern for students.
Managers that genuinely care if you succeed.
15. What are the weaknesses or problems with the program (up to three) from your perspective?
(22 commented)
- Never offered to pay for required transcripts, sexually discriminating e-mails.*
 - More one on one with the students in the beginning.*

*More preparation time to accept interns into area; Enough tools for all students;
 More mentors (1 mentor per every 2 students).
 Not much from what I can see.
 They need to let the interns work more than 25 hours a week when in school; Pay for
 holidays and 2 week shut down; Sick, medical, and vacation leave.
 Lack of benefits.
 The training could be more intensive and consistent and organized; The training
 could be more effective if there was a dedicated trainer.
 Lack of communication about needed/received forms/information.
 I actually didn't know about the NCPPRI before I began working here at Sandia, and
 actually found out kind of in random conversation that I was technically part of
 this program; I don't even think that my manager knows about it or anything;
 My suggestion is to publicize this program more with students coming into work
 in the Pulsed Power areas as well as with the managers who hire them.
 Summer interns have a long wait period before they actually start doing interesting
 work, or any work at all.
 Many students I know were given tedious clerical type jobs; Some manager's don't
 take students' work seriously.
 Clearances take too long; Aren't started early enough; Security issues are NOT
 made clear enough to interns; Hard to get something useful done in short time.
 Lengthy process to get information/assistance.
 Sometimes very busy/noisy...hard to concentrate (though I think the arrangement of
 the CCD is an important part of the experience.
 Lack of large/big activities for all interns.
 Projects should be suited to intern's ability.
 CCD isn't exactly the most open-minded of working environments – could be a little
 better.
 Gets noisy sometimes.
 Nothing, CCD is great!
 Expensive corporate housing; Lack of weekend trips; Not having a security
 clearance.
 It can be hard to get a hold of people; Everyone is very busy and communication can
 be difficult.
 Not enough opportunity to see New Mexico; Not enough networking events; Not
 enough classes on how to get along with others, i.e. social styles, team work type
 classes.*

16. What have you gotten from the program that you would not have gotten if you had not been in the program?

(28 commented)

*Opportunity to work w/experts in their fields & contribute to SNL's research focus.
 No one can answer this question, because they can't live out all possible choices.
 An understanding of my career choice & what I really want to work in for the future.
 Focus.
 Great work experience.
 Detailed training.
 Knowledge.
 Quality hands-on training.
 Experience.
 Yes.
 An idea of what kind of jobs are available.
 Experience and application of theory.
 Amazing exposure; Security clearance.
 National lab experience and security clearance.*

Valuable research opportunities in a corporate scientific environment, “real world” exposure.
Real world expertise.
Experience developing cutting edge tools.
In credible experience, great connections, and opportunities I would have not have had otherwise.
Valuable experience in my field.
My knowledge in Linux, programming and networking.
A respect for the importance of computer and network security.
An understanding of information security that I couldn’t have gotten from school.
Great learning with programming skills.
Great knowledge of computers that cannot be obtained from a school environment.
An excellent opportunity to polish the skills I have been developing in classroom, great pay, a great summer.
Experience working in a government research lab.
A taste of what it’s like to work in a professional work environment.
The chance to hear what other students are doing.

17. Please use the section below, or the back of this page, to write any additional thoughts about or suggestions for improving the intern program in which you participated.
(7 commented)

Please, please keep up a website or database with listings of received transcripts/registration/information, etc...
More technical speakers forums that address the research going on rather than just how to get involved or simply what a department does; It seems like the latter two points could be addressed if the topics were more specific.
Thank you for this wonderful opportunity.
CCD is excellent; Bob Hutchinson and Karen Shanklin are great; I am not really sure how it could be improved.
The CCD program taught me much about computer security and allowed me to develop my job skills. Bob Hutchinson, my manager, was very helpful in offering career advise.
I really appreciate the people in the SIP office; They are committed to making this a worthwhile experience.
I was very impressed with the relocation assistance—I am not sure if I would have interned here initially if there was no assistance; I was also impressed with the pay and benefits (the health insurance was great).

Appendix 3: Conversions to Employee Survey Responses

Pipeline Programs Survey 02 Conversions to SNL Employees—Responses

Background

1. Degree Received
 - a. BS-1
 - b. Ph.D.-1
2. Academic Field: 1-Mechanical Engineering, 1-Material Science and Engineering
3. School: U of Oklahoma and Penn State
4. Year Degree Received: 1 in 2002, 1 in 2003
5. In which Intern Program did you participate: 1-MESA, 1-MSRI
6. What role has the internship played in helping you in career planning and development? (Circle all that apply)
 - a. It reinforced my desire to be a SNL employee. 2
 - b. It helped me to focus my career objectives because I want to work at Sandia. 1
 - c. I was not thinking about SNL as an employer of choice before the internship. 0
 - d. I didn't really know anything about Sandia before the internship. 2
 - e. The internship has encouraged me to pursue further education in areas of interest to Sandia's research program. 0
 - f. The internship had no effect on my career planning and development. 0
 - g. Other: 0

Sandia as an Employer of Choice (an employer that you would prefer or choose)

7. Would you have considered Sandia as an employer of choice before being an intern at Sandia?
 - a. Yes 1
Yes, but I'm not sure if the opportunity would have presented itself (Sandia does not recruit at Penn State as far as I know)
 - b. No, 1
8. If you consider Sandia as an employer of choice, what aspects make it so? (Circle up to 3.)
 - a. Flexible research opportunities. 1
 - b. Work on areas that are important to the nation. 1
 - c. Challenging and interesting work. 2
 - d. Work with the people at Sandia. 1
 - e. Work on state of the art equipment. 1
 - f. Stable funding. 1
 - g. Work on long-term research programs. 0
 - h. The ability to work independently. 0
 - i. Financial support for further education. 1
 - j. Other: 0
9. What aspects make Sandia less than desirable to you as an employer?
I've noticed that unless you have an advanced degree, your options here are severely limited, even if you display competence (i.e. I can hold a 'staff member' or managerial—versus a technician—position at a commercial company with a B.S. degree). I feel that, with a B.S. degree, I have enough education and experience to manage more responsibility as far as job responsibilities.

Intern Experience

10. Please rank your overall experience in this internship program: average=5
11. Please rank the importance of this program to you in career development: average=4
- 12.
13. This program gave me an opportunity to learn about the range of career options at Sandia. (Check all that apply)
 - a. Not at all. 0
 - b. Introduced me, individually or in a group, to people in different organizations who have talked about their work. 2

- c. Provided tours of Sandia's research areas. 0
 - d. Provided me with other ways to learn about different research programs, such as: 0
14. What are the greatest strengths of this intern program from your perspective? (Circle up to 3.)
- a. Flexible research opportunities. 1
 - b. The opportunity to do challenging and interesting work that contributes to Sandia's research program. 1
 - c. Work with the people at Sandia. 1
 - d. Presence of someone to talk with about my field or career options. 1
 - e. Work on state of the art equipment. 0
 - f. The ability to work independently. 1
 - g. Being treated like a responsible adult. 0
 - h. Financial support for further education. 0
 - i. Other: 0

15. What are the weaknesses or problems with the program (up to three) from your perspective? 1 commented

I think its wrong that business/lib. art majors have lower GPA requirements than students with technical majors.

16. What have you gotten from the program that you would not have gotten if you had not been in the program? 2 commented

A job at Sandia.

Working with the scientists/engineers here was amazing—I've actually seen some of the technology here that has been on the news back in PA. Also, having a clearance was a big plus when I interviewed with other companies. I've also moved around in three different groups, and thus have covered two of the four areas in Material Sci. and now have experience in biology—all in three years here at Sandia.

17. Please use the section below, or the back of this page, to write any additional thoughts about or suggestions for improving the intern program in which you participated. 2 commented

Option of participating in New Hire program tours/talks.

During the summer, e-mails from SIP can et a little out-of-hand (especially right before the symposium). Maybe making these e-mails more concise and less frequent (and less confusing regarding the symposium info) would be a great idea.

Appendix 4: Supervisor's Survey Information

Critical Skills Intern Programs 03 Supervisor Questionnaire

Background

1. How many interns have you supervised over time? 14 supervisors of 79 interns over time
2. For how many years have you had experience supervising interns? Range from 1 to 10 years.
 - a. What degree level are your current interns? Almost all interns are at BS level (9 of supervisors from CCD).
4. Would you be willing to be contacted by another member of the staff who is interested in being a supervisor or mentor to interns and would like to talk with you about your experience? Yes: 6

Involvement in internship program

5. In the context of your most recent intern experience, what are your future plans to take on interns? (Circle all that apply)
 - a. I am willing to supervise another intern, this experience was positive. (14)
 - b. I am willing to take supervise another intern even though this was not a positive experience.
 - c. I am not interested in taking on another intern, my experience was not positive.
 - d. I am not interested in taking on another intern, but for reasons unrelated to the interns.
 - e. Comments/other
Subject to project needs and funding
They really make us think!!
6. Was your current experience supervising an intern worth the cost in time and resources?
 - a. Yes, because (Circle up to 3 elements, if one of the elements was most important, please put a star by that element)
 - i. He/she did work that would not have otherwise been done (9)
 - ii. He/she brought technical expertise and knowledge that benefited the program (7)
 - iii. He/she brought a different perspective to the work that was helpful (5)
 - iv. He/she is a good candidate for becoming a member of the staff (10)
 - v. He/she acts as a connection between my research program and the research program at his/her university (0)
 - vi. The experience was personally/professionally rewarding to me (2)
 - vii. Comments/other:
It is always somewhat useful but summer interns are not here long enough; by the time they come up to speed it is time to go.
The students who have positive experiences go back to school and tell others what a great place Sandia is to wok, providing us with good PR.
 - b. No, because (Circle all that apply, if one of the elements was most important, please put a star by that element) None commented
 - i. He/she did not do work that was useful to the program
 - ii. He/she took too much of my time
 - iii. He/she did not have sufficient expertise or knowledge to be able to do productive work
 - iv. He/she did not seem interested or willing to work
 - v. Comments/other: _____
7. What are the most important criteria for choosing an intern? (Circle all that apply)
 - a. Educational level and completed coursework (4)
 - b. Academic training and work experience (7)

- c. GPA (1)
 - d. Comments/other: (7 commented)
I did not do the selection
The interns' interests and motivations
Desire to learn
Interest in cyber security
All of the above
Curiosity and Willingness to learn
Recommendations from their faculty.
8. What is most valuable to you about the critical skills intern program? (Circle all that apply, if one of the elements was most important, please put a star by that element)
- a. Introducing Sandia and well-qualified potential employees (11)
 - b. Financial support in bringing interns into my research program (0)
 - c. Getting work done (10)
 - d. Developing/maintaining a research relationship with the intern's university (2)
 - e. The technical focus that the program provides (2)
 - f. Administrative support in locating and hiring interns (2)
 - g. Comments/other: (2 commented)
Giving inter valuable experience
Training the intern for real work.
9. In your experience, what elements contribute to a successful internship? (Circle all that apply)
- a. Interns return for multiple (summer or semester) time periods (6)
 - b. Interns have discrete projects that relate to overall research program, but give students independence and problem solving responsibility (9)
 - c. Interns have projects that are part of the overall research program and involve working as part of the research team (4)
 - d. Finding an appropriate balance between intern and independence and interaction with staff (4)
 - e. Selecting an intern with an academic or experiential background that will contribute to the research program (4)
 - f. Comments/other: (1 commented)
Interns perform research on projects across the lab
10. Please rank your overall experience in this internship program:
Average Rank 4.4 out of possible 5
11. Would you hire your intern (assuming appropriate qualifications) to be a member of the technical staff?
- a. Yes (7)
 - b. Too soon to tell (7)
 - c. No (1)
12. What are the weaknesses or problems with the program (up to three) from your perspective?
- I was too busy to spend adequate time with the interns.*
Same as 10
Summer interns are not here long enough
Sometimes experimental projects fall through due to the equipment failure, leaving the students little to do and us scrambling to keep them busy.
A little bit of disruption when they arrive due to need to find "meaningful"
13. Please use the space below or the back of this page to write any additional thoughts about or suggestions for improving the intern program in which you participated.
Don't have them commit to presentations so early in the summer, may need more time to define and limit their projects.
None, I really enjoy having them around once I find something for them to do.

Distribution

<u>Qty</u>	<u>Organization</u>
2	US Department of Energy Office of University Partnerships Att'n: Dr. Beverly Berger 1000 Independence Avenue, S.W. DP-134 / room 4B-103 Washington, DC 20585
2	Center for Occupational Research & Development Att'n: Darrell Hull Att'n: Leno Pedrotti P.O. Box 21689 Waco, TX 76702-1689
2	NACFAM Att'n: Leo Reddy, CEO & Founder Att'n: Egils Milbergs, President 1201 New York Avenue N.W., Suite 725 Washington, DC 20005-3917
3	Albuquerque High School Att'n: Art Fresquez Att'n: Linda Sink Att'n: Mike Stanton 800 Odelia Road N.E. Albuquerque, NM 87106-1699
8	Albuquerque Technical Vocational Institute Att'n: Steve Benavidez Att'n: Joel Gellman Att'n: Don Goodwin Att'n: Robert Hall Att'n: Fabian Lopez Att'n: Matthias Pleil Att'n: Nancy Stewart Att'n: Sue Sujka 525 Buena Vista S.E. Albuquerque, NM 87106-4096
9	Bernalillo High School Att'n: William Brooke Att'n: Barbara Vigil-Lowder Att'n: Ken Broussard Att'n: Sharon Fox Att'n: Clarissa Hastings Att'n: Philip Madrid Att'n: Javier Ramos

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1 Essel Baca
11508 Herman Roser Ave. SE
Albuquerque, NM 87123

1	MS0384	Bickel, Tom	09100
1	MS0186	Blanton, Don	03000
1	MS0145	D'Antonio, Perry	09713
1	MS0319	Fellerhoff, Rick	02610
1	MS0180	Gallegos, Jerry	10730
1	MS0956	Gallegos, Phil	14151
1	MS0836	Griffith, Richard	09117
1	MS0821	Gritzso, Lou	09132
1	MS1078	Hanselmann, Kathryn	01314
1	MS0121	Hart, Carolyne	01200
1	MS1023	Harty, Susan	03554
1	MS9904	Hibbs, Norma	08524
1	MS0785	Hutchinson, Bob	05516
1	MS1351	Jackson Connie	03555
1	MS1080	Jakubczak, Jay	01703
1	MS1026	Jones, BJ	03500
1	MS0603	Kemme, Shanalyn	01743
1	MS9403	Ketchum, Rose	08529
1	MS1349	Loehman, Ron	01843
1	MS0310	Martin, Marcus	09235
1	MS0132	Martinez, Lenny	14000
1	MS1194	McDaniel, Dillon	01640
1	MS1352	Moore, Jackie Kerby	14031
1	MS0824	Moya, Jaime	09130
1	MS1110	Phillips, Cynthia	09215
1	MS1190	Quintenz, Jeff	01600
1	MS0151	Ratzel, Art	09750
1	MS1231	Romig, Al	05000
1	MS1351	Roybal, Karen	03555
1	MS0960	Sanchez, Julian	14030
1	MS9904	Scott, Karen	08524
1	MS1372	Shanklin, Karen	05516
1	MS1084	Smith, Brad	01748-1
1	MS0561	Souther, Tom	14133
1	MS0865	Stinnett, Regan	01903
1	MS1194	Struve, Ken	01644
1	MS0513	VanDevender, Pace	01000
1	MS0629	Williams, David	09500
1	MS0139	Wilson, Pete	09902
1	MS1077	Zipperian, Tom	01740
1	MS9018	Central Technical File	8945-1
2	MS0899	Technical Library	9616
35	MS1351	Dominique Foley Wilson	03555