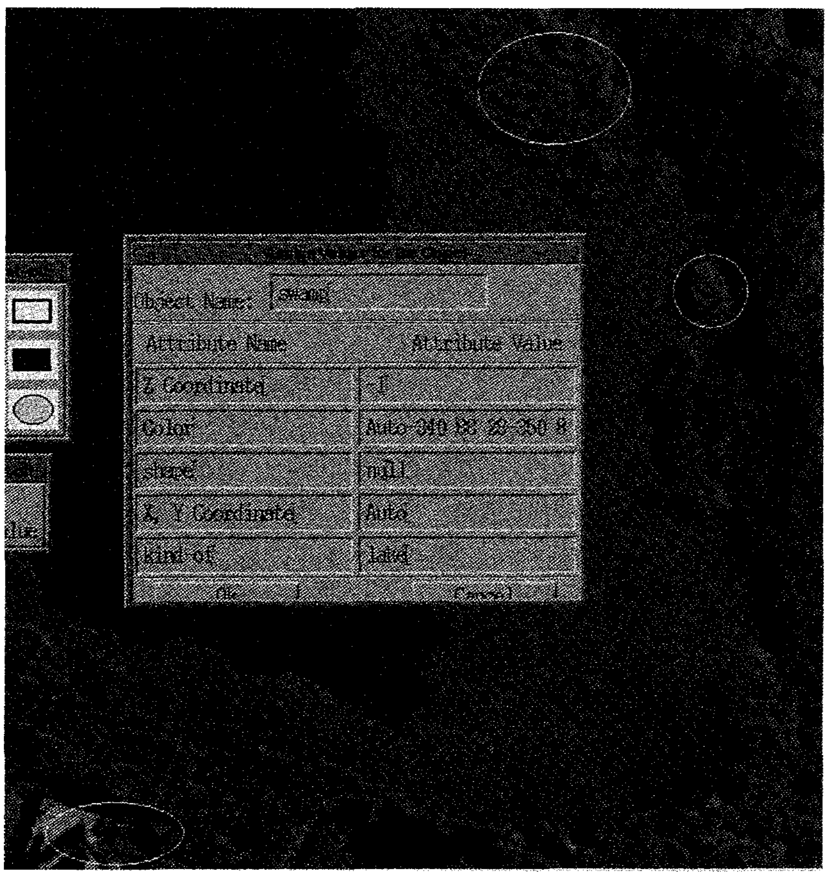
ANNUAL REPORT 1994

DOE/ER/75833-T4

Science and Engineering Alliance, Inc.



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SEA

Cover Caption

A sample window from SemCap (Semantics Capture) Tool is shown being used to semi-automatically capture the content in the image of a Louisiana swampland. The primitive features and logical features of the objects (such as the swamp marked in red on the top left, forest outlined by an ellipse on the top right, oil tank on the bottom left, etc.) are being captured and stored into the logical image database by the SemCap.

SemCap is an image indexing tool for distributed-content-based image storage retrieval systems for scientific users. This has been developed as a part of the DOE-funded JSU-SEA-HPCC project (in collaboration with another ARPA-funded project), of building an integrated scientific computing environment. SemCap is versatile in the sense that it can be used across several domains including scientific domains. SemCap takes a hybrid approach to feature extraction. Typically, primitive features are extracted automatically or semi-automatically while the logical image features are derived manually.

ANNUAL REPORT 1994

Science and Engineering Alliance, Inc.

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Science and Engineering Alliance, Inc.

Overview

The Science and Engineering Alliance (SEA) was formed in 1990. The goal of the SEA is to foster and encourage collaborative research among the Alliance members. Collaborative research enhances the production of well-qualified scientists and engineers graduating from the SEA member institutions. These students will become contributing participants in the United States technical workforce now and into the next century. The SEA consist of four historically black colleges and universities (HBCUs) and a national laboratory.

The four HBCU institutions are:

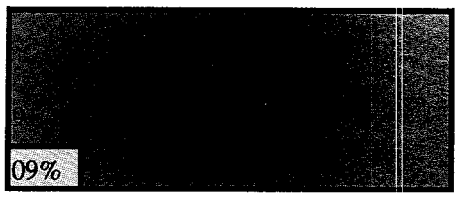
- *Alabama A&M University (AAMU)*
  Normal, AL
  (1890 Land Grant University)
- *Jackson State University (JSU)*
  Jackson, MS
  (Comprehensive Urban University)
- *Prairie View A&M University (PVAMU)*
  Prairie View, TX
  (1890 Land Grant University)
- *Southern University and A&M College (SUBR)*
  Baton Rouge, LA
  (1890 Land Grant University)

The national laboratory is:

- *Lawrence Livermore National Laboratory (LLNL)*
  Livermore, CA

The SEA is a non-profit consortium. The SEA collaborates on research projects with government agencies, national laboratories, private foundations, industry, and other universities in a broad range of scientific and technical areas.

Financial Highlights *(No salaries included)*



	Program Services	$ 188,071
	Management & Gen.	$ 17,751

Letter from the Chairman

The SEA is fast becoming the standard by which the member institutions conduct collaborative research. The process of bringing together technical faculty from each institution with an interest and commitment to work together (i.e., Design Teams) is beginning to bear fruit.

During 1994, the Alliance received its first major research award. The award is in the area of high performance computing and communications. It affords the members the opportunity to play an important role in the development of the nation's National Information Infrastructure (NII) activities.

As the SEA continues to use its Design Teams to foster collaborative interactions of the caliber of the high performance computing research initiative, the faculty and students will receive greater benefits. Ultimately, America's technical workforce will share in the rewards of the SEA successes.

Two of the benefits are observed immediately: (1) a better prepared entry level technical worker that translates into increased productivity; and (2) a reduction in the training dollars that employers need to invest to bring entry workers to an acceptable level of performance in their new technical assignments.

Looking toward 1995, we are convinced that the involvement of the SEA in high performance computing and communications will expand into other technical areas. Such focused collaborations help to strengthen the collective body and the individual science and engineering programs at each member institution.

SUBR will continue its involvement in the SEA. This will be achieved with a clear understanding of the long-term benefits of engaging in such a resource-sharing Alliance.

Marvin L. Yates

Marvin L. Yates
Chairman, SEA Executive Board
Chancellor, SUBR

Message from the Executive Director

This Annual Report focuses on *Accountability*. To meet the goals and objectives set for the SEA, it is important to constantly ask "what is being accomplished?" The Executive Board and Steering Committee believes that this question must be assessed annually.

SEA believes that obtaining research grants, conducting teacher enhancement workshops, and providing financial support are major accomplishments. But accountability requires an explanation on how the resources were used to accomplish the mission. SEA's explanation is linked to its financial data.

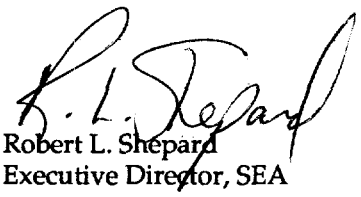
Supporters need to know that as a result of the SEA Program, junior faculty members (assistant professors and other non-tenured staff), are enthusiastically engaged in research like SEA's High Performance Computing and Communications (HPCC) initiative. This kind of focused participation helps improve the productivity of young faculty. It also enhances their career path and creates additional options.

SEA faculty continue to participate in LLNL's ongoing summer program. The goal is to establish long-term, funded collaborative research at each academic institution. Graduate and undergraduate students continue to receive expert training working with their faculty advisors and mentors in the SEA Program at LLNL.

The recipients of our high school incentive awards continue to enroll in science and engineering programs internal and external to the SEA institutions.

Teachers that participate in our teacher enhancement workshops continue to provide positive feedback regarding their summer experience. During the academic year following the 1994 workshops, in addition to the participating teachers, feedback was obtained from principals, department chairs, and counselors. The administrators reported observing that students have become more enthusiastic and motivated about science and mathematics. Additionally, they reported observing a renewed teacher focus and greater interest in overall classroom activities. These assessments will continue.

Change and new direction are the order-of-the-day. SEA will continue to demonstrate that the shared commitment of four HBCUs and a national laboratory, spread over five states, can make a difference.

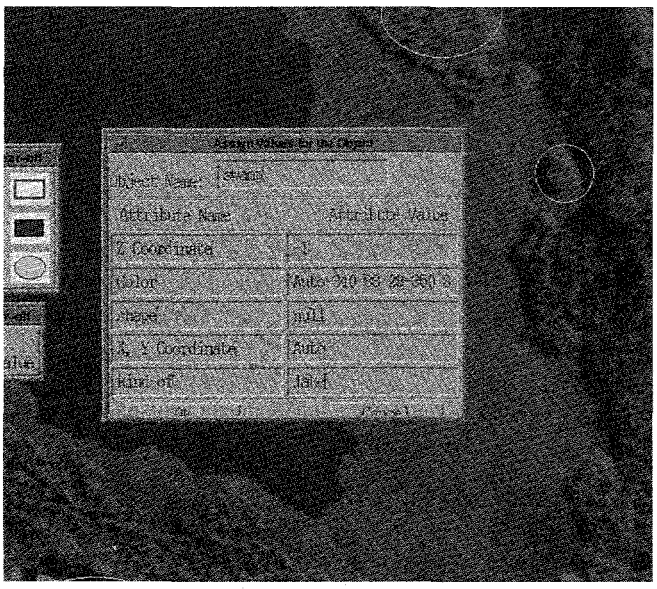


Robert L. Shepard
Executive Director, SEA

FY94 Achievements and Activities

High Performance Computing and Communications (HPCC)

During FY94, the SEA was awarded its first major multiyear grant. The grant was awarded by the U.S. Department of Energy's (DOE) Office of Scientific Computing. The purpose of the grant is for the SEA to conduct research and training in the broad areas of high performance computing and communications (HPCC).



Specifically, SEA researchers have initiated work that will: (1) design, implement, test, and evaluate an integrated environment for scientific simulations; (2) address the issues of data management, database creation, and database management; (3) examine the use of optics and optical scientific database management systems (SDBMS) as a replacement of conventional SDBMS; and (4) study high performance computing in high-tc superconductivity.

The SEA HPCC initiative is expected to result in development of an Integrated Work Bench (IWB). The IWB will provide solutions to data management and retrieval problems. The project has well-defined and measurable goals and objectives.

Other Special Projects

The SEA project entitled "*Installation of a Synchrotron Radiation and Beamline Facility at the J. Bennett Johnston, Sr. Center for Advance Microstructures and Devices for the Science and Engineering Alliance,*" was revised and re-submitted to DOE's Office of Energy Research for funding consideration. Also, a new project entitled "*Community Environmental Justice Awareness and Training,*" was developed and submitted to the U.S. Environmental Protection Agency (EPA) for funding consideration.

Toward the end of FY94, DOE's Office of Science Education Program provided feedback on the SEA's infrastructure development project Phase III. The comments will be reviewed by the Steering Committee, and a response forwarded to DOE during FY95.

Linking SEA Via The Internet

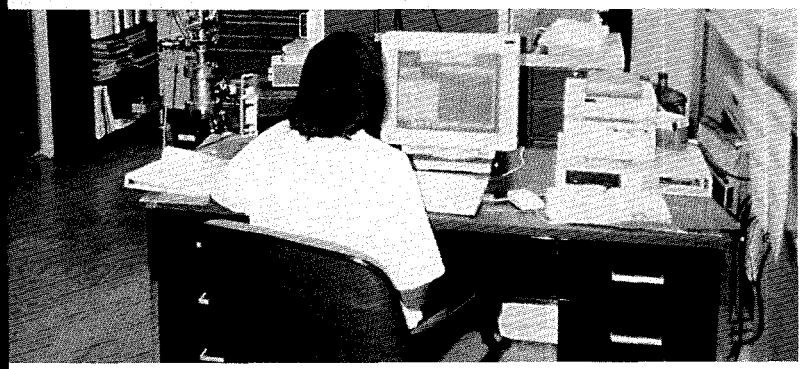
During FY94, more SEA faculty members became linked to the Internet. The numbers are expected to increase as more faculty and students obtain and use Internet addresses. Using Internet has improved interaction among the institutions and resulted in a faster way to get SEA tasks accomplished. Presently, linkage consists primarily of members interacting via electronic mail.

The benefits of interacting electronically was discovered when a SEA Design Team developed the EPA project document using this medium. Here is how it worked. An initial planning meeting was held at AAMU. At the meeting, project plans were developed and tasks and responsibilities were assigned. This was the first and last time that the design team traveled to physically meet. From this point, the entire project document was developed via Internet without additional meetings. This process eliminated generating the many draft copies of the same document which usually end up in the trash. The electronic process proved to be faster and more efficient.

The electronic process has become the "standard operating procedure" for generating SEA project documents.

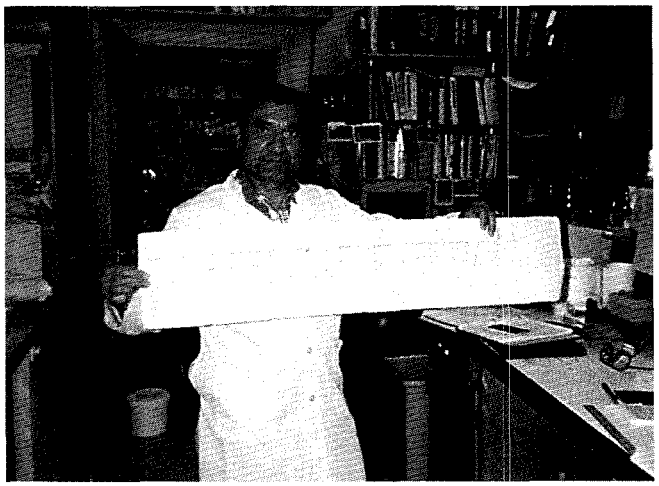
Summer Research at LLNL

LLNL continues to look for ways to enhance its summer research program for HBCU faculty and students. During FY94, LLNL established the Laboratory for Cooperative Applied Physics (LCAP). The LCAP employs a wide range of photonic technologies (x-ray to visible) to a broad spectrum of problems from environmental sensor development to basic physics research. The LCAP provides an experimental laboratory and serves as the focal point for the SEA summer program. It is now LLNL's permanent resource to help establish funded collaborative research activity among SEA and other minority institutions.



During the summer of FY94, eight students and four faculty from SEA institutions were involved in the following projects:

A plant geneticist from AAMU's Department of Plant and Soil Sciences, collaborated with LLNL scientists working in the Human Genome Center. The goal was to construct a high resolution map of a region that encompasses the entire q12 and q13.1 bands of human chromosome 19. The SEA researcher gained experience with the techniques, especially those involving large scale computing. The LLNL researchers were exposed to problems associated with plant genetics.



A research team from SUBR developed techniques making complex multiconfigurational calculations more efficient. Taking the results of detailed calculations for a sparse set of atomic/ionic systems, the researchers investigated the use of spline fitting techniques to interpolate results for intermediate isoelectronic charge states. These results, when widely applied, would make available data for all stages of ionization for all elements to be utilized by complex plasma modeling codes where a wide variety of plasma conditions exist in the same calculation.

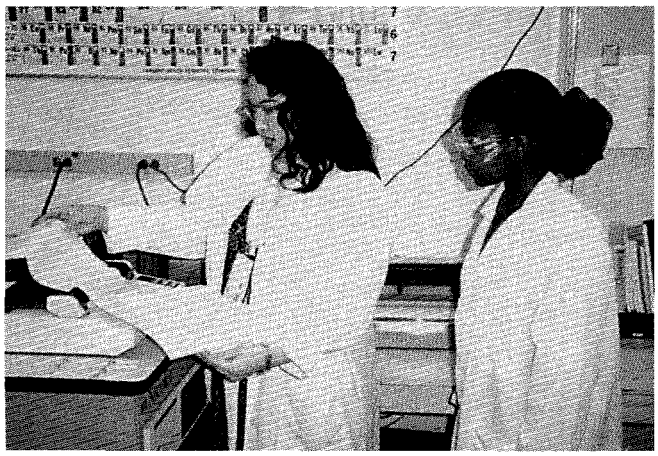
A geologist from PVAMU established a collaboration with researchers at LLNL's Site 300. The group studied the isotope hydrology of the gulf coast aquifer system involving Brazoria, Fort Bend, Harris, and Waller Counties, Texas. The goal of this research is to determine the flow system, age, and current ground water quality of this aquifer system.

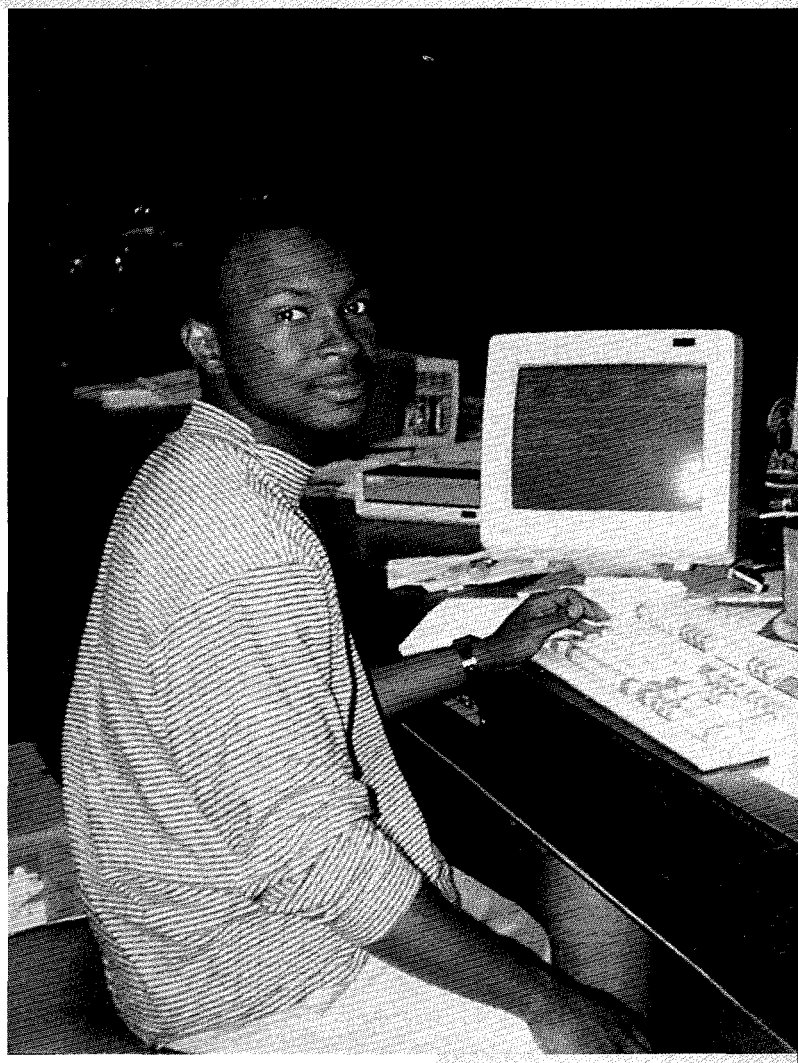
A physicist from JSU participated in research to develop blazed multilayer coated gratings in LCAP.

Besides working with SEA faculty, several SEA students worked with ongoing LLNL research teams. These students were involved in projects designed to:

- *Build a portable mass spectrometer*
- *Utilize X-ray fluorescence to detect trace dissolved elements in seawater*
- *Study the feasibility of using inelastic scattering of laser light to detect light elements*
- *Measure relativistic effects in highly stripped ions*
- *Enhance the spatial resolution of photon counting detectors*
- *Utilize two photon laser induced fluorescence techniques to detect rare gas atoms under atmospheric conditions*

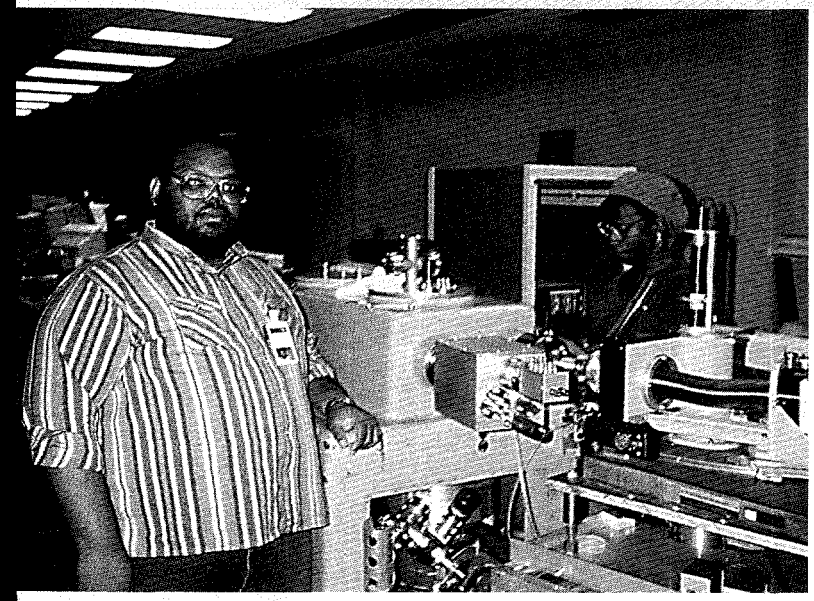
Twenty-two students and eight faculty members have participated in the LLNL program. Based on these interactions, four new spin-off research projects have been initiated at the academic institutions.





Student Support

During FY94, the SEA awarded 16 undergraduate scholarships and 16 high school incentive awards. These funds are used to supplement the education expenses of students that have demonstrated extraordinary talents toward science, engineering, and related subjects. This was the fourth year that the scholarship program has been in effect. This year the scholarships were presented at smaller events held at the individual institutions. The smaller events gave family and friends who would not be able to travel to Washington the opportunity to witness the activity.



Outreach

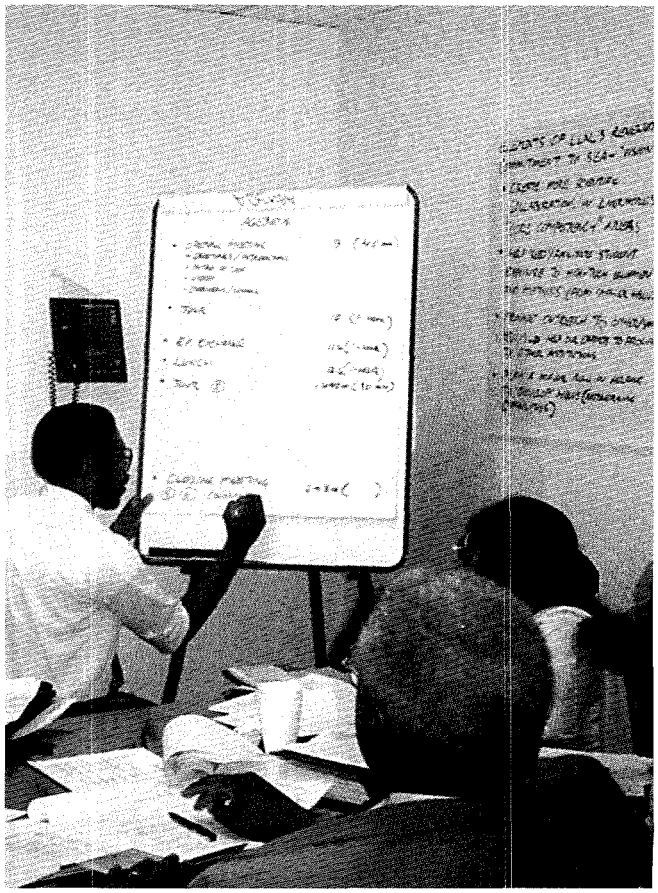
A total of 81 high school teachers participated in SEA's teacher enhancement workshops during the summer of 1994. For the first time, feedback was obtained from the participating teachers' supervisors and other key staff. These included principals, department chairs, and counselors. The administrators reported observing improvements in student enthusiasm and motivation toward science and mathematics. They also reported observing renewed teacher focus and interest in their classroom activities. It is expected that all of this will ultimately be reflected in student's standardized test scores.

The *Federal Information Exchange/Minority On-Line Information System (FEDIX/MOLIS)* continues to serve as the primary means by which SEA extends its services to others, especially to smaller HBCUs. Many of the inquiries in FY94 came from institutions interested in enhancing their science education programs. Interacting with the institutions continue to reveal the need for conducting need assessments. The assessment results will reflect how the existing infrastructure can be strengthened over time. To be successful, these institutions must develop strategic plans to aid their planning for the future.

FY 95 Goals

The SEA will continue to develop special research projects to enhance the member's institutional infrastructure. These projects will significantly advance knowledge in the physical sciences and engineering. The SEA will continue to serve as a vehicle to promote collaborative research. Also, SEA will continue to provide enrichment opportunities for junior faculty members and new students as special projects are funded.

The goal is to secure at least two funded research projects through SEA. Additionally, steps will be taken to involve more SEA faculty and students in the LLNL summer research program. SEA will host at least one technical seminar or colloquium at each of the Alliance institutions. LLNL and other organizations with the appropriate technical expertise will be included as participants. Additionally, at least one SEA course offering will be initiated using video teleconferencing.



Balance Sheet
As of September 30, 1994

(SEA, Inc. not-for-profit corporation)

ASSETS

CURRENT ASSETS	
Cash	$125,716
Receivables	60,080
	185,796
FIXED ASSETS	
Furniture, fixtures & equipment	17,370
Less: accumulated depreciation	9,279
	8,091
OTHER ASSETS	
Deposits	1,800
TOTAL ASSETS	**$195,687**

LIABILITIES AND FUND BALANCE

CURRENT LIABILITIES	
Accounts payable	$ 3,436
Accrued leave	582
Deferred revenue	100,000
	104,018
FUND BALANCE	**91,669**
TOTAL LIABILITIES AND FUND BALANCE	**$195,687**

The financial statements presented are only a portion of a comprehensive audited report of the Science and Engineering Alliance, Inc. for the year ending September 30, 1994. SEA will be pleased to provide, upon request, copies of the complete financial statements from which these financial statements were taken, together with all footnotes and the detailed report of our independent auditors.

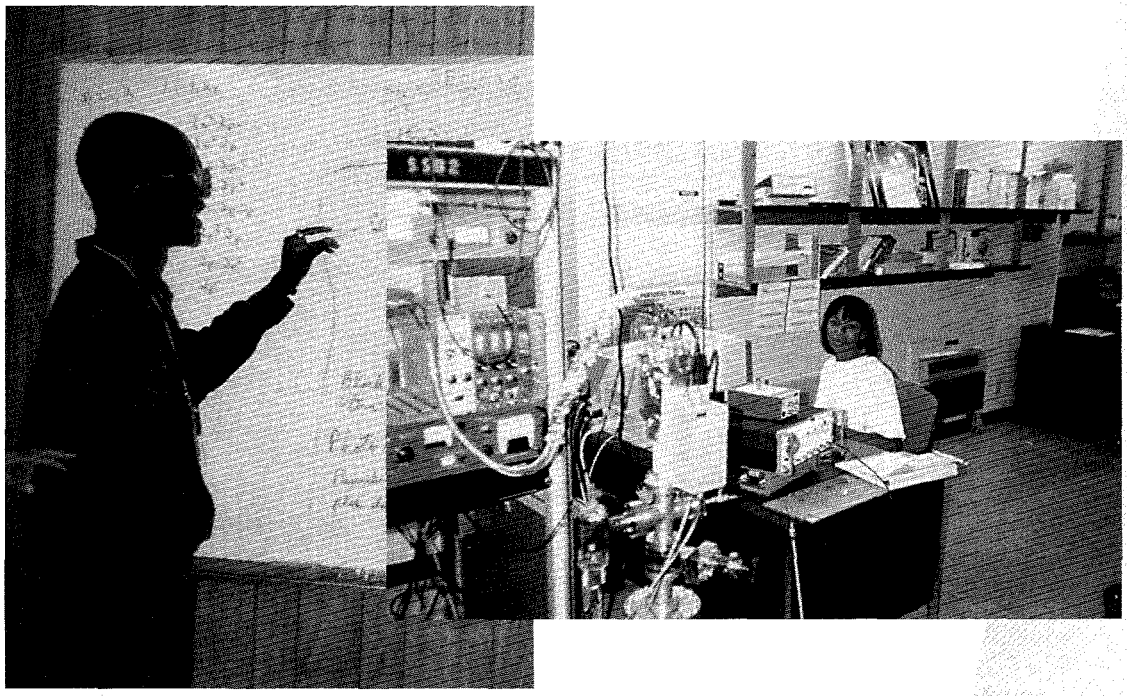
Statement of Revenue, Expenses and Changes in Fund Balance
For the Year Ended September 30, 1994

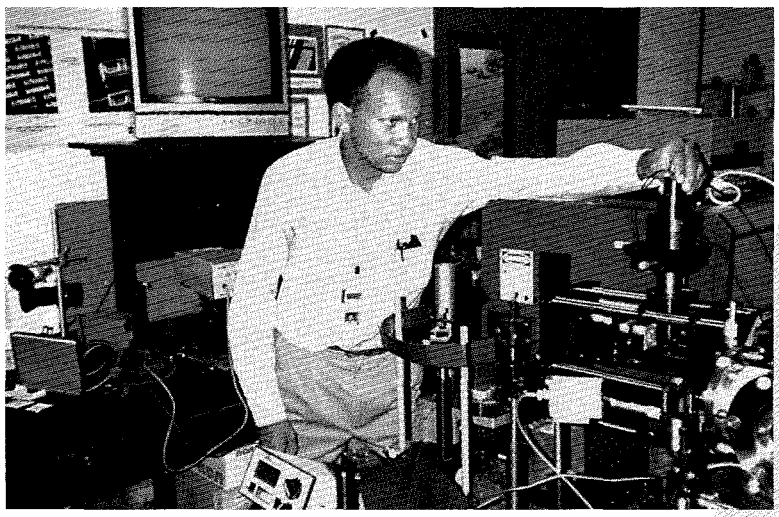
(SEA, Inc. not-for-profit corporation)

SUPPORT	
DOE Grant	$150,958
Other Grant & Contributions	17,850
Donor Support	12,450
Contribution	510
Reimbursements	1,767
Interest Income	1,578
Other Income	743
Total Support	**185,856**
EXPENSES	
Program Services	
DOE Grant	147,474
Scholarship Fund	22,846
Total Program Services	**170,320**
Supporting Services	
Management & General	17,751
Total Supporting Services	**17,751**
Total Expenses	**188,071**
Net Revenue over Expenditures	**(2,215)**
Fund Balance, October 1, 1993	**93,884**
Fund Balance, September 30, 1994	**$ 91,669**

Administrative support for SEA was through a grant from LLNL to Jackson State University, and thus, is not reflected as part of SEA's financial statement.

Impact Data





Composite Information on SEA Program for FY 1994

(Breakdown of data by race and gender available upon request)

Reporting Facility Name/Location:	Science and Engineering Alliance, Washington, D.C.
Contact Name and Phone Number:	Dr. Robert L. Shepard (202) 842-0388 (v) (202) 842-0403 (fax) e-mail: RShepSEA@aol.com
Date:	9/30/94

Program Name:	***SEA Research and Education Program***
Brief Description:	The purpose of the SEA is to enhance the research and teaching capabilities of its members, in order to provide opportunities for future scientists and engineers to become contributing participants in the nation's technical Workforce.
Labs Involved:	Lawrence Livermore National Laboratory (Sponsors Summer Internship program, Faculty, Student & High School Teacher Travel.)

TOTAL NUMBER OF PARTICIPANTS for fiscal year 1994

	Faculty	Postgrads	Grad Students	Undergrads	H.S. Students	H.S. Teachers
A. Program Totals:	48	0	4	24	16	81
State Level Data:						
State: Alabama	9	0	1	5	4	20
State: Mississippi	13	0	3	8	4	20
State: Texas	12	0	0	4	0	19
State: Louisiana	14	0	0	7	4	22
State: Maryland	0	0	0	0	1	0
District of Columbia	0	0	0	0	3	0

SEA Scholarship and Incentive Awards Program (SIAP) 1991-94

Undergraduate Scholarships

	No. of Awards	Amount
1991	5	$ 10,000
1992	12	18,000
1993	36	51,000
1994	16	24,000
Sub-total	**69**	**$103,000**

High School Incentive Awards

	No. of Awards	Amount
1991	5	$ 2,000
1992	8	3,200
1993	14	6,786
1994	16	7,750
Sub-total	**43**	**$ 19,736**
Total Support for SIAP	**112**	**$122,736**

Note: SEA scholarship and incentive awards are administered in the calendar year as shown; however, all funds are used during the academic year that coincides with SEA's fiscal year.

SEA Science and Engineering Graduation Data[1] Since 1991

	1991	1992	1993	1994	Increase Over 1993	Increase Over 1992	Increase Over 1991
Science	248	327	332	482	+ 150	+ 155	+ 234
Engineering[2]	245	250	313	438	+ 125	+ 188	+ 193
Mathematics	42	55	60	80	+ 20	+ 25	+ 38
Males	*309*	*331*	*366*	*569*	*+ 203*	*+ 238*	*+ 260*
Females	*226*	*301*	*339*	*431*	*+ 92*	*+ 130*	*+ 205*
Totals	535	632	705	1000	+ 295	+ 368	+ 465

[1] SOURCE: Compiled by SEA from data supplied by each member institution.

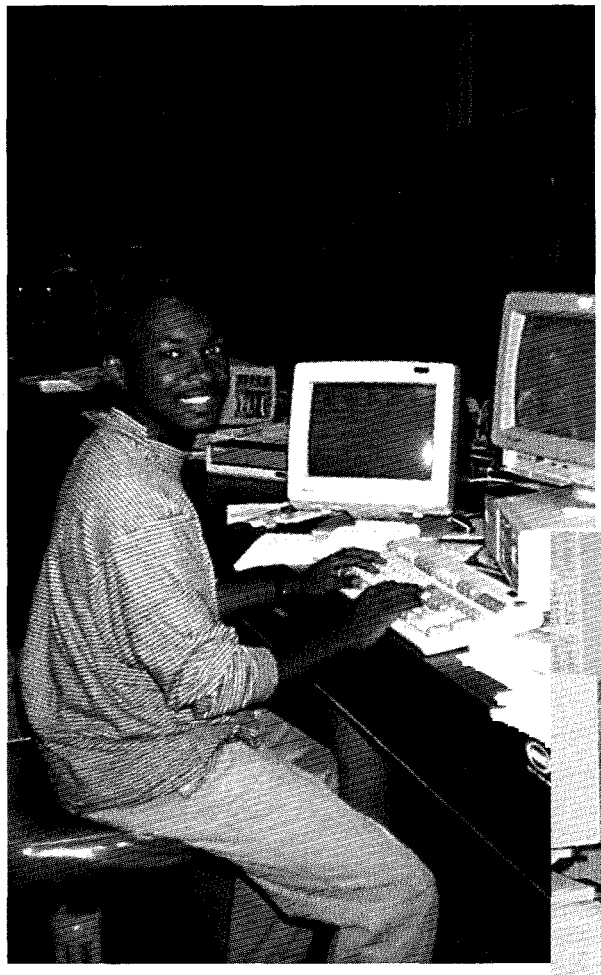
[2] Includes Engineering Technology/Industrial Technology (ET/IT). ET/IT graduates continue to increase...86 in 1991, 95 in 1992, 126 in 1993, and 154 in 1994.

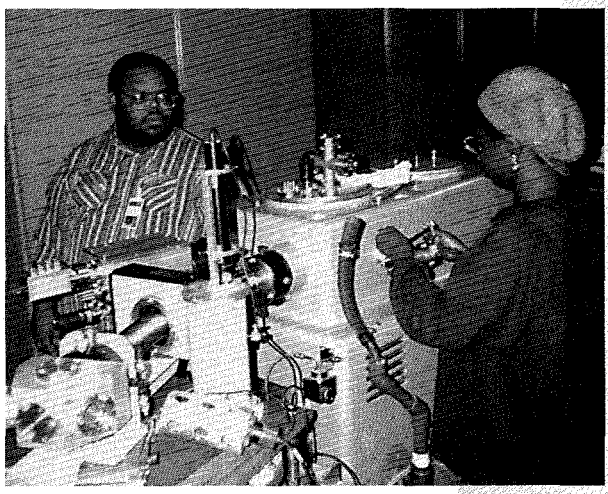
SEA Science and Engineering Degrees Awarded in 1994 By Major and By Institution[1]

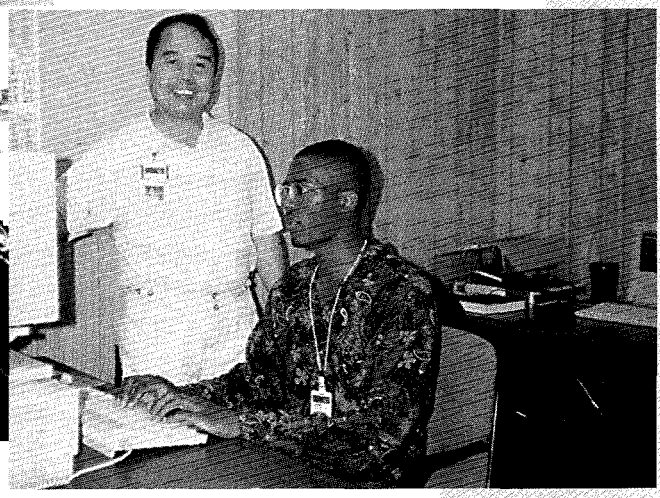
	AAMU			JSU			PVAMU			SUBR			TOTALS
	B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.	
Chemistry	7	-	-	11	2	-	3	1	-	7	8	-	39
Biology	29	3	-	50	10	-	59	-	-	18	4	-	173
Physics	4	7	2	-	-	-	4	-	-	4	-	-	21
Physics/Meteorology	-	-	-	8	-	-	-	-	-	-	-	-	8
Computer Science	29	29	-	57	28	-	16	-	-	42	19	-	220
Science Education	4	13	-	-	4	-	-	-	-	-	-	-	21
Mathematics	6	-	-	25	9	-	15	5	-	18	2	-	80
Sub-Total	79	52	2	151	53	-	97	6	-	89	33	-	562
Males	*33*	*31*	*2*	*77*	*30*	-	*50*	*4*	-	*37*	*15*	-	*279*
Females	*46*	*21*	-	*74*	*23*	-	*47*	*2*	-	*52*	*18*	-	*283*
Chemical Engineering	-	-	-	-	-	-	22	-	-	-	-	-	22
Mechanical Engineering	-	-	-	-	-	-	44	-	-	23	-	-	67
Electrical Engineering	-	-	-	-	-	-	101	-	-	51	-	-	152
Civil Engineering	10	-	-	-	-	-	19	-	-	14	-	-	43
Engineering Technology	36	-	-	-	-	-	46	-	-	20	-	-	102
Industrial Technology	-	5	-	46	1	-	-	-	-	-	-	-	52
Sub-Total	46	5	-	46	1	-	232	-	-	108	-	-	438
Males	*39*	*3*	-	*37*	*1*	-	*122*	-	-	*88*	-	-	*290*
Females	*7*	*2*	-	*9*	-	-	*110*	-	-	*20*	-	-	*148*
Totals	125	57	2	197	54	-	329	6	-	197	33	-	1000

[1] SOURCE: Compiled by SEA from data supplied by each member institution.

Leadership







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This Annual Report was produced by the SEA, as a guide to the activities in fiscal year 1994. The report also serves as an account of work sponsored by the U.S. Department of Energy (DOE) under Subcontract No. L3000025. For more information, send e-mail to rshepsea@aol.com, or call (202) 842-0388, or write to the executive director, Science and Engineering Alliance, 1522 K Street, N.W., Suite 210, Washington, D.C. 20005

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